

The sustainability challenge: Travelling, eating, living and performing activities within a carbondioxide quota

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■ 1. Title

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■ 2. Author

This project has been developed thanks to the collaboration of the Erasmus Plus student groups and teachers from the Aniaragymnasiet school (Gothenburg, Sweden) and the IES Bellavista (Seville, Spain).

■ 3. Abstract and key words

This project has been a scientific experiment in everyday life about sustainability. Our students have worked with different methods in order to minimize our impact on the environment, mainly climate. During two weeks with a separation of four months and in different countries it has been tried to execute a series of changes very previously studied in different areas of our daily life, focusing our attention on three fields: traveling (transportation), eating (food or diet) and a third group of different, more heterogeneous activities. The train has taken a stellar role in the first field. Students have become responsible for change by suggesting and experiencing changes in their lifestyles in order to achieve a level of impact on climate change that is acceptable and realistic at the individual level.

During the before mentioned time our students have measured the carbon dioxide emissions corresponding to each of the activities mentioned in the fields of study suggested above.

Before the first week of experimentation the previous notions were much more theoretical and an attempt was made to minimize as much as possible the emission figures, which improved strongly after several months and assimilation of contents and which were reflected in the results of the second week of experimentation. In this way we have been able to draw conclusions about what changes can be carried out realistically in the daily personal routines, giving also a global awareness of the impact of humanity and specifically of adolescents in our environment focusing exclusively on CO₂.

The multinational approach has been important to discover our differences and similarities with the challenges of living in a sustainable way. The environment and climate is a problem that has no limits. To build knowledge and raise awareness of this problem we need to compare perspectives from different countries. Experimentation has been used to practice our previously studied actions and methods to promote sustainability.



Keywords: train, environment, CO2 emission, climate change, environmental impact, sustainable, experimentation, coexistence, collaborative experiment, travelling, tourism, awareness, transport, food and activities.

■ 4. Introduction

Currently and unfortunately environmental education is a field that is not very considered and sometimes even forgotten in our society. It is true that there is a certain degree of general awareness of the environmental problems that threaten us like specie and its possible consequences, but we observe a great ignorance of the real and necessary instruments to set in motion an essential process of change.

During the courses 2017/18 and 2018/19 we have developed a project at our schools, a scientific experiment in the Erasmus Plus context funded by the European Union on sustainability in everyday life, in real life. In order to minimize our impact on the environment, particularly in the climate, we have tried to find practical solutions that are easy to apply in real life. For this we have considered different day-to-day activities, we have introduced changes in them and we have analyzed and measured them in relation to carbon dioxide emissions, obtaining important and realistic conclusions.

Groups of students and teachers from the Aniaragymnasiet school (Göteborg, Sweden) and IES Bellavista (Seville, Spain) have collaborated in the project. This type of international approach is fundamental to discover differences and similarities in the challenges posed by a new sustainable lifestyle. The environment and climate have no borders, the problems of some are those of all. We try to generate common knowledge and raise awareness of environmental issues, and for this we initially needed to compare the situation of different countries. This approach has also meant a great change in the way of teaching, of educating.

This experiment, this project has its origin in a previous Erasmus Plus project, carried out during the courses 2015/16 and 2016/17 in which, using the train as a hub and traveling with students across our continent (Europe), Different questions were addressed in the fields of environment, sustainability, lifestyle and tourism. It involved the schools Aniaragymnasiet (Gothenburg, Sweden), ITCS Vittorio Emanuele II (Bergamo, Italy), Berufliches Schulzentrum (Amberg, Germany) and the IES Bellavista (Seville, Spain); In that experience, no practical and applicable measures were taken to solve global problems, and what we wanted now is to challenge our students to carry out and evaluate the viability of the new changes in lifestyle to achieve a level of impact on climate change that is acceptable, real at the individual level.

Another of our purposes is to reach a wide range of group objectives and a great diffusion at a local, regional and scientific community level.



4.1. Antecedents and background

Aniaragymnasiet is located in the heart of Gothenburg, Sweden. It is a private institute of higher academic education focused on hospitality and tourism studies, business and administration, economics and social studies. It has about 300 students between the ages of 16 and 19. They provide a wide range in terms of general educational offer for later university studies or higher education.

Aniaragymnasiet has experience in international projects such as Erasmus Plus and Leonardo Da Vinci Program, mainly in Spain and the United Kingdom. It has also developed KA1 projects in order to encourage lifelong learning for teachers. In addition to this, Aniaragymnasiet has other international experiences such as study trips to Germany and France. Even so, the most influential project has been the before mentioned KA2 (strategic school partnership) "By-Train training through Europe towards sustainability".

IES Bellavista is a small high school that has about 400 students. In recent years, respect for the environment has been one of our concerns. This has been promoted through different events related to environmental awareness of environmental problems in our surroundings. As it has been mentioned above, it participated in the KA2 (strategic school partnership) "By-Train training through Europe towards sustainability".

The project is configured by students from both centers. Swedes are studying vocational training, while Spaniards are doing pre-university studies mostly. As for the teaching staff, it is made up of Swedish and Spanish professors, authors and coordinators in charge of the European project who have extensive environmental knowledge in their curricula as well as long experience in education. All of them have participated in previous projects related to this field. They share an interest in sustainable development and the environment.

4.2. Global warming

Global warming refers to the phenomenon that has been studied for years demonstrating the increase in temperature on the planet and the effects of that increase, and, citing conclusions from the different reports prepared by the IPCC, "it is extremely likely that human influence has been the dominant cause of global warming observed since the middle of the twentieth century ».

The greatest influence of humans has been the release of greenhouse gases, such as methane (CH₄), carbon dioxide (CO₂) or nitrogen oxides (NO), among others.

The greenhouse gases cause that the infrared emission of the Earth's surface after the previous incidence of the solar rays warms up in excess the different subsystems of the planet.



Human activity since the Industrial Revolution has increased the amount of greenhouse gases in the atmosphere, leading to an increase in the average temperature of the Earth.

The burning of fossil fuels has meant an increase in 3/4 of CO₂ in the last 20 years.

This global warming also causes important changes in the different subsystems, such as the generalized fusion of polar ice, a retreat of glaciers and a considerable increase in icebergs. During the twentieth century, the sea level has risen around 17 centimeters and an increase of 18 to 38 centimeters is expected in the next 100 years. This is due to the thermal expansion of the water and the melting of ice at the poles. When melting, this ice causes the decrease of the albedo, which leads to an increase in temperature.

Like a change in the ecosystems since the climatic zones can move towards the poles. The Arctic tundra can get to thaw giving rise to more important consequences since they act as sinks in a wide area of gases, which feed the effect greenhouse.

All this will also affect the water cycle, causing a reduction in quantity and quality, as well as being able to affect us in a more personal way, since a reduction in harvests is highly possible. This would worsen our health globally as a consequence of hunger and related diseases.

4.3. Climate change

Climate change is the climate of the planet attributed, directly or indirectly, to human activity, which alters the composition of the global atmosphere (which causes global warming, which in turn includes countless consequences), and which adds to the variability natural climate observed during comparable periods of time.

Climate change is a direct consequence of global warming, as the general temperature increases, being equally harmful to human beings and both terrestrial and marine flora and fauna, generating a dramatic decline in biodiversity.

For this great problem there is only one effective alternative: The reduction in the emission of carbon dioxide levels by humans.

The last climate summit held in Poland (2018) has tried to efficiently develop the Paris Agreements (2015), although at the end, the general feeling is that much remains to be done.

In 2015, this pact was closed in the French capital (Paris Agreement), but it will not start to be effective until the still valid Kyoto Protocol dies in 2020. Until that happens, the negotiators of the almost 200 countries involved in the Paris Agreement have to fully develop it, and it must be perfectly defined by 2018.



The objective of the Paris Agreement states that the maximum increase in the temperature of the planet must reach between 1.5 and 2 degrees. This is the limit set by scientists to avoid the most feared, catastrophic consequences of global warming.

4.4. IPCC

The Intergovernmental Panel on Climate Change (IPCC) is an international organization established at the request of the governments that comprise it. It was founded in 1988 from two organizations of the United Nations, the WMO (World Meteorological Organization) and the UNEP (United Nations Program for the Environment). The IPCC has the support of the UNEP and WMO organizations to carry out their reports and work.

The objective of the IPCC is to provide comprehensive scientific assessments on the risk of climate change and its potential consequences, both at environmental and socioeconomic levels and the possibilities to adapt to or minimize the consequences.

Five reports have been submitted, the last one was finalized in 2014 and have a 95% confidence level that human activity is behind the undeniable global warming.

After what was agreed at the 43rd Meeting of the IPCC held in April 2016, it was agreed that the sixth report would end in 2022, the objective of this sixth report will be to examine the progress made to ensure that the temperature rise does not exceed 2° C This report will be used for the first global assessment of the United Nations Framework Convention on Climate Change (UNFCCC). The Framework Convention on Climate Change is a body of the United Nations that organizes conferences every year since 1995 on climate change. The last conference took place in December 2018 in Katowice, Poland.

The IPCC is organized into three working groups to develop the reports: the first group deals with climate change scientifically; the second group assesses the vulnerability of socio-economic and natural systems to climate change, the consequences and adaptation options; The third group evaluates the possibilities to limit greenhouse gas emissions and mitigate climate change.

The fifth report was finalized and published throughout 2013 and 2014. It was delivered in stages, each one published on a different date. Finally, on November 2, 2014, the synthesis was delivered, which concluded the fifth report.

Two basic conclusions of the latter are drawn: the impacts on temperatures, sea level and ecosystems are increasingly worrying; the second affirms that the human being is the cause of climate change.

In this last report, the following sections stand out:



Pollution and climate, if the human being continues emitting greenhouse gases at the current rate, the impact of climate change will increase throughout the planet.

Temperatures, the global average temperature will increase 1.5 degrees compared to the average of 1850-1950. The climatologist ones consider the barrier of the 2 degrees as the presumable maximum limit before causing a serious environmental crisis.

Waters and rains, changes in the water cycle in response to climate change. The violent precipitations will be more frequent and the arid zones will receive less rain.

Seas and oceans, marine water will continue to heat up and marine ecosystems will be greatly affected by the acidification process that in particular destroys corals.

Air quality, global warming will cause more pollution in the air, especially in the lower areas of the atmosphere.

Polar areas and glaciers, it is very likely that the polar ice cover will continue to disappear especially in the Arctic, the number of glaciers will continue to decline.

Sea level, sea level will continue to rise, it is expected that for the period 2081-2100 has increased between 26 and 98 centimeters.

The report called “Global Warming of 1.5°” published in 2018 discusses how much carbon dioxide we have left to emit in order to reach the goal. There are different ways to calculate the remaining carbon dioxide quota, and we have chosen the 580 CO₂ Gt to compare our results. (It is shown in the discussion in number 8.2).

■ 5. Main

5.1. The purposes

So that once exposed all the above, comes the time to define and clarify what are the purposes and objectives or goals that we set out in our experiment.

The underlying idea of the whole project can be summarized in the following question: Can we improve the situation in which our environment is, based on realistic actions in activities of our daily life, such as food, transportation, leisure activities, in order to reduce their carbon dioxide emissions?

Also within an ambitious project like this, but without forgetting that we are located in the school environment and therefore of comprehensive training of future adult citizens, we add another series of goals that we directly or indirectly also try to achieve.



Without any doubt one of the main purposes collected at the beginning of our project was, as it has been shown during its development, to use travel as an instrument of knowledge, we understand as teachers and students that in the educational field it is consolidated as a tool essential in the global world.

No less important in this new globalized context and even more importantly speaking of teaching, it has been a planned purpose to develop linguistic and communication skills between Swedish and Spanish students, with a special preponderance of the English language as an international language.

Taking into account also the nature of the project, the collection of information, the research work has been the cornerstone. This activity in itself is an elementary skill, essential in today's world and that supposes as any other aspect of life a teaching, learning and training for our students.

No less important is another of the objectives set at the beginning of the project's useful life, and that is closely related to the scientific work: the skills, the development in the competence of cooperative, collaborative work, essential for all group work.

Finally we must summarize and translate all the previous purposes with a great idea; in the minds of all the creators of this project has always been present to instill as a great final goal the scientific method in the formation of our students.

5.2. The main question

So, and once all the above is exposed, it is time to begin to finalize our research, for which we elaborate an important list of questions with which we try to break down the great hypothesis of work, with the intention of enriching with all the possible nuances the experimentation to be carried out.

5.2.1. Is it possible to maintain the quota of CO₂ emissions established by the IPCC or other organizations such as the WWF (World Wildlife Fund) when making a trip from Spain to Sweden and back, crossing all of Europe, taking into account the means of transportation, weather, food, as well as any of the day-to-day aspects of that trip (accommodation-expenses, facilities, electricity, heating, climate change, etc.) in a realistic and economical way?

5.2.2. Could this method be moved and adapted in our lives in a viable and efficient way, in such a way that it implies a change of lifestyle to one more respectful with the environment?

5.2.3. Would it be possible to adopt a vegan or vegetarian diet or, failing that, be more responsible with the environment?



5.2.4. Could we keep this type of diet in any situation and / or place?

5.2.5. Is the train really the most efficient option, taking into account the time, the schedules, the expenses and the restriction of movement that this means entails?

5.2.6. Is there any other means of transport capable of making a trip of the same distance, in less time or with greater comfort, emitting the same amount of CO₂ as the train?

5.2.7. Was it possible to improve (decrease) the emissions produced with the development of the project in the activities carried out (leisure activities, basic activities such as electricity, heating, washing machine, etc.) in both mobilities?

5.2.8. Can leisure activities be carried out, for example spending a day in an amusement park, keeping the level of emissions low, or is it necessary to do more rural activities, for example games in the field without needing much material, for this to be fulfilled?

5.2.9. Is it possible to show society the importance of what we have worked on as well as the way in which CO₂ emissions are changing the planet?

5.2.10. Has there been improvement and learning during the process of the experience?

5.3. The hypothesis

The main objective of our project is to calculate the CO₂ emissions emitted during our daily life and find realistic and economical ways to minimize our production of this gas.

Food is a key aspect that we must address, since the amounts of CO₂ emitted differ considerably depending on the type of food we consume, the origin and the production process of these foods. We will check which foods emit the least: a diet that includes products of animal origin or a vegan based on substitute and vegetable products, which, despite being more natural, emit a certain amount of CO₂.

Transportation is an essential aspect that we must take into account since we use different means of transport every day, which are not always respectful with the environment. During this project we will find the optimal means of transport for long and medium-distance trips, discarding the plane from the beginning and choosing the train.

The **activities** we carry out daily also have a significant influence on the amounts of CO₂ emitted. In this aspect we will calculate the pollution produced by our actions (charge of mobile phones and tablets, use of heating or air conditioning, consumption of hot water, etc.) during the project and if it is feasible to do special activities (leisure activities, going out with friends, go to a theme park, go shopping, etc) keeping our emissions low.



■ 6. Material and methodology

In order to achieve the objectives set out in previous sections, two mobilities have been carried out, that is, two short stays of five days spaced by several months; the first one in May 2018 in Spain and the second one in Sweden during September of the same year. During these time intervals, considered at the time of experimentation, we collected data on the amounts of carbon dioxide emitted during the trips made according to the transport used (those necessary to reach both countries were taken into account, apart from those five days of stay), the emissions derived from the food consumed as well as the rest of the activities carried out in these periods. All this was done using the English language as a linguistic instrument and developing a team work of students (divided into the three categories discussed) and coordinated by teachers and put into execution through workshops or seminars in which they discussed and drew conclusions from all this data obtained.

Throughout the process a short film has been produced that has included all the experiences lived during the students during the two mobilities, including interviews in which testimonies and details of this process of creation and research are collected.

For more information, visit <http://sustainabilitychallenge.eu>

6.1. Material

As explained above, our project involved a journey through Europe going across Denmark, Germany, France and Switzerland, to reach Spain and the opposite way, by the two groups of different nationalities; Swedish and Spanish respectively, with the aim of seeing if there was the possibility of realizing these two mobilities or stays reducing the carbon footprint. First, observing the data of a first mobility and later trying to improve the results in the second as much as possible and adjusting as realistically as possible.

The objective of the project was clear from the beginning, it was essential to gather a series of students trained to carry out this experiment and with the necessary training to carry it out successfully.

In the case of Spanish students, they were subjected to three tests closely related to the essential aspects of the project.

The first test, of an individual nature, consisted of a personal presentation, exposing before a small tribunal formed by different professors the knowledge acquired in previous technical courses in terms of climate change and carbon dioxide emissions as well as sustainability and answering different related questions.



The second test put into play the communicative and linguistic abilities of the students focusing on English. The knowledge in this field was vital for the investigation, since language as it facilitated the work between the students of both nationalities and made it possible.

Finally, the students were subjected to some small psychological profile tests in order to assess the management capacity to the adversities and complications that could arise during the great adventure, three days of train crossing different countries and cultures, and the stay in another country. very different from the one of origin looking for similarities and cultural differences with the intention of expanding their personal baggage, their vital development and all this in a context of technical work.

In the case of Swedish students, a large part of the selection process was carried out after observing the involvement of the candidates and the quality of the work carried out during a thematic week on the project in Aniara.

It is important to remember that at all times, throughout the life of the project, one of the main activities and therefore understood as a reference material is the search for online information.

Another area of great importance in terms of the list of material used is undoubtedly transport. The train was mainly used, with the exception of shorter journeys, in which the bus or minibus was used. And why not the plane as a means of transport? Well it is true that it is obviously much faster and implies greater comfort, it generates a greater sense of comfort when it comes to making long journeys, but as has been clear previously, the essential objective of the project was to check the possibility of reducing the emission quota of carbon dioxide, in this sense the plane was against absolutely our purposes.

Regarding work place, our accommodation has taken place in two rural complexes both in Sweden and in Spain. The question is simple, the type of accommodation is directly related to the budget available within the Erasmus Plus program and to the carrying out of activities committed to the environmental spirit of the project. In addition to having greater accessibility when making menus and modifying activities in order to achieve our objectives.

Other essential key tools and to highlight are those related to technology, referring to the use of computers, mobile phones, tablets with internet access and photographic devices, for filming to make the video recording. It is probably appropriate here to highlight the little use we have given to traditional methods, elements of stationery.

During the dissemination phase we will present our project through videos and brochures in addition to the realization of this article. In order to get a greater diffusion and social impact, social networks have gained great prominence. The media diffusion has caused that a large number of users have come to know our project.



However we can establish with foundation that the most important tool of this project has been the human participation in this by the students and teachers of both countries. We have not only worked on this experiment being the protagonists together with the environment of which we are an intrinsic part, but we have also acquired these technical, academic, personal, and vital experiences that are incorporated into our own lifestyle inviting our environment to modify and assimilate it .

6.2. Methodology

When referring to the methodology of experimentation, we will approach the way in which we have put into play the instruments chosen for our experiment, thus implementing the planned initial design.

To carry out this project, the working group formed by Swedish and Spanish professors presented and requested funding with funds from the Erasmus + program in the March 2017 call.

Once approved, the rules of project development were planned and agreed through video call meetings and the final transnational meeting of October 2017 in Gothenburg.

As it has already been narrated, two enormous journeys have been made crossing Europe by train. The first of them from Gothenburg to Seville in May 2018 carried out by the Swedish group and the second of them, in an inverse way, carried out by the Spanish group.

The first mobility starts on April 31, 2018. The Swedish group travels by train from Gothenburg to Cordoba. The first day of the journey begins with the train stage from Gothenburg to Copenhagen; Afterwards, a bus is taken to Rödby, so that it can be used by boat on arrival to German soil, specifically to Puttgarden, where the train is used again to Hamburg and there we take the last transport of the day to Basel, where we stopped at night.

The second day began with the destination Olten, followed by another trip to Geneve and from Geneve to Lyon, from the latter to Paris where we stopped to visit it.

The last day of the trip was less hectic, we stayed overnight on the train and arrived early in Barcelona. From there we took the last train, which would take us to our first destination, Córdoba, where the Spanish group was, which had traveled from Seville to Córdoba. After the welcome we moved to Villa Duke by bus, where we spent the first days of the stay in Spain.

The stay at Villa Duke was four days and three nights. Here began the investigation of the project. We divided into four groups: food, transport, activities and media (collection of visual data), which in addition to facilitating the work allowed us to interact Swedish and Spanish students. Each group was responsible for calculating the data of the first mobility, in the group that corresponded to it.



This first stay between both countries, turned out to be an enriching experience, both for students and teachers. We worked in a compenetrated way and various leisure activities were carried out that facilitated the coexistence.

After the stay in Villa Duke began the last part of mobility, in Seville. Activities different from those of Villa Duke were carried out. Each Swedish student stayed with a Spaniard in their family homes for a weekend. During these days we enjoy the culture and gastronomic wealth of the city. On the last day of coexistence, the activities and calculations carried out to date were reviewed and proposals were made on the next mobility.

After these days, the Swedish group began its trip back. The return to Sweden was developed by train and had as its first stop Barcelona, where he spent the first night.

The second day was the hardest of the journey. Lyon was reached by train, from where it left for the Swiss city, Olten. Later, we arrived in Basel, where we took a night train that took us to Hamburg. We spent the night in the train and recovered strength to continue the trip.

The third day we arrived in Gothenburg, after making the journey from Hamburg to Copenhagen, where we took part by boat, and finally the train from Copenhagen to Gothenburg. Here finished the first phase of the project.

During the return to Gothenburg it was tried to take a vegan diet, but it was not possible in all the occasions.

The second mobility begins on September 5, 2018 at Santa Justa Station in Seville, with Barcelona as the first destination. In the Catalan capital we change trains to go to Avignon where we spend the night in a hotel near the station.

We had our first group dinner at a grilled meat grill, the only restaurant open at that time of night, making it impossible to carry out a vegan diet.

On the second day, we made two train journeys, the first from Avignon to Mannheim, and later to Heidelberg. We visited the city and did our second group dinner, in which it was not possible to avoid meat products.

The third and last day of travel by train, we traveled from Mannheim to Hamburg, where we were able to have a vegan lunch, which we ate on the train because of the lack of time between train and train. Afterwards to continue with our journey we had to take a ferry, and make a change of train to go to Copenhagen. Finally, we took the last train to Gothenburg, our final destination. It was the final stretch, we were very tired but eager to get there. At the station the Swedish teachers were waiting for us, who took us to Uddenpool, our accommodation for the next six days.



The days in Uddenpool passed similarly to Villaduke, however, we can say that in this second mobility we are much more comfortable since we enjoy greater independence and autonomy in the preparation of food. We cooked students and teachers, and it was necessary a previous organization of menus, we also had shifts to prepare food.

During the stay we worked on the project, but also made cultural visits such as the visit to the village of Alingsås or the center of Gothenburg, where we met the Aniaragymnasiet educational center, and the Liseberg amusement park. We also participated in activities and games directed by other Swedish students and enjoyed the lake, which was in Uddenpool.

The coexistence during these days made us acquire a lot of values and learn to manage ourselves in different situations.

We continue with the division of labor, carried out in the previous mobility.

We collect the data of the second mobility, analyzing the emissions of everything we did and reducing our impact on the environment.

Our stay came to an end and the Spanish students and teachers set out on the trip back to Spain. It started on September 14, early in the morning we arrived at the Gothenburg station, where we took the first train. Subsequently, we arrived in Denmark where we used another means of transport, the ship. Later, we arrived in Hamburg and spent a few hours at the station. Around ten o'clock at night we arrived at the German city of Karlsruhe, where we stayed.

The next day, we took a train to Paris, thanks to the waiting time for the next train (with change of station), we took the opportunity to make a quick visit to the city. We had lunch on the banks of the Seine and in the afternoon, after visiting Notre Dame, we went to the station to take the next train to Perpignan, where we spent the night. The hotel was in front of the station, which facilitated the transfer.

The next day we took what would be the penultimate train, bound for Barcelona. We spent the morning at the station and had lunch at the fast food restaurant. In the afternoon, we embarked on our final trip to Seville. In Santa Justa the families were waiting for us; this marked the end of the second mobility.

■ 7. Results

After the completion of the macro experiment we can say that the results obtained are largely as expected. We have not really been aware of the amount of carbon dioxide emitted



and the environmental impact generated to our planet and environment until we have seen it first-hand.

A.- Sum of the total of mobility 1 and the sum of the total of mobility 2, conclusions

According to the data obtained, the conclusion is very remarkable, there is a big difference between the emissions during the first mobility in May 2018 and the second mobility in September of the same year.

In the first stay, in the **Valley of the Pedroches**, Córdoba and taking into account the global food, transport and other activities of daily life a total of **202,99 kg / CO₂ per person** was issued while in the case of **Uddenpool, Västra Götaland** the amount was **197,61 kg / CO₂ per person**.

B.- Sum of the total CO₂ emissions of mobility 1 and the sum of total mobility 2 by subgroups, conclusions

B.1.- Sum of the total CO₂ emissions of mobility 1 and the sum of total mobility 2 for meals, conclusions

Sticking to the food data we can see how in the **first mobility** there is greater CO₂ consumption, being **41,43 kg / CO₂ per person**.

On the trip from Gothenburg to Seville, the Swedish group issued **9,86 kg / CO₂ per person**.

The first day, for breakfast we had a chicken and bacon sandwich and a salad with an emission of **0,85 kg / CO₂ per person**.

We had lunch menu with hamburger, chips and water, emitting **2,61 kg / CO₂ per person**.

For dinner we have a menu, vegan with hamburger and an apple with a total emission of **0,38 kg / CO₂ per person**.

The second day, for breakfast we had a sandwich and a banana emitting **4,69 kg / CO₂ per person**.

For lunch we had a baguette of chicken and bacon with an emission of **0,85 kg / CO₂ per person**.

That day we dined pasta with goat cheese and mushrooms causing an emission of **0,48 kg / CO₂ per person**.



The third day breakfast was a chocolate cereal bar with an emission of 0,04 kg / CO₂ per person.

In VillaDuke we made based on foods rich in CO₂, like meats with a total emission of 28,40 kg / CO₂ per person.

During these days of breakfast we had toast with butter and jam, milk, juice and muffins that emitted a total of 0,39 kg / CO₂ per person. Except for the last day we had breakfast bacon sandwich, orange juice and apple, with an emission of 3,47 kg / CO₂ per person.

The first day the lunch was meatballs, fish, salad, a piece of bread and an apple emitting a total of 0,77 kg / CO₂ per person.

For dinner we ate a sandwich of cheese and ham, chips, salad, a piece of bread and jelly, emitting a total of 0,30 kg / CO₂ per person.

The second day for lunch we ate salad, chicken legs, bread and an apple, emitting a total of 0,90 kg / CO₂ per person.

We had a scramble of eggs and ham, noodle soup with chicken, salad, bread and yogurt for a total of 0,70 kg / CO₂ per person.

On the third day we had lunch, fried fish, bread and strawberries, emitting a total of 0,48 kg / CO₂ per person.

And for dinner a potato omelet, salad, meat and apple emitting a total of 6.88 kg / CO₂ per person.

The fourth day for lunch we take spaghetti with tomato, veal, salad and apple emitting a total of 14,10 kg / CO₂ per person.

On the return trip from Seville to Gothenburg by the Swedish group, we issued a total of 3,12 kg / CO₂ per person.

For lunch we take chicken fillet with chips with an emission of 0,36 kg / CO₂ per person.

We had chicken nuggets, chips and a soft drink with a total emission of 0,39 kg / CO₂ per person.

The second day we had a chicken sandwich with an emission of 0,85 kg / CO₂ per person. We had rice and chicken lunch, causing a total emission of 0,55 kg / CO₂ per person.



The last day for breakfast we took a cereal bar with chocolate with an emission of 0,04 kg / CO2 per person.

For lunch we ate a vegan burger causing an emission of 0,81 kg / CO2 per person.

On the contrary, the diet that we carried out in the **second mobility** caused us to reduce the emissions with respect to the first, since most of the food was not of animal origin, emitting a total of **32,79 kg / CO2 per person**.

On the trip from Seville to Gothenburg we issued a total of 10,97 kg / CO2 per person. The first day we had lunch with hamburger, chips and water, with a total of 2,75 kg / CO2 per person.

At dinner we ate beef, chips and water, emitting 4,06 kg / CO2 per person.

The second day we had a ham sandwich, with an emission of 0,44 kg / CO2 per person. For lunch we ate a sandwich of ham and cheese, emitting a total of 1,24 kg / CO2 per person.

And at dinner we ate pizza and water with a total of 1,08 kg / CO2 per person.

On the third day for breakfast we had a chocolate croissant with an emission of 0,22 kg / CO2 per person.

At lunch we ate "fish and chips", vegan burgers and chips emitting 0,39 kg / CO2 per person.

At dinner we ate a chicken and bacon sandwich with a total emission of 0,78 kg / CO2.

During the stay in Uddenpool, we issued a total of 12,05 kg / CO2 per person.

We have breakfast every morning with toast and jam, vegetable milk, cereals, fruit juice, porridge; emitting 0,62 kg / CO2 per person.

The first day in Sweden we had a halloumi hamburger with a total emission of 0,14 kg / CO2 per person.

For dinner we ate quorn tacos emitting 0,40 kg / CO2 per person.

The second day in Sweden for lunch we ate lentils and pesto pasta, emitting 0,12 kg / CO2 per person.

We dined Mexican soup with beans, emitting 0,85 kg / CO2 per person.



The third day for lunch we had spinach soup with a total emission of 1,10 kg / CO₂ per person.

And we had falafel tacos with an emission of 0.40 kg / CO₂ per person.

The fourth day we visited the Liseberg amusement park, where we had lunch in a vegetarian buffet, emitting 0,28 kg / CO₂ per person.

For dinner we ate Falun sausage with rice, emitting 1,78 kg / CO₂ per person.

On the fifth day for lunch we ate baked tubers and "chickpea meat" with a total emission of 0.21 kg / CO₂ per person.

And for dinner we ate a vegan burger causing an emission of 0.81 kg / CO₂ per person.

The last day in Sweden we had lunch at the Aniaragymnasiet institute buffet, emitting 0.92 kg / CO₂ per person.

At dinner we ate salmon with potatoes and peas, emitting 0,69 kg / CO₂ per person, that same day of dessert we took Mississippi cake with an emission 0,25 kg / CO₂ per person.

On the return trip from Gothenburg to Seville we issued a total of 10,57 kg / CO₂ per person.

The first day we had a cheese sandwich and a piece of fruit (orange or apple) with an emission of 0,75 kg / CO₂ per person.

For lunch we ate breaded fillets of fish or meat and chips with an emission of 0,72 kg / CO₂ per person.

And for dinner pizza and chocolate bar with an emission of 2,89 kg / CO₂ per person.

The second day we had a sweet, emitting 0,90 kg CO₂ per person.

We had lunch in Paris with a baguette with omelet and chicken, and for dessert a crepe, emitting 0,87 kg / CO₂ per person.

For dinner we ate sandwich cheese and ham, emitting 1,24 kg / CO₂ per person.

Finally, on the third day, we had a ham sandwich, emitting 0,43 kg / CO₂ per person and we had lunch with a hamburger, chips and water with an emission of 2,74 kg / CO₂ per person.

B.2.- Sum of the total CO₂ emissions of mobility 1 and the sum of the total mobility 2 per transport, conclusions



Regarding transport, we observed a negligible difference between the first and second mobility, with the last one being the one that caused the most emissions.

In the **first mobility**, a total of **159,62 kg / CO2 per person** was issued.

The first day of travel, the train from Gothenburg to Copenhagen by train caused an emission of 1,50 kg / CO2 per person. To go from Copenhagen to Rödby we used the bus emitting 9,10 kg / CO2 per person. The trip from Rödby to Puttgarden by boat, caused an emission of 4,90 kg / CO2 per person. Subsequent trips were made by train, from Puttgarden to Hamburg 10.80 kg / CO2 was emitted per person, and the last journey of the first day, from Hamburg to Basel, caused an emission of 0.12 kg / CO2 per person.

The second day of the crossing, started from Basel to Olten by train, emitting 0,02 kg / CO2 per person. The route from Olten to Geneve followed, whose emission was 0,15 kg / CO2 per person. From Geneve to Lyon, 1 kg / CO2 was emitted per person. The trip from Lyon to Barcelona emitted 7,6 kg / CO2 per person, ending here on the second day.

The last day we took a train from Barcelona to Córdoba, emitting 28 kg / CO2 per person.

On the other hand the Spanish group we moved by train first from Bellavista to Santa Justa emitting 0,26 Kg / CO2 per person and from Santa Justa to Central Cordoba with a total emission of 3,60 Kg / CO2 per person.

Once in Córdoba, we moved by bus from the center of Córdoba to Villaduke, with an emission of 5,24 kg / CO2 per person. One of the days of the Villaduke stay, we made a bus visit to the most important dairy and meat processing factory in southern Europe, which emitted 1,38 kg / CO2 per person. After the stay in Valle de los Pedroches, the entire group moved to Seville by bus, emitting 10,48 kg / CO2 per person.

In Seville, we visited the center of the city and we moved by bus from Bellavista emitting 0,60 kg / CO2 per person.

The return trip of the Swedish group began with the train from Bellavista to Santa Justa whose emission is 0,26 kg / CO2 per person. The train from Seville to Barcelona followed, with an emission of 32,30 kg / CO2 per person. We spent the afternoon in the city, and we stayed there the first night.

The next day, we took a train to Lyon, whose emission was 14,80 Kg / CO2 per person. The train from Lyon to Geneve followed, emitting 1 Kg / CO2 per person. Later, we took a train to Olten, whose emission was 0,15 Kg / CO2 and from Olten to Basel, emitting 0,02 kg / CO2 per person. On the next train, from Basel to Hamburg with an emission of 0,12 Kg / CO2 per person. We spent the night on the train, ending our second day of the return trip here.



In the morning, we took a train to Puttgarden, which emitted 10,80 Kg / CO₂ per person. It was followed by the train from Puttgarden to Rödby by boat, which caused an emission of 4,90 kg / CO₂. Once in Rödby we took a bus to Copenhagen whose emission was 9,10 Kg / CO₂ per person. And to end the journey, and close the first mobility we took a train from Copenhagen to Gothenburg with an emission of 1,50 Kg / CO₂ per person.

In the **second mobility** carried out from Seville to Gothenburg we observed how the figure decreases minimally to **156,40 kg / CO₂ per person**.

The first day of the trip we took two trains: the first from Seville to Barcelona, with an emission of 32,30 kg / CO₂ per person; the second from Barcelona to Avignon, emitting 6,50 kg / CO₂ per person.

The second day of the trip we traveled only once by train, from Avignon to Mannheim, whose emission was 11,30 kg / CO₂ per person.

The third day, it was the hardest of all. The first train of the day was that of Mannheim-Hamburg, with an emission of 0,08 kg / CO₂ per person. It was followed by the train from Hamburg to Puttgarden whose emission was 10,50 kg / CO₂ per person.

We continued with the boat trip of Puttgarden-Rodby, which was 4,90 kg / CO₂ per person. We ended the day with the train from Copenhagen to Gothenburg, emitting 5,90 kg / CO₂ per person. Finally, we drove a large car from Uddenpool Västra Götaland to Gothenburg station, emitting 6,36 kg / CO₂ per person.

On the first day of the return trip, we started the day with Uddenpool's big car trip to the Gothenburg station whose emission was 6,36 kg / CO₂ per person. We continued with a train from Gothenburg to Copenhagen whose emissions were 5,90 kg / CO₂ per person. The boat from Rödby to Puttgarden followed, emitting 4,90 kg / CO₂ per person. From Puttgarden to Hamburg, the train emission was 10,50 kg / CO₂ per person. Then, we took another train from Hamburg to Karlsruhe, with an emission of 0,09 kg / CO₂ per person, here finished the first day.

The second day we took a train from Karlsruhe to Lyon, whose emission was 7,60 kg / CO₂ per person. Ending this day, we took a train from Lyon to Perpignan that issued 6 kg / CO₂ per person.

The third and last day, we traveled from Perpignan to Barcelona emitting 4,90 kg / CO₂ per person, and finally closing the mobility we made the journey from Barcelona to Seville, which issued 32,30 kg / CO₂ per person.

B.3.- Sum of the total CO₂ emissions of mobility 1 and the sum of the total mobility 2 of activities, conclusions



With respect to the data of the group of activities we have verified that the CO₂ emissions are not as unequal as it would be expected initially.

We can explain this when we understand the project by mobilities.

During the **first mobility** we settled in Villaduke, Córdoba. It was a rural hostel, therefore most of the leisure activities carried out (tree planting -which is a negative CO₂ emissions activities-, cars without motors, climbing wall, etc.) emitted little CO₂ being a total of **1,92 Kg / CO₂ per person**.

It also influenced the time of year in which we made this trip. This mobility was made in May 2018, which means that the weather and the temperature in Andalusia were ideal, it was not necessary to use heating, but the reduced use of air conditioning, whose emission was 1,05 Kg. / CO₂ per person. In the case of basic activities such as showers, the emissions were 0,50 Kg / CO₂ per person.

Washing machines were not used either because since it was four days it was not necessary to do the laundry any day.

Regarding lights, the total consumption per person was 0,22 Kg / CO₂. On the other hand, the use of the dishwasher meant an emission of 0,13 Kg / CO₂ per person.

In the **second mobility**, we stayed in Uddenpool and did activities like canoeing, gymkhanas, etc. The total emission of the mobility was of **8,41 kg / CO₂ per person**. It was made in September 2018, having in Gothenburg a lower temperature, with respect to Cordoba. Due to this, it was necessary to use heaters, emitting a total of 7,63 Kg / CO₂ per person.

In this case, the emission of the showers was 0,11 kg / CO₂ per person. In this mobility, the emission of CO₂ from the lights was greater, being 0,39 kg / CO₂ per person. Finally, in the case of the dishwasher, the consumption was 0,16 kg / CO₂. The emission of the visit to the amusement park was 0,10 Kg / CO₂ per person.

■ 8.- Discussions and conclusions

In order to express the information in the most orderly and exhaustive way we proceed in this section to answer the main questions raised in section five of our study

Is it possible to maintain the quota of CO₂ emissions established by the IPCC or other organizations such as the WWF (World Wildlife Fund) when making a trip from Spain to Sweden, crossing all of Europe, taking into account the means of transportation, Weather, food, as well as any of the day-to-day aspects of that trip (accommodation-expenses, facilities, electricity, heating, climate change, etc.) in a realistic and economical way?



In our trip from Spain to Sweden we have been able to experiment in different aspects such as food, transport and leisure activities, the level of CO₂ we emitted. The main objective of this project is to see if it is possible to make this trip while maintaining the quota of CO₂ that is established by organisms such as the IPCC according to the report called Global Warming of 1.5° published in 2018, choosing the 580 CO₂ Gt to compare our results. In addition to the WWF (World Wildlife Fund) but in a realistic and economic way. These agencies are responsible for providing comprehensive scientific assessments of current scientific, technical and socio-economic information on the risk of climate change caused by human activity, its potential environmental and socio-economic consequences, and possible options for adapting to these consequences or avoiding their effects. Despite the effort made by the group, we have observed that maintaining levels below the established is practically impossible, even being extremely scrupulous with food, travel or accommodation, the share of CO₂ ends up shooting, since not all places it was possible to carry out a diet low in meat products, either because of the purchasing power we had or simply because we were not offered that option. Also, as for the trip, realistically, after a series of hours on the train, we all needed to go out and rest, which required a night accommodation, with its consequent consumption of CO₂ and money. For example, in the food field, we exceed 53 kg / CO₂ per person, in terms of activities we exceed 13 kg / CO₂ per person, and in transport 140 kg / CO₂ per person. The sum of these data would end up surpassing the average established by the IPCC, so that in the long run the established limit of 2 °C would be passed. Based on our experience, we could have compared the figures of both mobilities. In each one we are over the quota, in the first one 16,46 Kg per person by day, and in the second one 20,3 Kg per person by day. After analyzing these factors, we conclude that currently, both our society and our way of life, do not allow us to lead a life respectful of the environment.

Could this method be moved and adapted in our lives in a viable and efficient way, in such a way that it implies a change of lifestyle to one more respectful with the environment?

To change to a way of life so different from ours is a big step, difficult, although during our trip we could observe that we could really adapt to the vegan diet. It would be easy to adapt it to our Mediterranean diet, since it is quite rich in vegetables. The change would be to introduce plant foods and reduce the consumption of meat.

In Spain, the use of public transport is not as widespread as we could wish, its use could be greater. During our trip we used the train as a means of transport since it was the one that generated fewer emissions. To boost the use of public transport should be increased its strength, extend schedules, lower cost, among other things. Its use in addition to reducing CO₂ emissions would mean a decongestion of urban roads.

Taking into account the activities, there are those that do not cause emissions, such as those practiced in the open air. At Villa Duke we put it into practice and we did gymkhanas and activities like karts. In Uddenpool we also carry them out except for the visit to the Liseberg



amusement park. We come to the conclusion that leisure activities can be carried out emitting little CO₂.

Responding globally to the question, it is difficult to change and adapt to a life somewhat different from ours, but with small changes we could contribute to a great improvement.

Would it be possible to adopt a vegan or vegetarian diet or, failing that, be more responsible with the environment?

After our experience in the second mobility we could see that establishing a vegan diet in our way of life was feasible despite a series of issues to consider. On the one hand, in the case of the Spanish delegation, adapting our Mediterranean diet is somewhat complicated (as we could verify it in our stay in the foreign country) on the other, buying vegan food in our country is much more difficult since the sale of this type of products in Spain is smaller. Personally students and teachers were involved in a bit bittersweet experience for what we were used to. Despite all this, this experience has opened our minds to this lifestyle and we do not rule out the possibility of acquiring it in a definitive way in some cases.

Could we keep this type of diet in any situation and / or place?

After having traveled Europe by train, we have observed the different environmental awareness in the different European countries. As we moved towards northern Europe it was easier to find a variety of vegan food establishments.

On the contrary, in the railway stations it was very difficult to carry out this diet, since there were only fast food restaurants. If we wanted to carry out this style of feeding, we had to move around the station, which was not always possible because we had little time difference between one train and another. When we had to eat on the train we came back to find this difficulty.

Therefore, we consider that it is difficult to keep this diet away from home, or at least it depends a lot on the country in which you find yourself.

In the day to day if we can do it, it is feasible, substituting meat foods for vegans, or reducing consumption of them. We should only change our conception about food and be willing to incorporate them into our lifestyle.

During the stay in Sweden we checked it, and unlike the first mobility in Villaduke, our CO₂ emissions were considerably reduced.

Is the train really the most efficient option, taking into account the time, the schedules, the expenses and the restriction of movement that this means entails?



Observing the data obtained in our project it can be affirmed that the train is the most recommendable option thanks to the lower emission of CO₂ taking into account the duration of the journey and the expenses, since it is possible to say that there is no other means of transportation that satisfies these conditions.

Although the duration of the trip is longer than the option of using air transport, it can be seen that the airplane contributes to serious problems in emissions.

The CO₂ emissions of an airplane in a distance of 2617 km (Seville-Gothenburg) going back and forth suppose 124045 kg / CO₂ per person. On the other hand, on a train journey it would be 507.7 kg / CO₂ per person. This data led us to choose the opinion of the use of the train as we can see that there is a large difference in emissions.

On the other hand we must report the major inconveniences due to the option chosen, the change of trains that leads to difficulties (the loss of a train due to the short time we had in some cases, problems in the luggage, difficulties for large groups of people, etc), in some stations there was not enough information in the station itself and it can lead to a mistake taking a train.

With regard to our project we have been able to travel by train most of Europe in a 3-day approximation and seeing the results in comparison with the route of the Swedish institute, which part of that journey had to do it by bus, it can be affirmed in base to the data that the best option is the train.

Is there any other means of transport capable of making a trip of the same distance, in less time or with greater comfort, emitting the same amount of CO₂ as the train?

Thanks to our experience and referring to the facts, we have been able to verify how there is no other travel option (faster and more comfortable, emitting the same amount of CO₂) than the train, our chosen medium.

An alternative, faster and more comfortable could be the plane, but this would not meet the third requirement, premise, of emitting a considerable amount of emissions, which could not replace this transport.

Also based on data we can also see how, for there to be any transport that travel the same distance in a minimum amount of time should increase the amount of CO₂, since the increase in speeds causes that fuel consumption is increased.

Was it possible to improve the emissions produced with the development of the project in the activities carried out (leisure activities, basic activities such as electricity, heating, washing, etc.) in both mobilities?



In our first mobility to Villaduke, unlike the second in Uddenpool, the facilities in which we occupied were smaller and, therefore, required a lower consumption of heating and lighting. This, added to the fact that one of our main activities during our stay in Uddenpool was the amusement park of Liseberg caused that the CO₂ emissions regarding the activities and daily life increased more than initially planned.

Our facilities in Sweden had four buildings: the main house (in which most of the students and some teachers slept), the "Fishhouse" (where the rest of the teachers slept and the work seminars were held) and two cabins that they lacked heating and whose electrical consumption with respect to lighting is insignificant and which, therefore, are neglected in the face of calculation. Since the main house and the "Fish house" were large buildings, it required that the heating was active 24 hours, which, added to the fact that the lights of the main house did not turn off during the night, increased the electric consumption considerably.

The foregoing is different in the case of our stay in Spain, since the facilities only had one main building where, despite the fact that the lights were switched on at night, the continuous use of the air conditioners was not required.

Regarding the activities, those carried out in Villaduke were respectful with the environment, since none involved an electrical consumption or a direct emission of CO₂. The activities carried out in Uddenpool were very similar to those previously mentioned.

Can leisure activities be carried out, for example spending a day in an amusement park, keeping the level of emissions low, or is it necessary for more rural activities, for example games in the field without much need? material, for this to be fulfilled?

As we have seen, our visit to the Liseberg amusement park caused that the CO₂ emissions in our stay in Sweden were higher than those of mobility in Spain, which shows that this type of leisure activities contribute more than rural activities to the emission of CO₂.

This does not mean that we should carry out these activities, it only shows that we must be more responsible when carrying them out. In most amusement parks vegan food is offered, as is the case of the one visited in Liseberg, which allows that within the emissions produced in a park we can, personally, maintain a lower level of emissions, since as good We have been able to verify the vegan food is the ideal if we want to reduce our emissions. Unfortunately, the offer of vegan food at leisure sites is usually not very varied, and we believe it is one of the things we should improve if our goal is not to contribute to global warming, offer more variety of vegan food at stations, amusement parks and places where many people go for tourism or for entertainment.

Obviously, and as we have observed, rural activities are more profitable than other leisure activities to achieve our goal, so rural activities such as hiking or kayaking, for example, should be more common in our lives, which does not mean that from time to time when we



can not do other leisure activities. That rural activities are less polluting and healthier does not mean that they are less entertaining, there are many rural activities that adapt to varied tastes, so that the realization of this type of activities does not mean that we have to have less fun to not contribute to the emission of greenhouse gases.

Is it possible to show society the importance of what we have worked on as well as the way in which CO2 emissions are changing the planet?

Our intention with this project is not only to seek information about the problem of increasing CO2 emissions, but also to raise awareness from the closest to us as we try to reach the whole world, from the great dilemma of the measures to be taken and executed in the face of the threat of global warming; it is a reality of enormous dimensions in severity.

For this we intend to transmit and show its importance by traveling to places which are information and dissemination points, where we will talk about and explain our experience with emphasis on the data collected.

Has there been improvement and learning during the process of the experience?

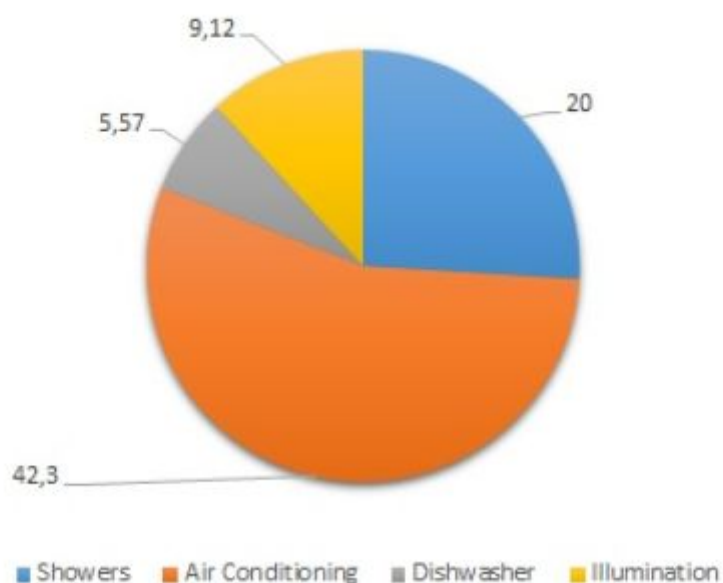
This experience has served both students and teachers to change our habits taking into account the impact of them on the environment. Modifying our diet, mainly consuming vegan products and avoiding others, such as meats. Using public transport more frequently, preferably the train, thus reducing the emission of greenhouse gases and consequently air pollution and above all avoiding the use of the plane, since it is the means of transport that produces the greatest impact.

As for the activities, both in Villaduke and in Uddenpool, we carried out outdoor activities that did not emit CO2 into the atmosphere. This allowed us to know new possibilities in terms of entertainment, since until then we had not done anything other than activities (such as using mobile phones, watching TV, etc.) that entailed high CO2 emissions into the atmosphere. This taught us that there was a whole new field of environmentally friendly activities that we had not implemented before and that could be replaced by other more polluting ones.

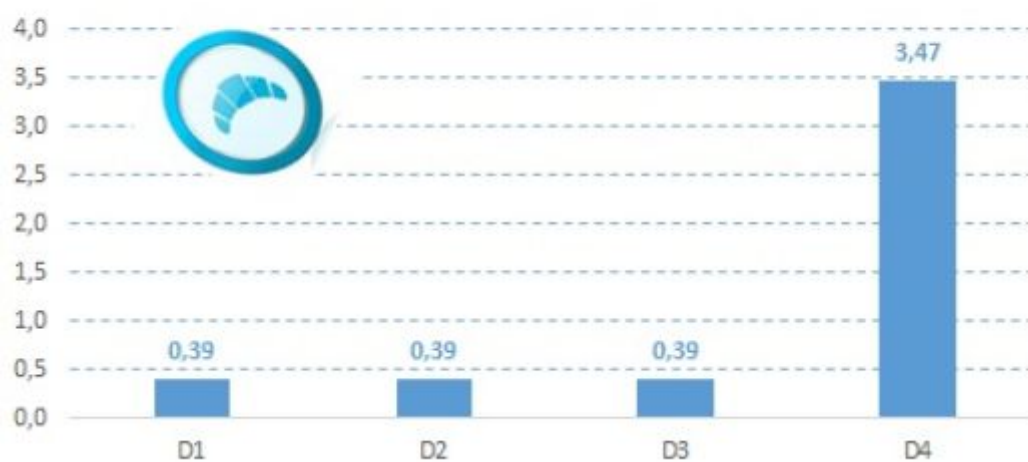


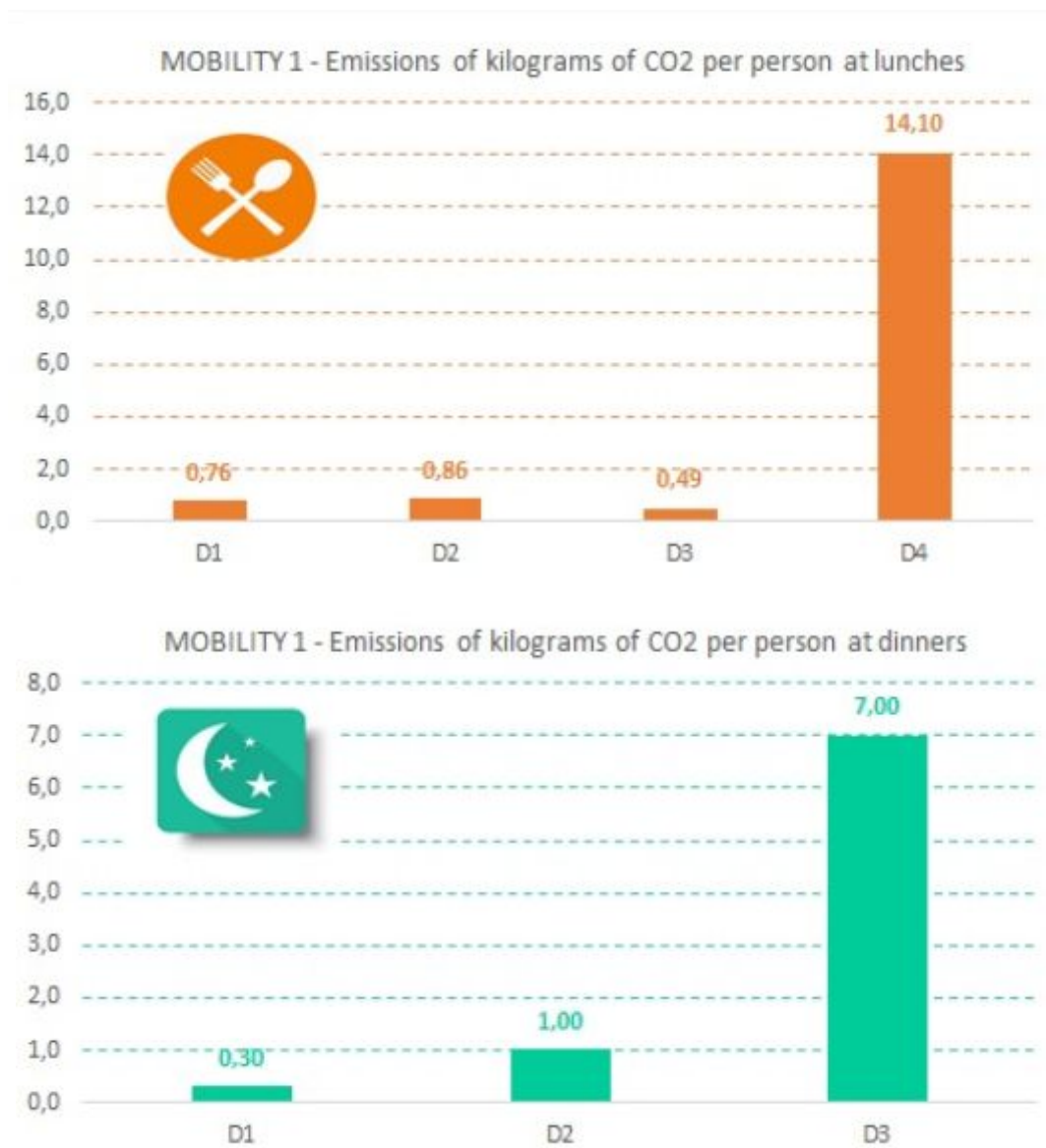
9. Extended data figures and tables

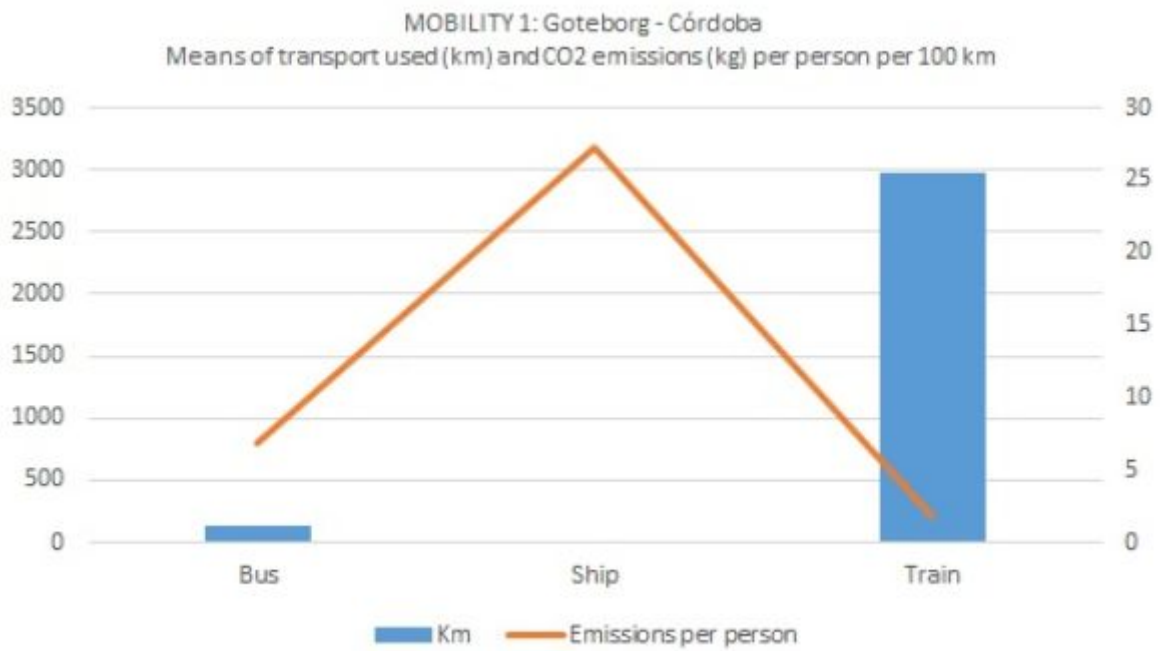
Mobility 1: Activities - Total CO2 emissions (kg)



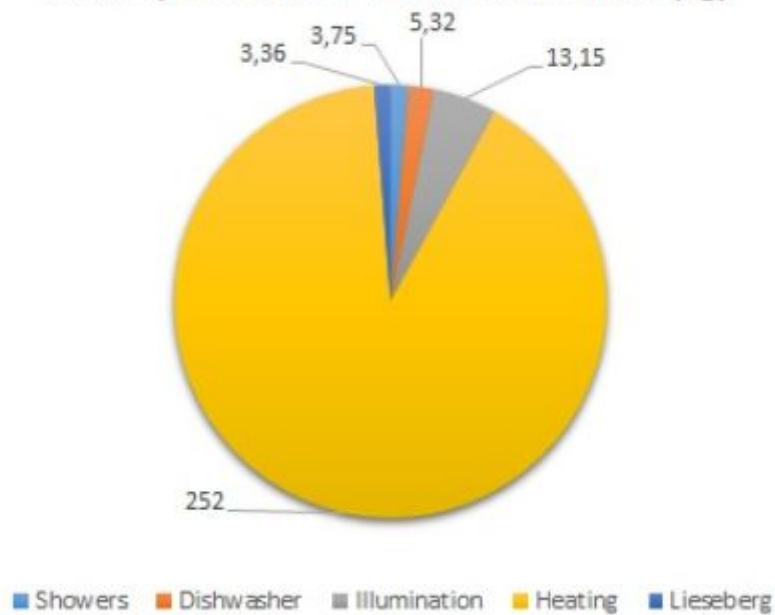
MOBILITY 1 - Emissions of kilograms of CO2 per person at breakfast



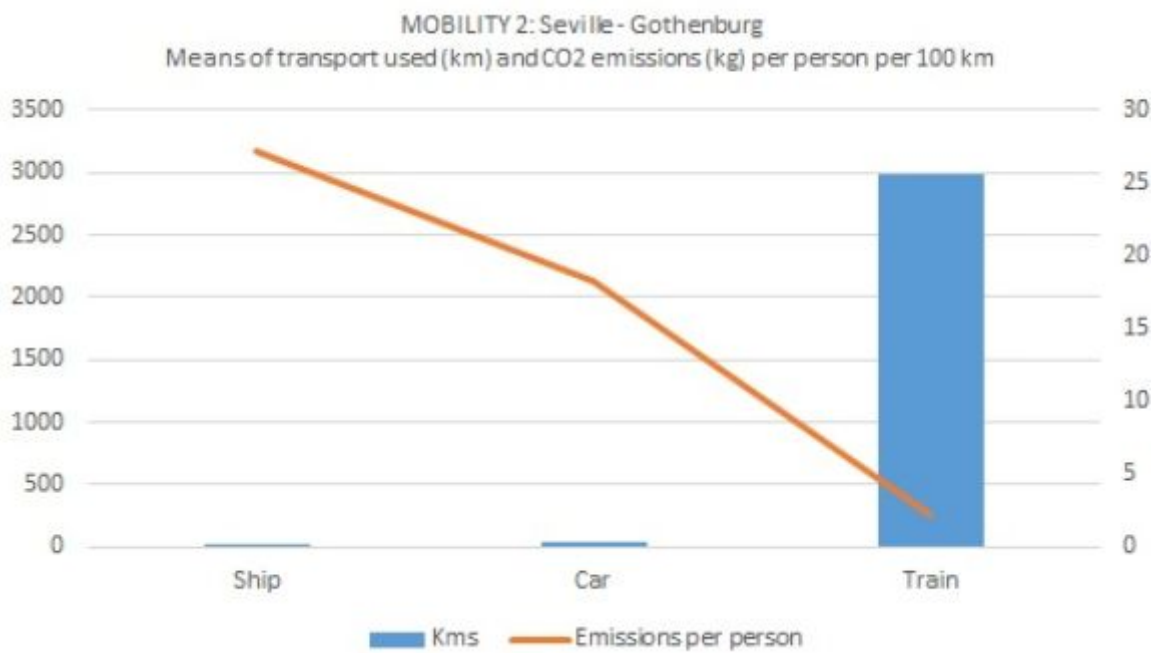
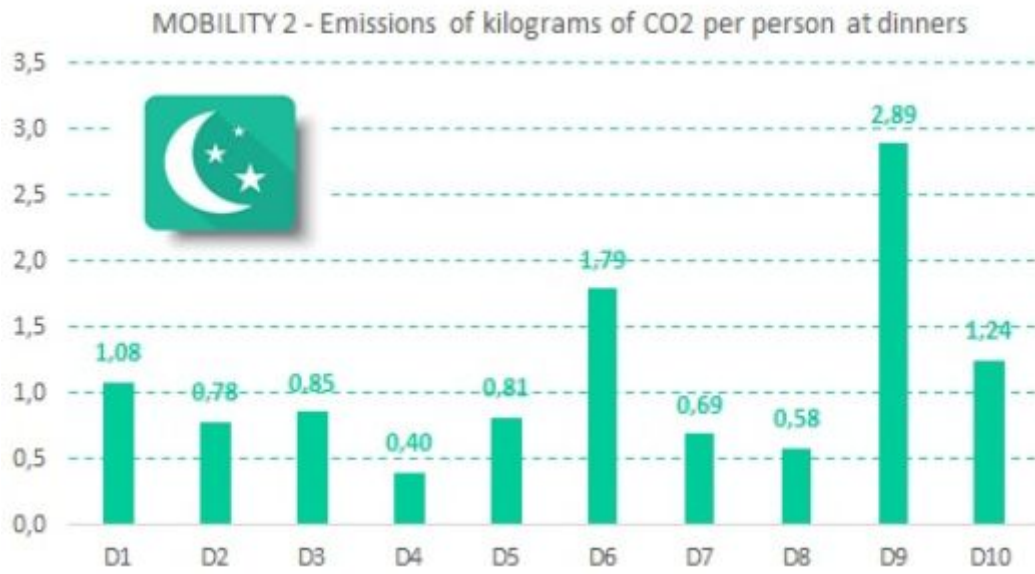




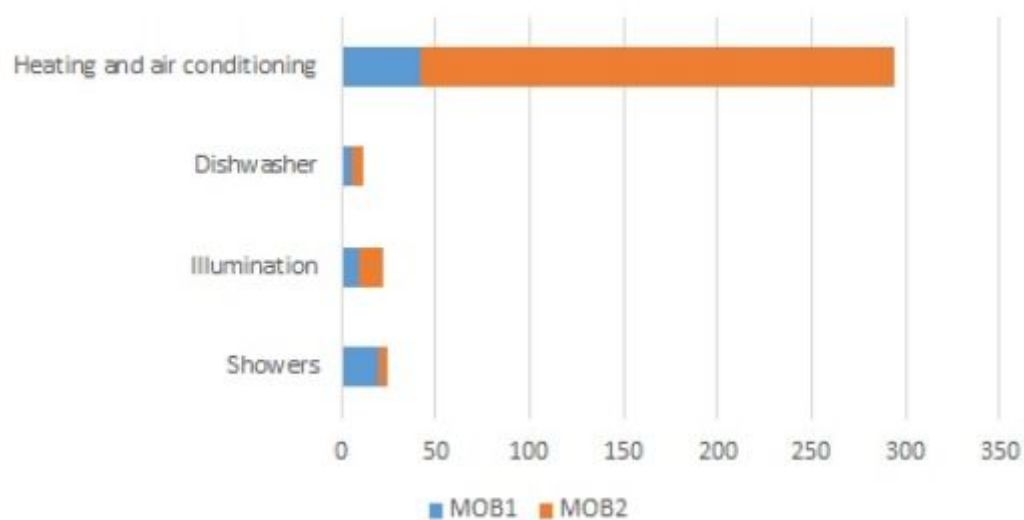
Mobility 2: Activities - Total CO2 emissions (kg)





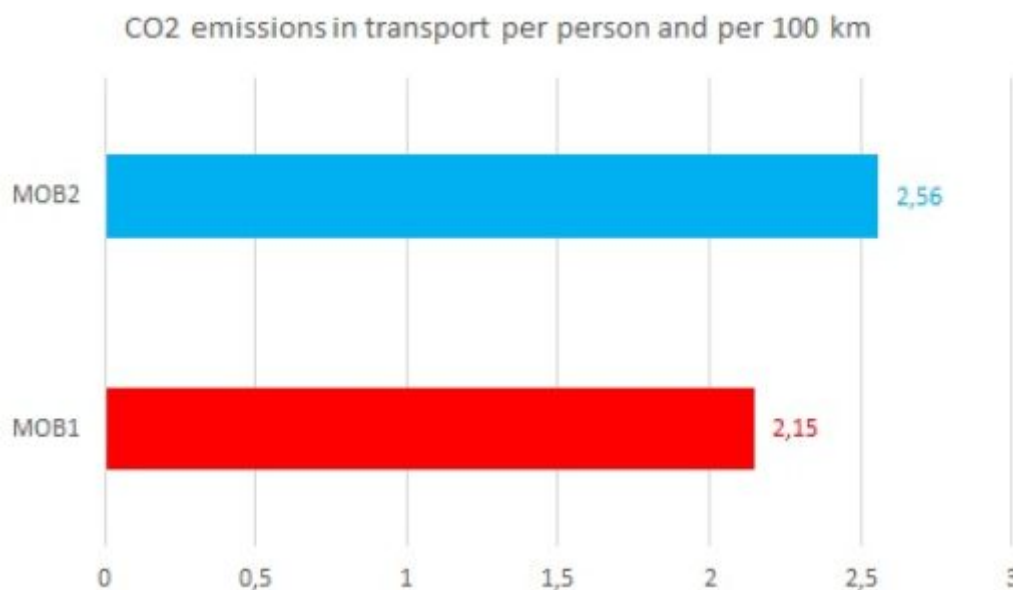


Average kg CO2 emission by common activity in mobilities



Average kg CO2 emissions per meal, person and day





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