Everyday Knowledge of Energy Efficiency. A Cross-Cultural Study Among Students in Germany and Honduras

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"Energy Efficiency Preconceptions
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Preface

The efficient use of energy is a global concern and involves multiple dimensions. Looking at it from an educational point of view, the topic is interdisciplinary and multidisciplinary for its strong link to current climate problems and their mitigations. From an educational perspective, in the topic are included not only cognitive characteristics but also affective characteristics like the interests and motivations toward the efficient use of energy. In the development of educational measures toward the efficient use of energy this hybrid character has to be take into account.

The present project reported the students' perspectives toward energy efficiency on an international level. As a cross-cultural study the projects was carried out in two countries with two different socioeconomic situations and two different cultural contexts. In the study there participated almost 1,000 students from three different levels of educations; among them are secondary school children and university students from both regions. As a cross-cultural study, in the project several obstacles were overcome that have been seen as challenges instead as difficulties.

I would like to express my gratitude to all the participants who took part in the study, namely the secondary school children and the university students in Germany and in Honduras.

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I am grateful to the personal of the Universidad Pedagógica Nacional Francisco Morazán, with special thanks to the authorities of the University, David Orlando Marin, Hermes Alduvin Diaz and Lea Cruz for their support during the project. I would also like to thank Luis Enrique Santos for his help with this project.

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technical literacy Section of physics, its didactics and its history, until this final report of the results.

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1. Introduction

1.1 Background

Energy supply and the efficient use of energy have been discussed extensively at an international and national level. The topic is linked to the future of our society due to climate problems that have as common staring points the inefficient use of energy and the increased demand of energy in different sectors. The reserves of fossil sources of energy, such as coal, gas and oil are coming to an end. This makes the ever-growing energy starvation of the world's population one of the main problems of society. In addition, the necessary degradation of these raw materials, as well as the subsequent burning or refining of them, leave massive traces on the environment.

Environmental protection and the mitigation of climate change are two of the great global challenges of the 21st century. In 1998 the United Nations recognized in the Kyoto Protocol the danger and the importance to take measures to mitigate climate change. The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The Protocol recognizes that the high level of GHG emissions are mainly the results of a long industrial activity by developed countries. The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005.[1]

In the protocol the 192 participating countries agree to implement measures in order to mitigate climate problems, such as the enhancement of energy efficiency in relevant sectors of the national economy. The research and promotion of new and renewable forms of energy also play an important role in the protocol.

The Paris Agreement is also an important global measure to mitigate climate change, it was adopted in 2015 at the twenty-first session of the Conference of the Parties to the United

[1](United Nations, 2017) Accessed (11.07.2017)

Nations. Under this Agreement 200 nations have recognized climate change as one of the most important global problems pointing out that the measures to its mitigation have to involve the diversity of people and take as staring point the important role of education to develop awareness. [2]

The global concern about climate problems is clear, the increasing demand of energy in different sectors and its inefficient use are one of the main causes of this growing problem. In this regard the efficient use of energy is one of the most important measures to mitigate this increasing problem, making energy efficiency a complex and ambivalent term that can be motivated by the consumption of energy from an ecological, economic, technical and subjective perspective. Frequently, the word is used synonymously with the concept of energy saving, here above all, economic interests are at the forefront, but these are often combined with a restriction on quality of life and well-being. An example would be the consistent lowering of heating for the purpose of cost saving or the restriction of water consumption in daily body hygiene. However, appropriate measures are often justified from an ecological point of view.

An efficient handling of energy therefore goes beyond the purely economic, focusing on different perspectives which also includes the ecological and social aspects concerning the domestic handling of electrical energy and heat. An efficient handling of heat energy stored in a heated room would in this case be, for example, the use of programmable heating radiators which, depending on the time, regulate the temperature in the room according to the presence of the occupants. This leads to a considerable saving in heating costs, but does not limit the subjectively perceived quality of life with a lower room temperature. In a societal context, this reduction in energy consumption by the local energy supplier leads to an ecological improvement in the long term, since the energy supplier has to provide less energy with correspondingly many customers trained in energy efficiency.

To anchor this understanding on the population it is necessary to create appropriate educational measures which intend to achieve the development of awareness about the

[2] (United Nations, 2019) Accessed (12.04.2019)

efficient use of energy. But first of all, to create these educational measures it is necessary to know the preconceptions, interest and motivations toward energy efficiency. The school seems to be the right place, where future generations can develop competences in the area of energy efficiency and awareness of the efficient use of energy through science instruction. However, this argument assumes that students should not only understand the physical significance of energy but they also have to be aware of the importance of energy in the ecological, economic and social environment. It should also be intended to develop an understanding of the environment and nature in conjunction with personal influence and personal responsibility.

Intercultural perspective

The study was carried out in two countries, Honduras and Germany. German and Honduran students from three different levels of education (year eight secondary school children, year eleven secondary school children and university students forming a population of students which have just completed their school education) are compared with each other with respect, among other things, to their preconceptions about energy efficiency, the efficient use of energy, interest regarding the topics of climate change, their motivation to make efficient use of energy and attitudes with respect to climate problems. These aspects are taken from two different cultural contexts in order to get a global perspective and to identify profiles of presuppositions, perceptions and performances of students from different cultures concerning the efficient use of energy. Rather than just generally stereotyping each group, the application of social science to social problems in each culture will be analyzed. The use and the appreciation of social resources, as well as the values and awareness related with them, will be also identified.

The cross-cultural study allows us to identify, on one hand, potentially existing problems in the everyday life of each country and, on the other hand, it also contributes to a very broad perspective and understanding of the subject of energy efficiency. This should create a basis for appropriate educational methods for heterogeneous groups, considering the multiplicative role of schools as a microcosm of change in neighborhoods, cities and countries. The engagement of students with this particular social problem through the teaching of it at schools is a key to empower social responsibility at this level.

The perspectives and performances regarding energy efficiency from students from a developed country and from students from a third world country were collected by using a Likert scale survey. The pilot version of the survey consists of thirty-one different types of questions: twelve frequency scale questions, ten level of agreement questions, six association questions and three single choice questions. The questions were made using the 5-point Likert scale. Due to the interdisciplinary nature of the topic energy efficiency, the search for students' perspectives includes not only students' preconceptions about energy efficiency but also students' attitudes, motivations and interests with respect to energy efficiency. The scale allows us to measure these affective characteristics, categorizing them in different levels.

The Likert scale does not request the participant to give a simple yes or no answer, more than that, it allows the participants to respond to a degree of agreement. In this manner, the data will provide not just information to create a pertinent curriculum related to energy efficiency in Germany and in Honduras, it will also provide information to set up a profile regarding education about energy efficiency, which will describe the level of social responsibility of the students, considering their culture and their perceptions regarding energy efficiency. This profile will also include the scale of willingness and interest of the students to take part in solving social problems, which involves an awareness of the existing social problems related to the use of energy in each country. To set up this profile, the level of acceptance of energy saving measures set by governments in each country will also be considered.

Due to the complexity of the topic, the survey is divided in seven categories: behavior in relation to energy use, preconceptions about energy efficiency, level of concern regarding energy efficiency and climate problems, level of responsibility in taking action to mitigate climate problems, level of exposure to information about the efficient use of energy and climate problems, level of interest in energy efficiency and level of willing to know more about the topic energy efficiency. The university students are teacher students who were in their first semester when the study was targeted, one of the aims to choose teacher students was to know the level of engagement as future teachers in taking action regarding climate problems. Apart from the seven categories, the first version of the survey had five association questions which intended to find out, among other things, students' motivation in making

efficient use of energy, as well as associations to energy efficiency and their sources of information.

To ensure that the survey captured the necessary data to meet the research objectives, a pilot test was made. The results of the pilot test led us to review and improve the instrument to be used in the main study. The data from the main study reveals important information about the level of social responsibility from the students associated with the use of energy and the consequences that this involves. Data also describes the perceptions of the students about this particular topic, the level of interest in knowing more about it and in taking part in the possible solutions. Differences and similarities between the groups were founded and explanations for this have been made.

1.2 Framework and features of the study

The study is framed by two theories. The interdisciplinary characteristics of the topic energy efficiency follows the principal of the "thematic structure of science"(Tondl, 1998) where it is argued that: "Apart from traditional scientific branches and academic disciplines which are often integrated into larger units or thematic complexes, new complexes of problems emerge, enhancing the need of transcending the horizons, of elaborating interdisciplinary methodology, fostering cooperation and especially communication. (A case in point exemplifying such problem complexes are those areas which synthesize many different disciplines, for instance, disciplines involving the creation, research and protection of the living environment, social mastery of technology, technology assessment, the problem area called "science, technology and society" etc.)"[3] The thematic structure of science reorganizes science based on themes or problems instead of academic disciplines covering various dimensions; these themes or problems are interdisciplinary or multidisciplinary.

There has been a restructure of knowledge in the last decades where interdisciplinary or multidisciplinary fields and comparative studies have created pressure upon the traditional scientific branches, for example, the International History, Philosophy and Science Teaching Group (IHPST). They promote research linked to i.a. history and philosophy of science , which aim to improve science at school and university integrating into teachers education programs,

[3] (Tondl, 1998) p.263

domains of history, science education and philosophy of science.[4] The present study accords with the principle that the thematic structure of science transcends the horizons of traditional scientific branches and is centered on problem complexes, including affective and cognitive characteristics where social problems, intercultural differences, global responsibility and preconceptions and attitudes toward the efficient use of energy linked to the protection of the living environment are put together.

The study is also framed by the model of "educational reconstruction" proposed by (Kattmann, Duit, Gropengiesser, & Komorek, 1996) as can be seen in figure 1.1, the model integrates three well-known lines of educational research and essential components to the reconstruction of the science curriculum, which are: (1) The analysis of scientific content, its clarification and educational significance, (2) The investigation into students' perspectives on a chosen subject, and (3) The design of learning environments or teaching- learning sequences.

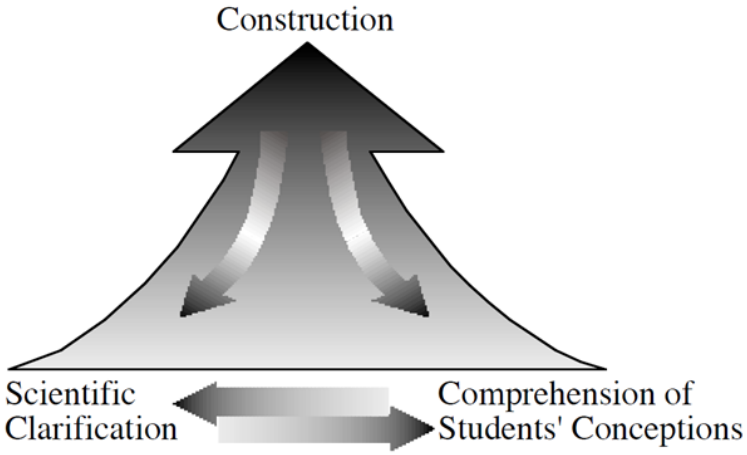


Figure 1- 1: Model of educational reconstruction (Kattmann, Duit, Gropengießer, & Komorek, 1996)

"The key feature of our model is the way in which these components are brought together and in which their interactions are used for educational reconstruction"(Kattmann et al., 1996)p.4.The three components do not strictly follow upon one another but influence each other mutually (Kattmann et al., 1996) "Students' conceptions and alternative framework in everyday life are accepted here above all as a necessary starting point to and even an aid for

[4] (IHPST, 2017) Accessed (11.07.2017)

learning and not as an obstruction of scientific thought that should be removed" (Kattmann et al., 1996)p.6.

"The results of the research already conducted within the framework of Educational Reconstruction clearly show that intimate knowledge of students' conceptions may provide a more adequate understanding of the referring science content by the curriculum developers. The MER has been designed primarily as a frame for science education research and development. However, it also provides significant guidance for planning science instruction in school practice"(Duit, Gropengießer, Kattmann, Komorek, & Parchmann, 2012)p.19. (Niebert & Gropengiesser, 2014) and (Felzmann, 2017) also concluded that the model is adequate to develop science instruction contents.

The present study aims to investigate students' perspectives of energy efficiency, corresponding to the area of "comprehension of students' conceptions". Due to the interdisciplinary and multidisciplinary nature of the topic energy efficiency, in the section of "comprehension of students' conceptions" a broader search is proposed which includes not only preconceptions about energy efficiency but also "students' perceptions", "students' opinions about the topic", "students' attitudes towards the topic" and "students' interest in the topic".

Further to this the study is a focus on the efficient use of energy in private homes, considering cultural differences and different levels of education, students' conceptions about energy efficiency from various levels and cultural backgrounds, which should provide a good basis for the systematic instructional formation (Vosniadou & Ioannides, 1998). Adopting the model of educational reconstruction(Kattmann et al., 1996). the main features of the study can be illustrated in Figure 1-2.

The clarification of key concepts of energy efficiency corresponds to the area of "scientific clarification which correlated to students' conceptions" could make it possible to design effective teaching and learning activities regarding energy efficiency. The aims of the study correspond to the sphere of empirical investigation, while the results of the present investigation should be the basis for the design of learning activities toward the efficient use of energy.

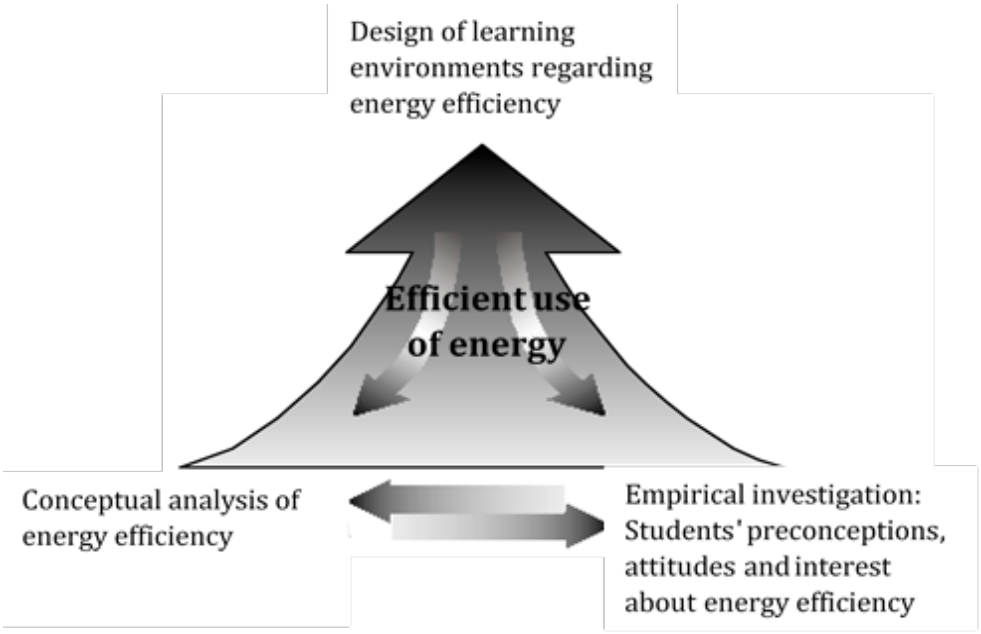


Figure 1- 2 Main features of the study illustrated in the model of educational reconstruction

The study can be summarized into the following features:

1. A cross-cultural investigation on students' preconceptions about energy efficiency, highlighting their energy efficiency behavior.
2. A cross-cultural analysis of some conditions (interests, opinions, attitudes and motivations) that have to be found in order to support the construction of instruction/conceptual reconstruction.
3. An approach that could be the basis to construct an instruction of the topic energy efficiency in schools.

1.3 Purpose of the study

The study is intended to investigate the students' opinions, interest and attitudes toward energy efficiency, considering their level of education and their cultural background. The study is led by two principal arguments.

First, the topic of energy efficiency needs to be taught at school in order to anchor an understanding in the population and create awareness of the efficient use of energy as a factor to mitigate climate problems. But according to the model of educational reconstruction, the subject to be taught has to include the students' preconceptions.

In this regard the results of the present study aim to be the starting point to a possible construction of learning environments, instructional materials, learning situations and teaching and learning sequences.

Second, the exploration of the cross-cultural ideas of young people allows us to capture the cultural dimension of the topic energy efficient, given that different international studies (Liu, 2005) (Paz Matute, 2011)have proved the implication of culture in science instruction. The study also aims to find relations between the different categories of analysis that are involved in the study.

1.4 Research questions

The study is based on the argument that the investigation of students' preconceptions about the efficient use of energy allows a more adequate understanding regarding the scientific content of this topic, which at the same time is essential for a pertinent and efficient development of science instruction strategies. In this regard, the present study is centered on searching on an international level for the preconceptions, interest and attitudes toward energy efficiency. At the center of the study is the efficient use of energy in private households. The study covers two different cultures and three different levels of education in order to gain a broad understanding of the topic.

The study should therefore clarify the following questions:

1. What “level of energy efficiency” do the students from Honduras and Germany have? Do the participants differ in their use of energy, taking into account their level of education and their cultural backgrounds?
2. Do the participants from different cultures differ in their preconceptions about the efficient use of energy?
3. Are the participants aware of current climate problems? Does this awareness differ taking into account their level of education and their cultural backgrounds?
4. Are they interested in the topic of energy efficiency?
5. What individual behavioral measures and perspectives do they see for themselves in order to use energy efficiently?

At the same time, associations about the topic energy efficiency will also be asked, for example, economic associations or ecologic associations. The focus of the study is on the efficient use of energy in private households and everyday concepts about energy-efficient behavior, as well as their possible origins and manifestations. In addition, the global responsibility in acting to find solutions to solve climate problems is inquired.

2. International comparative studies and students' “preconceptions” in science education

In the chapter are discussed the importance of international comparative studies to an educational system. In this regard, some general data of Honduras and Germany where the study is carried out is explained. Students' preconceptions in science education are discussed, summarizing students' preconceptions about energy. At the end of the chapter are discussed the model of educational reconstruction and students' preconceptions in science education as well as Energy efficiency and science education.

2.1 International comparative studies in science education

International comparative studies have an important part in science education as a measure to understanding a particular educational system but also to improving it by comparing a particular educational system to other one. The Organization for Economic Cooperation and Development (OECD) has been comparing the educational systems of its member countries in order to develop guidelines for optimizing them. The “Program for International Student Assessment” PISA, is the comparative study that the OECD has carried out in order to evaluate the performance of the educational systems of its members (OECD, 1999).

PISA aims to know the level of necessary skills that students have acquired to fully participate in society, focusing on key domains such as reading, science and mathematics. “The PISA assessment frameworks define competence as far more than the capacity to reproduce accumulated knowledge. According to PISA, competence is the ability to successfully meet complex demands in varied contexts through the mobilization of psychosocial resources, including knowledge and skills, motivation, attitudes, emotions and other social and behavioral components. Rather than assessing whether students can reproduce what they have learned, PISA measures whether students can extrapolate from what they have learned and apply their competencies in novel situations” (OECD, 2017)p.32

PISA is made with student samples ranging from four thousand five hundred to ten thousand, from a minimum sample of one hundred and fifty schools, in order to ensure the representativeness of the country as a whole. Countries can request extending the number of their schools to have greater representation. The target population is students of 15 years and three months old to 16 years two months old (abbreviated to 15 years old). It was developed between 1997 and 1999 and applied for the first time in 2000 with the collaboration of 28 OECD member countries, including Germany (plus four non-members, giving a total of 32 countries) (Baumert, et al., 2003)

In 2000 the first evaluation was carried out in which around 180,000 students worldwide participated. The second cycle in 2003 included 41 countries. After that, the evaluation has been taking place in cycles of three years. The most recent cycle was in 2015, which included 57 countries. In this latest cycle, the survey focused on mathematics, reading, science and problem-solving.

The International Association for the Evaluation of Educational Achievement (IEA) is conducting International comparative studies since 1958. "IEA studies hold the promise of meeting governments' needs to obtain information on how their educational system operates relative to other systems, which may help to identify deficiencies and strengths"(Kellaghan, 1996) p.143. According to the information in the IEA Internet homepage [5] these studies contribute to understand each individual educational system by monitoring changes in curriculum and, educational achievements.

The Third International Mathematics and Science Study (TIMSS) is the continuation of the role the IEA have being playing since 1959. The First and Second International Mathematics Study (FIMS and SIMS) were accomplished in 1964 and in 1980 to 1982. Both the First and Second International Science Study (FISS and SISS) were carried by the IEA in 1970 to 1971 and in 1983 to 1984 (List, 1998).

[5] (IEA, 2019)Accessed (13.05.2019)

In 1995, with the name of Third International Mathematics and Science Study (TIMSS), the first study was conducted in both mathematics and science and began with a series of cycles of four years (1995, 1999, 2003, 2007, 2011 and 2015). TIMSS is not about pure knowledge; reasoning, analyzing and solving problems are also important elements of the evaluation. TIMSS covers these procedural skills just as much as making substantive understanding of contexts. TIMSS and PIRLS set five performance levels in each of the skills assessed. These are delimited by international fixed reference points 400, 475, 550 and 625 (Bos, Heike, Olaf, & Christoph, 2012). The distribution of the items at different levels according to their difficulty can describe the degree of acquisition of competence corresponding to each[6].

In (Beaton, et al., 1996) TIMMS is described as an enormous program, according to them forty-five countries in more than 30 different languages participated in the study involving more than 1500 schools and half a million students. "The main purpose of TIMSS was to focus on educational policies, practices, and outcomes in order to enhance mathematics and science learning within and across systems of education" (Beaton, et al., 1996) p.7.

The benefits to a nation or system of education by participating in an international educational study are essential to policy makers. These kind of studies not only provide information about educational achievement, they also provide information about learning contexts (Kobarg, et al., 2011). "Most international studies collect information that allows for a detailed examination of factors likely to influence educational achievement" (Beaton, et al., 1999) p.14

It has also been defined the following broad groupings of explanatory factors: "home background, school characteristics, teacher characteristics, teaching conditions and practices and student motivation"(Ouane & Singh, 2004)p.3. "The relationships among these factors and the educational achievement of students can be studied within individual countries, but international studies facilitate comparison of the relative importance of the factors in different countries. That is, international studies offer an important opportunity to replicate analysis across countries, which permits researchers to discover whether such factors

[6] (IEA, 2016) Accessed (22.05.2016)

affecting achievement are 'universally' important, or important for a group of countries, or important for a particular country" (Beaton, et al., 1999) p.15

Using education in one country as a reference enable us to a better understanding of education in other country. By making an international comparison some questions arise, for example, how does the achievement of students in a particular country compare to the achievement of students in other countries? Is it probable that other countries are the proof that it is possible to reach higher achievement? How can the education of a country be improving if there are not comparisons with other countries? By studying education in other countries, alternative approaches to teaching and learning may be discovered. When high achievement countries have alternative practice, they might suggest hypotheses for how education can be improved in low achievement countries (Linn, 2002)

By discovering alternative approaches to teaching and learning, applying practices that work in other countries, it is then necessary to take into account the differences among each country and an alternative practice that work perfectly in high achievement countries will not necessarily produce the same results in a low achievement country. To generate a change in a particular country the features of each country have to be taken into account. But still, the results of a comparative study can generate a change or an improvement in the educational system of a country (Shorrocks-Taylor, Jenkins, & Edgar, 2002).

There are plenty of cases and lots of information about the impact that an international study can generate in an educational system. For example, "the German public and policy makers assumed that Germany had earned pride of place among the world's education systems for having one of the most effective, fair and efficient school systems. It was not until the close of the 20th century that they found out that that was not the case at all, and that Germany's schools ranked below the average for the PISA countries" (OECD, 2011) p. 202. The first results of PISA revealed deficits and differences in contrast with comparable countries. "Missing standards and input instead of outcome orientation of the school system have been assumed to be two of the most important reasons for the mediocre or even poor ranking of Germany schools" (Fischer, Kauertz, & Neumann, 2008) p.29. But this has generated an important change in the German educational system. Now, ten years later, Germany has significantly improved its position in the PISA study.

The present international study is carried out in two different countries, one in Europe, the so called “first world” and the other in Honduras, a developing country in Latin America. (Von Kopp & Schmitt, 2004) explained that factors of school systems as well as cultural and economic factors could be responsible for the “productivity” of a school system. One of the targets of the present study is to identify whether these factors can influence students' preconceptions, perceptions, attitudes and interest with respect to energy efficiency, but it also aimed to find out whether the efficient use of energy differs in these two different cultural contexts. To have a broader perspective about the countries in which the following investigation took place, the following section describes some general data of the two countries.

2.2 Germany and Honduras, General data

2.2.1 Honduras

Honduras has an area of 112,492 square kilometers and a population estimated at more than nine million. Honduras has two seasons: dry and rainy, the average high temperature is 32°C and the low temperature is 20°C. The population growth rate is 2.8%, which is one of the highest in Latin America and the Caribbean, a region where the average is 2.1%. 47% of the Honduran population is urban and about 20% of it lives in Tegucigalpa, the capital, and San Pedro Sula, the main industrial center. These two cities are located in the so called "Central Corridor", the most developed area covering the departments of Atlántida, Cortes, Comayagua, Francisco Morazán, El Paraiso and Choluteca, where more than a half of the population lives.[7]

According to a study conducted in April 1999 for the Confederation of Indigenous Peoples of Honduras (CONPAH), there are nine ethnic villages totaling about half a million people; this is equivalent to 8% of the total population. The largest ethnic groups are the Lenca (110,000

[7] The Information about the socioeconomic situation from Honduras and its educational system was taken from the Honduran Curriculum Nacional Básico, version 2003 (CNB).(SEH, 2003)

people) and the Garifuna (200,000 people). There are other non-native ethnic groups (Arabs, Palestinians, and Chinese) but the vast majority of the population is mestizo.

"Honduras is also characterized by its high levels of social insecurity. 40% of the poorest homes receive less than 10% of national income; while 10% of the richest homes receive around 50% of national income" (UNESCO, 2003) p.160. According to the Report on Human Development in 2012, in Honduras 66.1% of the population lived in poverty and 57% lived in extreme poverty. Honduras is still predominantly rural and 76% of rural residents are poor. Moreover, poverty is higher in the western region of the country, showing a strong correlation between poverty and education.

Honduran educational system

The Honduran educational system consists of four educational levels, defined as follows:

- Pre-basic education

A 6 years' level, attending to the population aged between 0 and 6 years old, is composed of two cycles (first cycle, 0-3 years old; and the second cycle, 3-6 years old). The state compulsory care for children in the last year of the second cycle of pre-basic education (5-6 years old) is through official kindergarten and basic education centers, delegating childcare from 0 to 5 years to alternative centers such as kindergartens, government institutions or private preschools, with the understanding that they will be regulated by the Honduran ministry of education.

- Basic education

A 9 years' level, free and compulsory to an average age of between 6-15 years old, is composed of three cycles of three years each. The basic education curriculum is organized into curricular areas, with the first cycle begins the instrumental skills development; the second cycle deepens the development of instrumental skills and increases mental and attitudinal training processes. During the third cycle, the education acquires a scientific and technological nature, at the same time it reinforces and expands the curriculum of the previous cycles. This cycle prepares students to enter into the secondary level.

- Middle education

A 2-3-year level, at an average age of between 15-18 years old. Middle education comes in two forms: scientific humanist school and vocational technical school. The first one is a baccalaureate in general arts and science, it consists of a period of two years; it offers to students an academic training, aiming continue studies at the higher level. The professional technical baccalaureate, allows access to the higher Education but also enables the entrance into the labor market. It is developed over a period of three years. This method will favor a process of dual training where school and private enterprises are integrated and coordinated for the preparation of human resources demanded by society.

- Higher education

This is for students from 17 to 18 years, and older. The level of higher education has the mission of academic excellence, with a role of an intellectual leadership, whose core functions are part of the promotion of research, dissemination of culture, technological development and execution of teaching at the highest level. These essential functions are embodied in the formation of professional staff which includes all actions relating to the initial and continuing training of teachers, required by all educational levels of the national education system.

- Science education and basic education in Honduras

Natural science at the basic education level in Honduras aims at the study of the nature, structure and functioning of beings, the methods of science, as well as the complex relationships between science and society. It comprising: Physics, Chemistry, Biology and Ecology. It is related to the social environment in areas such as sustainable management and protection of the environment, the development of habits for the preservation of health, comprehensive care to women and families and to improving the quality of life. As these issues have significant relevance in the country, this area prepares the students to improve the living conditions of the population and to combat environmental degradation that threatens food security and ecological balance. Natural sciences from year one to year nine has four blocks:

1. Living things and their environment.

2. The human being and health.

3. The earth and the universe.

4. Matter, energy and technology

- Science education and middle education in Honduras

The study of science, technology, humanities, arts, culture, sport and a foreign language prepare the students in the different areas of knowledge. In this way they can cope efficiently in the future. It generates in the student the necessary solvency and skills to enter into higher education and/or their integration into the world of work. Science education in middle education is dived into three areas: Physics, Biology and Chemistry. In this research the scientific and humanistic baccalaureate is taken into account, that which prepares the student to go into high education or university.

Natural science in the scientific and humanistic baccalaureate is considered as a curricular area which aims to prepare the student for critical analysis of scientific and technological advances, its application in solving problems of daily life and its relationship to development in health, food security, reproduction of the species and especially the threat and consequences of the irrational use of natural resources, such as climate change and its negative impact on biodiversity.

This area is divides into four associated fields of knowledge as follows: Biology, Physics, chemistry and Environmental Education. The last one has become particularly important globally. Environmental education, takes priority in the field of knowledge in the curriculum of middle education pretending to identify relationships between the environment and human beings as well as promote a balanced relationship between them in order to ensure the sustainability and quality of life of present and future generations.

Project Design. provides different means and methods for effective planning of a scientific paper.

In the two years of middle education Physics as a knowledge field is divided in four blocks, with four hours a week, totaling 80 hours per block. Environmental education is taught in the last semester of year eleven for three hours a week, totaling 60 hours. The topic of energy is taught in year ten and eleven. Also, in year eleven environmental education is taught as a priority field.

Teacher training in Honduras

By Decree No. 262-2011, published in the Official Journal "La Gaceta" on 22 February 2012, the Fundamental Law of Education in Honduras was approved.[8] The implementation of this reform in the Honduran educational system responds to a new Vision and Nation Plan for the country. The Fundamental Law of Education promotes the quality and the inclusiveness of education for all students and according to this law the initial training of teachers is an essential factor in it. The Fundamental Law of Education regulates that from 2018 to enter the teaching profession at least a bachelor's degree in education will be required. Before the application of this law, until now it was possible to become an elementary school teacher after studying three years at a special school for primary teachers.

The National Autonomous University of Honduras, (Universidad Nacional Autónoma de Honduras) the Francisco Morazán National Pedagogical University, (Universidad Pedagógica Nacional Francisco Morazán) and the Pedagogical Institute created under the Article 85 of the Fundamental Law of Education in Honduras are the only authorized institutions to offer teacher training in order to enter into the teaching profession at different levels, modalities and specialties. The initial training of teachers may run on different modalities, face-to-face, distance education and mixed.

To enter into teacher training at university level and non-university, it is a fundamental requirement to possess a bachelor's degree in any of its forms which accredits having completed official studies at the middle level. Applicants to enter into teacher training, in addition to the requirement mentioned before, must pass the selection test with a score of not less than 80%. The selection test, besides the cognitive aspect, should contemplate aspects to determine the vocation of the applicants for teaching. The test will be standardized annually for all teacher training institutions and approved by the National Board of Education and the Secretary of Education of Honduras. Every teacher training institution, in accordance with its own regulations, may establish specific requirements for entry to teacher training.

[8] The information about the teacher training in Honduras was taken from (Goberment, 2012)and (SEH, 2016) Accessed 23.05.2016

Teacher training generally lasts four years, depending on the available time of the future teacher; In some cases, the future teacher will have a part-time job.

- Teacher training competences

Teacher training aims to give the future teacher the skills and controls in cognitive, curricular, pedagogical, sociocultural and affective areas, orientated towards achieving the quality of education that has the learner as the rightful holder and the main actor of the educational process that takes place through the national education system. Initial teacher training must provide the knowledge, skills and attitudes necessary to develop a quality learning process that translates into results for learners.

The graduate of teacher training must possess and apply the following domains to join the teaching profession:

- The CNB (the basic national curriculum) and the level curriculum that has been formed, which involves understanding the topics, subtopics and their theoretical foundations and which is supported from various educational perspectives, pedagogue development and objectives, as well as the results they expect from the student.
- Understand the complexity of the educational process which means leading the learner to think about people, institutions, society and their cultural, religious, political and economic communities so as to understand the globalized world, its benefits, its crises and contradictions.
- Develop educational research to identify the reality to be transformed, plan actions or projects to change this reality and the management that allows the learner to generate a new reality.
- Apply the educational and pedagogical research aimed at improving the teaching-learning process.
- Reflect and take critical attitudes about the types of learning, teaching methods, teaching media, school systems and processes of evaluation to ensure the quality of education.

- Provide the necessary elements to ensure the excellent performance of students when they join the professional world of work.
- Foster a critical and reflective spirit in students in order to respond to the needs demanded by the context in which they operate.
- Analyze complex and challenging situations.
- Work together with other teachers to reach solutions.
- Consult other teachers or experts in real environments.
- Use information and communications technology.
- Participate in group sessions to reflect on results.

2.2.2 Germany

Family and school are educational institutions, each having their own specific characteristics, explicit boundaries and defined functions. On one side, the educational conduct of schools in a specific country fits the general pattern of the dominant culture in the society in which the educational system is involved. On the other side, the educational conduct of the family is influenced in some measure by the social class, culture and subculture of the family; this could be the dominant culture in which the family is involved or by a minority one like a migrant culture (Von Kopp & Schmitt, 2004). In Germany the family plays a central role in the schooling of children by preparing and accompanying them through the process.

Family and its social and cultural environment strongly influence the expectation and encouragement of achievement. In a multicultural society like Germany, the differences between these two educational institutions have been topics of discussion in the scientific community. The situation could be taken as considerably discontinuous, but could be also be seen as an opportunity for cooperative and mutual work (Von Kopp & Schmitt, 2004).The parenthood in Germany is a strictly anchored in the constitution. Schools in Germany have also firmly defined zones of responsibilities. For both schools and families in Germany, their rights and responsibilities are exactingly formulated (Fuligni/Stevenson, 1994).

German society has an orientation toward autonomy and an accentuation of self-control and control of the environment (Trommsdorff, 1984). Regarding conflicts between parents and children, the situation seems to be more equal in Germany, that is, generally the parents do

not use their influence as adults in dealing with conflicts with their children. This could have as a result that children learn how to assert their own will. This way of dealing with conflicts creates a series of problems. In the last decades liberal behavior in children has increased. Children in Germany are empowered or sometimes forced to make their own decisions, even at an early age. The most important characteristics of the German cultural educational pattern are to form one's own opinion, to have self-confidence and independence, with a dominance in social competence (Von Kopp & Schmitt, 2004).

Socioeconomic situation of Schleswig-Holstein

Schleswig-Holstein is the most northern state of the Federal Republic of Germany. Here live some 2.8 million people. The land area is 15,799 square kilometers. The state capital Kiel is also the largest city with around 240,000 inhabitants. The eleven districts and four separate urban districts are divided into 1,110 communities (as of 31.8.2013). Almost 13% of the population has an immigrant background; the largest groups of migrants are Turkish, Polish and Russian.[9]

The Schleswig-Holstein education landscape is changing. After primary school, there occurs at the lower secondary level a two-tier education system of community schools or "Gemeinschaftsschule" and high schools or "Gymnasium". It focuses on longer together learning. At a community school all educational qualifications of primary education can be acquired in a common educational background. In an increasing number of locations, the community school teaches pupils for nine years until graduation. Parallelly, the majority of high schools or Gymnasiums offer pupils eight years of schooling.[10]

Germany educational system

"Article 30 of the German constitution provides: 'The exercise of governmental powers and the discharge of governmental functions is incumbent on the Länder insofar as this Basic Law does not otherwise prescribe or permit'. For the education system, this means that the Länder have the legislative and administrative competence for all issues of cultural policy and

[9](Schleswig-Holstein)Accessed (24.06.2016)
[10](Schleswig-Holstein) Accessed (24.06.2016)

administration, from radio to state libraries to theatres, schools and universities" (Klemm, Lehmann, & Weiß, 2004) p.304. Normally primary school in Germany lasts four years, followed by the transition to secondary school at the beginning of the fifth year. This is followed by a two-year period of observation when the child receives support and orientation, and the transfer decision may also be reviewed during this period of time. The secondary level differs with regard to the numbers of years the student needs to attain the graduation certificate.[11]

Each of the federal state has differences in their school systems.

The following explains some general data about Schleswig-Holstein and its school system.

Schleswig-Holstein educational system

The school system in Schleswig-Holstein is divided in two parts:

- Primary school

After kindergarten, at the age of six, children go to school; its name in German is "Primarstufe (Grundschule und Sonderschulen)". Children attend this school from year one to four. The primary school curriculum follows the concept of common basic education. With basic education is meant a versatile education that encompasses all dimensions of human interests and opportunities.

- Secondary school

This is from year five to year thirteen. The secondary school is divided into two levels, the "Sekundarstufe I" from the year five to year ten and the "Sekundarstufe II" from year ten to year thirteen. The curriculum for the lower secondary school or "Sekundarstufe I" has been created to apply to all types of schools, community schools or "Gemeinschaftschule" and also for regional schools. Individual plans are shown separately for "Gymnasiums". The curriculum

[11] On this topic see (Eckhardt, 2017), (Schleswig-Holstein)Accessed (24.06.2016)(Schleswig-Holstein) Accessed (24.06.2016)

of the "Sekundarstufe II" is broken down, as is the curriculum for the "Sekundarstufe I", in two related parts, the basic part and professional activities.[12]

- Science education and primary education in Schleswig-Holstein

From year one to year four, one of the twelve classes that children attend is home and social studies, the main themes in this class are integrated into six areas of learning. One of these six areas is nature and environment; in the development of this area the topic learning about the benefits and dangers of electric currents will be taught. In home and social studies, the first physical and chemical contents are addressed, approaches which are characterized by everyday experiences. Therefore, the early lessons in physics are based on ways of dealing with the pre-instructional conceptions.

- Science education and secondary education in Schleswig-Holstein

Physics introduces, along with Biology and Chemistry, the task of the scientific method of thinking and working to students. In the "Sekundarstufe II" natural science will be also taught through Physics, Biology and Chemistry. In Physics the topics are generally chosen so that they reference the everyday experiences of children.

Teacher Training in Germany

In Germany the responsibility for teacher training rests with each Länder. "which regulate training through study regulations or training regulations and examination regulations or corresponding statutory provisions. The First and the Second State Examination are conducted by the state examination authorities or boards of the Länder" (Eckhardt, 2017)p.191. While it is not homogenous in all the 16 states of the federal republic, a common factor is that teacher training takes place in three chronological phases. The first phase takes place at university; the task at this first stage is to provide the aspiring teacher with knowledge and the reflectiveness in order to prepare them for their future as teachers (Blömeke, 2009).

[12] The data about the Schleswig Holstein educational system was taken from (Ministerium für Bildung, 2015) Accessed 03.04.2015

The first scientific training phase takes place at universities, “Technische Hochschulen / Technische Universitäten, Pädagogische Hochschulen” (colleges of education) and colleges of art and music. This first phase is followed by a second practical phase (“Referendariat”) lasting 1.5 or 2 years in which to the “Referendar” or the aspiring teacher is paid a small salary. This phase is organized by the school administration of the Land. The aspiring teacher is instructed by a guide teacher and a leader of the pedagogic and science education seminars. The “Referendar” has to attend and to give lessons at a school of their branch. During this phase the aspiring teacher has to pass several examination lessons. The first two phases both culminate in a state examination. “Training in the preparatory service takes place in different training formats at schools, teacher training colleges or similar establishments”(Eckhardt, 2017) p.199. The second state examination is the requirement for employment as a teacher at a public school.

The requirement for teacher training is generally the “Abitur” which is achieving after twelve of thirteen years of schooling, normally at grammar-school. Beside the “Abitur”, there is no special requirement for teacher training, there is no entrance exam, nor selection on the basis of “Abitur” results. Before or during the training there is no test in order to get the job. The Standing Conference of Ministers of Education and Cultural Affairs of the federal state (KMK) has defined six types of teaching qualifications, while the estimated duration of the teacher training is 10 semesters. Type 1 is the teacher qualification for primary level. Type 2 is the combined teaching qualification for primary level and lower secondary level in one or more types of school. For some types of school at lower secondary level the type 3 teacher qualification is required. For the upper secondary school or grammar schools is require type 4. Type 5 is the teaching qualification needed for vocational schools. For special needs schools is required the type 6 teaching qualification (Blömeke, 2009) .

The teacher training for primary and secondary school generally consists of two school subjects; in the case of vocational schools it is one specialist area. Besides the specific subjects, teacher training for all the school levels also consist of the didactics of specific subjects, courses about school pedagogy, pedagogical psychology, sometimes educational sociology and philosophy.

Teacher competences

The Standing Conference "Standards for Teacher Training: Educational Sciences" in the Resolution of the Standing Conference (of 16.12.2004 i.d.F. from 06.12.2014) describes the competences that a future teacher must have acquired during their two phases of teacher training (studying at a university and the “Referendariat”). The teacher mission is defined (KMK, 2000) standards that lead to competence in the fields of teaching, educating, assessing and innovation. The standards are implemented in teacher training in the states since the academic year 2005/2006.

“The Standards for Teacher Training: Educational Sciences adopted by the Standing Conference in 2004 define the requirements to be met by teaching staff and refer to the education and training objectives formulated in the Education Acts of the Länder. The requirements are generated by the competences aimed for, which are subdivided into four areas:

• Teaching

• Education

• Assessment

• Innovation

In June 2014 the Standards for Teacher Training: Educational Sciences were amended and updated with regard to inclusive teaching requirements. According to the content requirements for subject-related studies and subject-related didactics in teacher training which apply to all Länder, which were adopted by the Standing Conference in 2008 (last amended 2015), on completing their course teacher training students should have

• compatible subject-related knowledge

• subject-related cognitive and working methods

• compatible subject-related teaching methods

The preparatory service (*Vorbereitungsdienst*) provides future teachers with the

ability to:

• plan and structure subject-related learning

• deal with complex teaching situations

• promote sustainable learning

• manage subject-specific performance assessment

• planning, performing and analysing lessons in heterogeneous learning groups

• the ability to cooperate in multiprofessional teams" (Eckhardt, 2017)p.195.

2.3 Germany and Honduras in international studies

Germany as a member of the OECD has participated in PISA since the beginning. In the first cycle in 2000 the study was especially centered on reading. The results showed that in reading the performance of German children is significantly under the OECD average. Germany got 484 points in this area, while the OECD Average was 500. In mathematics Germany, as well as the USA, Spain, and the Eastern European countries that participated in the study, scored under the average of the OECD. Germany got 490 points, while the OECD average was 500. In science the performance was similar to mathematics, with only a little more than 3% of the German children being among the highest level of performance. (Baumert, et al., 2003) pp.52-66.

In PISA 2003, in mathematics Germany is on the OECD average with 503 points. In the International Ranking it was in a better position than it was in PISA 2000. 12 States of the Federal Republic of Germany were within or above the OECD average range. Only four Länder were below the OECD average. In reading Germany was under the average of the OECD with 491 points, while the OECD average was 494. In mathematics the average value improved by 7 points, although this is above PISA 2000 the difference is not statistically significant. In science the performance of the German children was higher than in PISA 2000. Germany got 503 points in this area, while the OECD average was 500, thus it was located above the USA, Denmark, Spain and Austria. In the international comparison of problem solving, the

performance of German children was on the high level compared to the other areas of competence. In this area, in first place was Korea with 584 points, second was Finland with 550 point, Germany was in the thirteenth place with 513 points, The OECD average was 500 points (Prenzel, et al., 2004).

In reading the first position for PISA 2006 was for Korea with 556 points, Germany got 495 points in this area, which was not statistically significantly different from the OECD average. In mathematics, the highest percentage of students at Levels 5 and 6 were found in Korea (27%) and Chinese Taipei (32%). "Finland, Switzerland, Belgium and the Netherlands all had more than 20% of students at these top levels" (OECD, 2007b) p.313. Germany was with 504 points in the area comparable with Sweden 502, Ireland 501, France 496 United Kingdom 495 and Poland 495; not statistically significantly different from the OECD average. Students in PISA 2006 were classified at one of six proficiency levels, according to the difficulty of the science tasks that they could perform. "Those unable to perform even the easiest PISA tasks reliably were rated as "below Level 1"" (OECD, 2007a)p. 19. The percentage of German students at this level was 4.1%, while the percentage of German students at the two top levels (5 and 6) was 10% and 1.8% respectively.[13] In 2009 the performance of German student in PISA 2009 was on the same average as the previous three times. It didn't show any relevant improvement.

The results of the most recent international study for German students was PISA 2012.[14] shows that "Students in Germany score 524 points in science, on average – above the OECD average and comparable with Australia, Canada" (OECD, 2013a) p.3. Regarding the top and low performing students in science they concluded that "Some 12% of students in Germany do not achieve the baseline level of proficiency (Level 2) in science (the OECD average is 18%)"(OECD, 2013a)p.3.

The performance of immigrant students was apparently influenced by the reforms adopted in 2001 (OECD, 2013a). These reforms were intended to promote the quality and equity in education. "Immigrant students are socio-economically disadvantaged compared to the non-

[13] See (OECD, 2007a)pp.20-53
[14] For more Information about the results of Germany in Pisa 2012 see (OECD, 2013b)pp.5-12

immigrants; thus, after accounting for students' socio-economic status, the performance difference between immigrant and non-immigrant students was more than halved to 25 score points. However, the proportion of immigrant students scoring below the baseline proficiency Level 2 in mathematics (31%) was more than double the proportion of non-immigrant students at that level (14%). Some 39% of first-generation immigrant students and around 29% of second-generation students performed below that level"(OECD, 2013a)p. 5.

In 2012, eight Latin American countries (Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru, and Uruguay) participated in PISA.[15] The results of Pisa 2012 show that the region was at the lowest third of the rankings. In mathematics, reading and science, Latin American countries were placed among the 20 worst performers. In all three subjects, Chile is in first position in the region and Peru is last. The average student only reached the lowest level of performance of PISA. Seven countries in the region had an average score in mathematics below Level 2 (of the 6 levels of performance), which is considered the minimum threshold to have basic skills in this area. Students who are below Level 2 cannot interpret and recognize questions that require a more direct inference. They cannot use basic algorithms, formulas or procedures for resolving problems using whole numbers and interpret results literally. The only exception in the region is Chile, which crosses the threshold by a small margin.

On February 24, 2016, the Government of Honduras through the Ministry of Education signed with the Organization for Economic Cooperation and Development (OECD) an agreement which will allow Honduras to participate in the Program for International Student Assessment (PISA).[16]

Honduras has not been part of an international study since 1997. It was not until 2011 that Honduras was part of The Trends in International Mathematics and Science Study (TIMSS) which is an international survey that monitors the mathematics and science achievement of

[15] (OECD, Program for International students assessment (PISA) , results PISA 2012, 2014) pp.40-55, 200-210
[16] Secretaría de Educación Honduras 2015 (SEH, 2015, 05 24)

year five (pupils aged 9-10) and year nine (pupils aged 13-14) world-wide. TIMMS is an international study conducted by the IEA.

In 2011 Honduras participated for the first time in the study Trends in International Mathematics and Science Study (TIMSS) and Reading Comprehension, but the results placed the country among the last places. The TIMSS and PIRLS assessments were applied in 2011, but not published until December 2012, and applied to students in years four and eight.[17]

According to the minister of education of the country, because of the low Honduran educational level, Honduras was allowed that the year four tests were taken by year six and the year eight test were taken by year nine. From Latin America only Honduras, Chile and Colombia participated. Worldwide, 60 countries were enrolled in those assessments.

Honduras in year four mathematics was in second from last place with 396 points, just above Yemen which acquired 348 points. The evaluation planed a score of 500 points as a standard measure and nations that are under that are seen to have a very low level in education. In year eight mathematics Honduras was also ranked second from last with 338 points, just above Ghana which got 331 points. In year eight science Honduras was placed again in the second last place with 369 points, beating only South Africa that scored 332 points. It was in year four science where the location of Honduras improved slightly. In this category they scored 432 points, above Botswana (367) and Yemen (345). The best qualification for Honduras was in Reading Comprehension with 450 points, in which four countries were exceeded: Colombia scored under Honduras (448 points), Morocco with 424 points , and Kuwait and Botswana, both with 419 points (Martin, Mullis, V.S., Foy, & Stanco, Timss 2011 International Results in Science, 2012),

In 2015 for the third time Germany participated in the study with year four students. In 2011 and as for a first time in 2007 German students took part in this study. With the results of 2011 in science and mathematics, the year four students were in the upper third in

[17] The Information about the Results of Pisa 2011 were taken from (Martin, Mullis, Foy, & Stanco, 2012)pp.39-50 and (Mullis, Martin, Foy, & Arora, 2012)pp.38-50

international comparison. In both areas the pupils achieved better than the average of participating EU and OECD countries[18].

Compared to TIMSS 2007, the performance of primary school students in year four had no statistically significant changes. It is outstanding that few children were at the top level of competence in Germany in an international comparison. The influence of social background on the performance of the students was high in Germany, as in many other countries. Children from immigrant backgrounds scored comparatively worse. Their achievements, however (as opposed to TIMSS 2007), had significantly improved. A positive is to say that the primary school children performed well attitude in mathematics and natural sciences.

The results in 2011 for the German year four students was "similarly across the three subjects, with 46 percent reaching the high benchmark in reading, 39 percent in science, and 37 percent in mathematics. Nearly one-fourth (23%) of the students reached the High International benchmark in all three subjects, and most students (94%) reached the Low International Benchmark in all three subjects"(TIMSS & PIRLS, 2011) p. 26.

2.4 Investigation of Students' Preconceptions

Energy efficiency preconceptions are one of the main components of the study. Together with these preconceptions we aimed to find out, among other things, students' attitudes with respect to energy efficiency and climate problems, students' motivations in making efficient use of energy, as well as students' interest in climate problems as a global issue. The study took into account both by group and by country, the socio-economically situation, previous dealings with the topic, level of education, and sources of information about topics related to energy efficiency. In the previous sections brief accounts of the socio-economically situation of each country were given where the study took place, as well as the educational system and the curriculum of each participant group. They provided a source of information for future discussions about their impact on students' preconceptions and the relationships between them in correlational terms.

[18] See (Bos, Wendt, Köller, & Selter, 2012)pp.93-104

It should be noted that the emphasis was given to the differences or similarities between the German students and the Honduran students regarding their preconceptions, attitudes and motivations with respect to energy efficiency. In this section is conceptualized the term "preconception" used in this research, mentioning previous studies in science education related to students' preconceptions. In the next section of the chapter the main findings of some previous research about energy preconceptions are mentioned, then the model of educational reconstruction and the students' preconceptions are discussed.

2.4.1 Students' Preconceptions

Students' interpretation of scientific concepts has been directed as a constructivist view that has a substantial impact on science education. Over the last two decades, many international researches have been done trying to explain students' understanding of scientific concepts. Terms like *alternative framework*, *alternative conceptions, students prior conceptions, misconception, preconceptions and conceptual profiles* have been used to refer to the various interpretations of scientific concepts (Rowlands , Graham, & Berry, 1999).

However, accordingly it would be reasonable to make a clear distinction between preconceptions and misconceptions. "Unlike the classical approach, the framework theory approach makes a fundamental distinction between preconceptions and misconceptions and considers many misconceptions to be synthetic conceptions or models. Preconceptions are the initial ideas about the physical world and explanations of physical phenomena that children construct on the basis of their everyday experience in the context of lay culture *before they are exposed to school science*. On the contrary, misconceptions are students' erroneous interpretations of scientific concepts *after they are exposed to school science*"(Vosniadou, 2012) pp. 121-122. She also argued that "These initial conceptions, or preconceptions, are not superficial beliefs but represent a coherent although relatively narrow explanatory framework, which some call intuitive or naïve theory"(Vosniadou, 2012) p.122.

Preconceptions about more "uncommon" concepts in science have also shown that the students' brains are not empty when they come into a learning environment. (Lichtfeldt, 1992) studied children's preconceptions in quantum physics and their possible changes

through teaching. After interviewing and recording 270 children in Germany, among them 141 children as a testing group and 129 as the control group, he concluded that the individual conceptual structures of the everyday life of the children meet again in their scientific language, students attempt to build new concepts based on their preconceptions. He also concluded that the construction of these new concepts always bears the individual's meaning connections through the everyday activities of each student.

Research on students' preconceptions has been an important dimension of science education in trying to explain students' difficulties by understanding science concepts. Since the late 1970s various science educators, e.g. (Driver & Easley, 1978); (Viennot, 1979) noticed that students bring to science learning alternative frameworks or preconceptions that are strong and difficult to extinguish through teaching. It has been also proved that these preconceptions are influenced by the cultural-context and the students every day activities. This raises the responsibility to create instructional materials that begin with what students already know in order to reconstruct a “scientific concept”.

The aim of the investigations is to collect and analyze the everyday concepts of the topic energy efficiency in the household. At the center of the analysis, an intercultural comparison is made between Germany and Honduras. The ideas and attitudes towards energy efficiency of secondary school children are collected, but also of university students. In the analysis these are analyzed among themselves and in an international comparison. This approach is intended, on one hand, to identify potentially existing problems in each of the two countries in everyday life and, on the other hand, to contribute to a perspective and very broad understanding of the topic of energy efficiency.

2.4.2 Students' Preconceptions about energy

While regenerative energies are now a central topic in physics teaching, this is different for the topic energy efficiency. The teaching of this topic at school is only just starting. There are so far no insights available regarding students' preconceptions about energy efficiency. In addition to this, the question arises as to how such an issue is perceived by cultural and life-world differences in different societies, and also which similarities and differences can be found in students' preconceptions.

(Paz Matute, 2011)researched students' preconceptions regarding regenerative energy in Germany and in Honduras, In the research 25 university students from Germany and Honduras participated. At the time the research was carried out the students were in their first semesters. To collect the information a questionnaire with 14 open questions was used. Similarities and differences were found between the two groups of respondents. The results of this research showed that the German participants associated the concept of energy with a physical sense, but that they mix it with their own reality, while their energy preconceptions show the influence of scientific instruction but which later was mixed with personal experiences, turning the concepts into a personal reference, making it real, concrete and practical.

The Honduran participants, on the other hand, had a concept of energy which could be derived from their everyday experiences, the energy concept of the participants show a lack of scientific instruction, concluding that this concept could come from a simple way of thinking which reflects a low level of knowledge about physics concepts. The fact that the interviewees perceived fatigue as a measure of consumed energy shows that their perception of energy is a personal one and does not come from scientific instruction. This personal concept of energy was a concept that every human being can derive without any knowledge of physics. A significant part of the respondents thought that energy can be seen with the naked eye.

Honduran respondents found the sun to be the most important source of energy. However, their answers showed that they did not know the function of the sun in the process of photosynthesis. This confirmed the theory that the knowledge of the interviewees comes from everyday experiences and prevailing myths in which the sun is the king of the universe. The energy concept of the interviewees was found to be a concept that was passed on from generation to generation and did not develop, as there was no influence of physics instruction.

The research confirmed the influence of customs and traditions in the reconstruction of a scientific concept. From the findings it was concluded that previous knowledge and traditions prevailed over the school year despite scientific instruction. These myths and traditions were an important part of students' preconceptions and also difficult to avoid.

It is a fact that preconceptions about energy have always been an important part of science education around the world and learners of all age groups have participated in such studies. (Kambouri-Danos, 2015) made a research about Children's preconceptions in science and how these can be used in teaching, she concluded that teachers in general, are aware of the importance of preconceptions and the need to identify them. In the same year (Lee, Lee, Altschuld, & Pan, 2015) researched the energy literacy among secondary school children in Taiwan, by using a sample of 2400 students from different schools around the country, these school were participated in an energy education program . The data was collected by using a questionnaire and the results were divided into three domains; cognition, affect and behavior. The first domain included i.a. concepts like energy transformation, renewable and not renewable energy, awareness of the use of energy as well as units of energy and power. The affective domain was mainly centered on the recognition and interest regarding the gravity of energy problems, the behavior domain included the use of energy and to motivate others to make good decisions regarding the use of energy. The main goals of the study were i.a. to find correlation among the three domains but also to find out whether grade, gender and family socioeconomic status might influence student's performance.

They concluded that; "Among the variables, energy saving behavior was more predictable by affect than by knowledge and gender" (Lee et al., 2015) p.105

(Trumper, 1993)researched in a cross-age study, children's energy concepts in Israel. The study was conducted in two rural, regional schools with children attending the year seven, eight and nine. When the study was conducted the participants were between 10 and 14 years old. A total of 398 students participated (68 fifth graders, 67 sixth graders, 79 seventh graders, 89 eighth graders and 95 ninth graders). None had any formal physics instruction previous to the study. To collect the data a written questionnaire was used where the participant had to write i.a. associations with the word energy and to choose three of eight pictures which could represent the energy concept. In the results were not found any significant differences among students' associations with the word energy in years 7-9, there were also not found any significant difference among students' choice of pictures and students' alternative frameworks about energy in years 6-9. He concluded that: "No significant difference among students' associations with the word energy was found in grades

7-9, no significant difference among students' choice of pictures and students' alternative frameworks about energy was found in grades 6-9. The building blocks in the teaching of the energy concept, the cause and product frameworks, are held by students from 5th grade onwards. These frameworks appear in more than half of the occasions in which students from 6th grade on describe the pictures they have chosen. Fifth-grade students seemed to have a remarkable tendency to anthropocentrism when relating to the energy concept"(Trumper, 1993) p.146. About the implication in science teaching, he concluded that the teaching of the energy concept should begin as early as possible.

Cross cultural studies about students' energy preconceptions have also been made. (Duit, 1984) made an empirical study in the Philippines, West Germany and Switzerland. In the study the learning of energy concepts in schools was researched. In Manila, in the Philippines, the study was made with 87 year six students, in elementary school before physics instruction and 89 year ten students, in high school after physics instruction in years seven and ten. In Kiel, in Germany, the study was made with 147 students in year six, before physics instruction, 67 students in year eight, after physics instruction in year 7 and 8 and 71 students in year 10, after physics instruction in year 7-10. From Basel, in Switzerland, 76 high school students in year seven, without any physics instruction, 124 students in year ten, without any physics instruction. Students in year six were about 11-12 years old and students in year 10 about 15-16 years old. The samples in Switzerland served as 'control samples' because these students in both years 7 and 10 had no physics instruction at all.

As an instrument to collect information for the research a questionnaire was used. "The first part of the questionnaire focuses on the meaning of the words (the names of the concepts) energy, work, force and power. In this part the students are asked to state the meanings the concepts have in physics if they have already had physics instruction and, if not to, state the colloquia meaning. *Task l.* Students are asked to write down their *associations* with words presented for 30 ***S*** on the blackboard"(Duit, 1984)p.61.After 30 s the participants had to write possible associations to these words. For every 30 s a new word followed. In Task 2. students had described the meaning of energy, work, power and force. In Task 3 examples of energy, work, power and force were given. In Task 4 students describe the process shown in a figure of an electrical motor connected to a battery that lifts a weight when the switch is on.

From his findings he concluded that physics instruction has not been very successful with regard to the learning of the energy concept and that: “The general features of the meaning of the word energy in colloquial language and in physics as learned by the grade 10 students who took part in the study were very similar. The main influence of physics teaching regarding the meaning of energy is a closer link with the term work and other physical terms. Furthermore, a larger number of energy forms come to the students’ minds when confronted with the word energy”(Duit, 1984) p.64.

Regarding the explanations of processes in mechanics, he concluded that: “Most students do not use the word energy (or another physics term) to explain a process, they prefer words which stem from colloquial language. They do not employ physics notions like energy conservation either but prefer notions which stem from everyday experiences. This summary about learning the energy concept is valid not only for this concept but for the other concepts of the study as well, i.e. for power, force and work”(Duit, 1984) p.64.

But not only energy preconceptions have been the object of research in previous years, research on the different “forms” or manifestations of energy have been also made. (Herrmann-Abell & DeBoer, 2011) used a Rasch model to explore “middle school, high school, and university students’ understanding of ideas about energy transformation, energy transfer, and conservation of energy. The data are a result of a field test administered to 9739 middle school students and 5870 high school students in 46 states across the country and 176 students from a public university in the south central region of the U.S.”(Herrmann-Abell & DeBoer, 2011)p.1.

The results showed a trend of increasing ability with increasing year level through middle and high school to university. From the findings they concluded that: “the idea of conservation of energy was significantly more difficult than the ideas of energy transformation and energy transfer. In addition, in some cases, students were more likely to know a general principle than they were to know how to apply that principle to specific instances” (Herrmann-Abell & DeBoer, 2011) p.11.

“The results also showed that some misconceptions about energy are prevalent at all grade levels” (Herrmann-Abell & DeBoer, 2011) p.11. But these “decrease in popularity from

middle school to university. For example, very few university students thought that "coldness" is transferred from a cold object to a warm object" (Herrmann-Abell & DeBoer, 2011) p.12.

Most studies have so far focused on students' preconceptions about energy, there is however no evidence so far about students' energy efficiency preconceptions, or the results of the affective characteristics that have to be taken into account when studying energy efficiency as an interdisciplinary topic. The need for education, participation and the development of awareness of the importance of energy efficiency at a social and ecological level is required to know student's preconceptions about this topic. From this arise the following questions: Is this topic taught at schools? Is there a relation between the use of energy and student's energy efficiency preconceptions? Do these preconceptions influence on the use of energy? Do the secondary school children and the university students want to know more about it? Is there a significant difference in the use of energy at home between two groups from two different countries? The preset international comparison gives us the possibility to have global perceptions of the topic, giving us two different cultural contexts, which can be used to create effective teaching strategies regarding energy efficiency at schools.

2.5 The model of educational reconstruction and students' preconceptions

The model of educational reconstruction by (Kattmann, Duit, Gropengießer, & Komorek, 1996) brings together the scientific clarification and students' conceptions. The present investigation is centered on the research of students' conceptions, but due to the interdisciplinary nature of the topic energy efficiency, the research of student's conceptions includes not only preconceptions about energy efficiency but also students' attitudes regarding energy efficiency in connection to climate change as well as students' motivations and interest to make an efficient use of energy as students. In the following chapter, the different categories of study are explained in detail. It is important to mention that in the model of educational reconstruction the students' conceptions and scientific clarification are put together at the same level of importance in curriculum development.

In the model of educational reconstruction, the empirical investigation of students' conceptions are conducted to answer at least some of the following questions

"How are the scientific concepts represented in students' perspectives?

- Which conceptions, i.e., theories, principles, notions and concepts, are used by the students?
- Which perspectives do students have about science itself?
- How do alternative conceptions of students correspond with scientific conceptions? Students' conceptions and alternative framework in everyday life are accepted here above all as a necessary starting point to and even an aid for learning and not as an obstruction of scientific thought that should be removed. The **construction instruction** is based on the feedback from scientific clarification and investigations of students' conceptions" (Kattmann & Baalmann, 2001)p.14.

Research in different areas have been framed in the model of educational reconstruction, for example, in different areas of biology (Lewis & Kattmann, 2004) (Sander, Jelemenská, & Kattmann, 2006) (Kattmann & Baalmann, 2001), in different areas of physics, for example, (Komorek, Stavrou, & Duit, 2003) developed a teaching sequence and evaluated it in a school setting. The data provided information about "how these teachers transform their reconstructed subject matter structure into an appropriate content structure for instruction, and into the students learning processes towards understanding nonlinear systems" (Komorek, Stavrou, & Duit, 2003) p.269.

(Liu, 2005a)framed her investigation of student's preconceptions and historical ideas about the heavens and the earth in the model of educational reconstructions by interviewing 64 students from years three to six in Taiwan and Germany. The research was carried out in 2001-2002"The questions in the interview were centered around "the heavens" (space, heavenly bodies, and familiar astronomical events) and "the earth" (the appearance, shape, movement, and, in some cases, gravity)"(Liu, 2005b)p.295.

From the results she concluded that "some common features exist between the students' and early scientists' alternative conceptions which lie in their structural form. The students construct for themselves a model of the universe which organizes a limited scope of

information, like early scientists did. Furthermore, our investigation discovered that the alternative models among students appear to be the mixture of the two distinctive sets of ancient conceptions from Chinese and European cultural contexts”(Liu, 2005a)p.153.

“As for the difference between the sample of two countries, the German students show more intention (or are more aware of the need) to explain astronomical phenomena than their Taiwanese counterparts, and thereby presented more precise models with stronger explanatory power. On the other hand, the Taiwanese students appeared to have more imagination and conceptual flexibility that should also be valued”(Liu, 2005b)p.295.

(Pahl, 2012) researched the conceptions of energy that primary and secondary school physics teachers have. To explore and evaluate teachers' conceptions, the research questions were organized in semi-structured interviews. 19 single two-hour-interviews were carried out with primary and secondary school physics teachers. The results of the work concluded that teachers explain energy by saying the energy concept is based on the concept of work, and based on the concept of force and explanation as quiddity.

From the results it was also concluded that teachers' conceptions of energy can be summarized in six categories; thinking in terms of conversion process is one of them. The influence of myth and traditions on energy preconceptions was also identified. She concluded that the participant viewed the sun as the origin for life and energy that enables life on the earth and all possible processes. However, the influence of a scientific instruction was also part of their preconceptions about energy. She concluded that the concept of energy was based on terms like "work" and “force”.

The studies previously mentioned were placed in the context of the model of education reconstruction but are limited only in the research of students' conceptions in a particular field, they “are looking for statements about the structure and quality of conceptions and not about quantities in which certain conceptions exist in a population.”(Baalmann & Kattmann, 2001) p.15. According to this, interviews as a qualitative method of empirical research in social science are used; in this the research of conceptions is not limited to only one domain, as was done in previous studies.

The present study is placed in the context of model of educational reconstruction under the argument of the importance of empirical investigations of students' understanding of basic ideas. The students' conceptions are described in the model as conceptions that make learning science more profitable than before. In the model it is also argued that "[t]he reconstruction also includes theoretical pre-assumptions and controversial conceptions, which are quite often left out by scientists"(Kattmann et al., 1996) p.7. It is also pointed out that the content of science instruction must be integrated into environmental, social and idiosyncratic contexts to demonstrate the role for of the life of the individual, society and the entire bio planet, so the subject is not prescribed by science instruction, instead they have to be prescribed by an educational purpose (Kattmann, Duit, Gropengießer, & Komorek, 1996).

The interdisciplinary and multidisciplinary topic energy efficiency is complex and difficult to describe only from a physics point of view. Due to the relation between energy efficiency and environmental protection, the topic of energy efficiency has to be described from a social, ecological and subject level, from these the present investigation argued that the research of students' conceptions about energy efficiency has to included elements from the social, ecological and subject level.

In this regard, the present investigation researches the students' conceptions about energy efficiency not only from the point of view of physics. Next to this, under the argument of the model of educational reconstruction that educational instruction has to be produced with an educational purpose, which in energy efficiency is environmental awareness, it is aimed to know whether the students are aware of the current climate problems. There is also the intention to know what could be the students' motivations and interests in the efficient use of energy. After this, the efficient use of energy will be compared, taking into account two different cultural context and three different levels of education. In the model of educational it is argued that more than science itself, the content of science instruction must be integrated into the environmental, social and idiosyncratic context in order to demonstrate its role in society. The present study aims then to find out not only cognitive characteristics but also affective characteristics.

Affective characteristics must involve the feelings or emotions of a person; these must have an intensity, direction and target. Intensity is the strength of the feeling, direction is the

positive or negative orientation of a feeling, but, when the direction and the intensity of a felling are combined, most affective characteristics exist along a continuum and the distance from the midpoint indicates the intensity of the feeling. The third feature is a target which is referred to the object, activity or idea toward which an affective characteristic is directed (Gable & Wolf, 1993) (Anderson & Bourke, 2000) .

From the strong relation between energy efficiency and environmental protections arises the need to awake in the students an environmental awareness of the topic in science instruction. In this regard, we must know which and how much affective characteristics are, such as: environmental problems awareness, responsibility in taking action to mitigate the current climate problems, the interest in the topic and in knowing more about it. This information could enable us to design more effective science instruction in energy efficiency. by assessing affective characteristics has to be take into account each of the attributes mentioned before (Gable & Wolf, 1993). The most known scale in assessing affective characteristics is the Likert-scale. In the present research the scale asses not only affective characteristics, the Likert-scale also enables us to find out the level of energy efficiency behavior of the participants. In the following chapter the methodology used to gather information about the efficient use of energy of the students is explained in more detail.

2.6 Energy efficiency in science education

Energy efficiency has been given considerable attention in the industrial sector on a national and in an international level in recent years as an important measure to mitigate climate change, but it has not become a topic of school science instruction so far. Literature on this subject is limited to mainly energy efficiency in the industrial or commercial sector but nothing about energy efficiency in the residential sector or in science instruction. In science education can be also be found research in regenerative energy and energy saving but nothing about energy efficiency at schools could be found in either country. There are several efforts to inform people about saving energy at home and most of the time in public advertisements energy saving with energy efficiency is confused. But attempts to teach energy efficiency at schools are almost completely missing.

3. Methodological issues

In previous sections the importance of energy efficiency as a topic of the governmental agenda was discussed, both nationally and internationally regarding the industrial and commercial sector, but in regards to the educational sector there is little or nothing that can be found in either country. In Germany, different programs in relation to school building optimization have been carried out in recent years, but nothing related to a formal educational program about the topic. Although in Honduras the subject seems to be important for the government, no formal program at schools was found. It is then to be expected in searching the existing related studies and instruments regarding energy efficiency in private households that nothing in this regard could be found.

Due to the complexity and extension of this research as the first cross-cultural study on the topic of energy efficiency "preconceptions" and the lack of information in this regard, developing a new survey is both appropriate and necessary, which not only allows us to collect the necessary data to achieve the research's objectives, but it can also be used in two completely different cultures. A Likert scale questionnaire was the instrument used to collect information for the research. The Likert scale survey was presented in a set of items which were offered as statements for measuring the participant's reaction in either five or four categories.

31. Subjects

The subjects of the research are 965 students, 750 secondary school children and 215 natural science university students. The study was carried out in Honduras (Tegucigalpa and San Pedro Sula) and in Schleswig Holstein, Germany. The secondary school children were in year eight and eleven while the investigation was conducted and the university students were in their first semester. With a non-random probabilistic sampling and according to the student numbers at each educational level, a sample of 401children from public schools in Honduras and 349 from Germany, making a total of 750 secondary school children both in Germany and in Honduras., took part in the study.

Each school was chosen taking into account its location in the city. This selection was made with the intention of covering different neighborhoods in the cities were the study was carried out. Due to the different school systems in these two countries, the secondary school children in Germany were drawn from five different types of school (*Gemeinschaftsschule, Realschule, Hauptschule, Gesamtschule and Gymnasium)*.The targeted university in Honduras was the Universidad Pedagógica Nacional Francisco Morazán, where 109 students taking natural science and from the two campuses (Tegucigalpa and San Pedro Sula) participated in the study. In Germany the interviewing took place at the Europa-Universität Flensburg with 106 students of physics, chemistry and biology. At the time the study took place the university students were in their first semester. Natural science students (physics, chemistry and biology) were chosen under the supposition that these are the future teachers of topics related to climate change and the efficient use of energy at schools.

3.2 Developing the instrument

In order to create equivalent indicators, not only the content itself but also considering national idiosyncrasies, different social structures, the reality of each country and multicultural perceptions were taken into account. In order to limit the scope of the investigation it was necessary to define the level of education as the principal background variable for each country. Both countries have schools at two principal levels, in Germany they are called "*Sekundarstufe I*" and "*Sekundarstufe II*" and in Honduras there are two equivalent levels at schools too. Therefore, a sample at each level, year eight pupils for the first level ("*Sekundarstufe I*") and year eleven pupils for the second level ("*Sekundarstufe II*") was chosen. As the highest level of education involved in the study university students who were in their first semester of natural science in Honduras and the equivalent in Germany were chosen, students who were in their first semester of physics, chemistry or biology when the study was targeted.

The topic energy efficiency cannot be described only from the physical point of view; it is a topic that involves not only the cognitive domain but also the affective domain. The efficient use of energy is related to ecology, the economy, and psychology. The development of the instrument was outlined by two theories in which the present investigation is framed: the

principle of the “thematic structure” and the model of “educational reconstruction” The thematic structure of science does not organize knowledge by themes or problems instead it is organized by conventional subjects or disciplines. The model of educational reconstruction puts the importance of preconception on the same level as the scientific concept. In this regard, the development of the instrument was based on the interdisciplinary nature of the topic energy efficiency and the importance of preconceptions in science education.

From the interdisciplinary of the topic and to achieve the research targets the investigation was divided into seven common categories for the six participating groups:

- Level of energy efficiency
- Preconceptions about energy efficiency
- Level of concern about climate change and the efficient use of energy
- Level of responsibility regarding climate change and the efficient use of energy
- Level of exposure to information
- Level of importance of the topic energy efficiency
- Level of willing to know more about energy efficiency

For the university students two more categories of analysis were included:

- Level of waste of energy
- Level of engagement as a future teacher

In addition to these categories, the study intended to find associations with energy efficiency, the reasons to make efficient use of energy, the reasons why people do not make efficient use of energy and the sources of information that the respondents could use to get information about environmental problems and the efficient use of energy.

3.3 The Likert scale

The present investigation aims to analyze the preconceptions about the efficient use of energy in Honduras and in Germany but also aims to find the possible connections between the efficient use of energy and preconceptions about energy efficiency, the level of concern about environmental problems and the efficient use of energy, the level of responsibility, the level of exposure to information, the level of importance of the topic energy efficiency and the level of willing to know more about energy efficiency. The interdisciplinarity of the topic makes it

possible to include in the research not only the cognitive domain but also the affective domain, which includes, among others, attitudes and emotions.

(Ary, Jacobs, & Razavieh, 2010) described scale as the method to measure attitudes, values, opinions and other characteristics that cannot be measured easily by tests or other instruments. To measure each category of study in the present investigation the Likert scale was used. The scale was first published by psychologist Rensis Likert in 1932. By using the Likert scale the respondents are given a series of attitude dimensions in which they are asked to agree or disagree with the given statement.[19]

Other Likert scales could also have different response alternatives, such as “very satisfied” to “very dissatisfied” or “excellent” to “poor". Five is the most common number of alternatives; this number of responses offers the respondents a sufficient range of choices and does not require unnecessarily minute distinctions in attitudes.[20]

A Likert scale is a summated rating scale in which a numeric value to each response alternative is assigned. The total scale score is found by summing the score given to each item; this total score assesses the individual's attitude in respect to a topic.[21] Due to the fact that the response alternatives have a fixed order in the Likert scale, each item is an ordinal measure. The overall score of a Likert scale is the sum of individual ordinal items; many researchers agree that a Likert scale is ordinal in nature. [22]

Following the target of the investigation and as the Likert scale requires, the survey was constructed by assembling a number of statements related to each category of analysis. The statements were made in positive and negative ways, that is, some of the items represent a positive attitude toward a category while others represent a negative attitude. For example, a negative item in the category “level of responsibility” was item 2.4 “Science and industry can alone solve energy problems”. This item represents a negative attitude in taking personal responsibility to solve “energy problems”. If the respondents agree with the statement they

[19] (Brace, 2008) p.73
[20] (Monette, Sullivan, Dejong, & Hilton , 2014) p.349
[21] (Ary, Jacobs, & Razavieh, 2010) p.209
[22] (Ary, Jacobs, & Razavieh, 2010) p.249

agree in letting science and industry solve “energy problems”, suggesting that the respondents do not want to be involved in the solution. Item 2.1 “Climate change is the biggest global challenge”, on the other hand is a positive item. If the respondent agrees with the statement it means that they give more importance to climate change than any other problems on Earth, suggesting that is a problem that involves all of us as a global community; this attitude is interpreted in this context as positive toward taking responsibility for climate problems.

To determine whether the items of a questionnaire are suitable for collecting the desired data, the survey has to be tested in a pre-test. In this manner it should be ensured that the questionnaire is evaluate with at least 100 people.[23]

There are two crucial tasks in analyzing each item; on the one hand, the item should ensure a high reliability of the scale. The term "reliability" describes how exactly the selected measuring instrument works and whether the measurement is repeatable. On the other hand, it is possible to query whether an item is suitable for measuring the desired property. In order to determine whether an item is suitable, two characteristics must be assessed, that is, the difficulty and the “the separation sharpness” of an item. If an item is difficult, it means that only a few people have been able to answer the question and the participants can be differentiated using the mentioned item. When an item is difficult to respond to, this item is not suitable, since only a few respondents can answer this item correctly. It would be impossible to make a good differentiation between the respondents.[24]

The second characteristic of an item to be measured is the “the separation sharpness”. If an item has a high “separation sharpness”, the item makes it possible to distinguish between “higher scores” or respondents who score higher and the “lowers scores” or the respondents who score low on the scale. If, on the other hand, an item has a very low “separation sharpness” it is not possible with this particular item to distinguish between the “higher scores “and the “lower scores”. [25]

[23] (Kuckartz, Rädiker, Ebert, & Schehl, 2010) p. 221
[24] (Kuckartz, Rädiker, Ebert, & Schehl, 2010) p. 222 ff.
[25] (Koller, Alexandrowicz, & Hatzinger, 2012) p.5

3.4 Elicitation of items

Taking into account the lack of information on this topic, it started with the development of a completely new questionnaire. Following the suggestion of (Harkness, van de Vijver, & Ph Mohler, 2003) for cross-cultural survey development, the design of the questionnaire was simultaneous, which means that the translations and questions development went hand in hand. Questions in each language were developed simultaneously, incorporating cross-cultural input from all targets, and individually formulated to suit each culture.

As it was said in previous sections, the interdisciplinary of the topic energy efficiency makes it necessary to include in the survey affective characteristics like responsibility, concern, interest and engagement. According to (Anderson & Bourke, 2000) ,affective characteristics correspond to ways of feeling, that is, the feelings and emotions that are characteristics of people.

According to(Gable, 1986),affective characteristics have three attributes: intensity, direction and target. He described the intensity attribute as the degree or strength of the feeling, the direction is the positive, negative or neutral aspect of the feeling and the target is the object or topic of the feeling. (Anderson & Bourke, 2000) makes a clear difference between assessing affective characteristics and evaluating affective characteristics; assessment is described as gathering information about a characteristic while evaluation refers to a judgment or value of the characteristic. As mentioned previously, the Likert scale is the most used scale to assess affective characteristics. The present investigation also aims to identify the opinions of the respondents regarding the efficient use of energy and climate change, which is also possible to assess using the Likert scale.

Once the scale was chosen, the items belonging to each category were selected. The first version of the questionnaire was applied in a pilot study in order to assess the validity and reliability of it; the results are shown in the next chapter. Based on the research objectives and the characteristics of the students, four different types of questions were made: frequency questions, level of agreement questions, association questions and single choice questions.

As for the response alternatives present in the Likert scale, a minimum of 3 and a maximum of 7 are suggested.

Considering the characteristics of the respondents in this research it is appropriate to include a small number of response options to validate the scale, as the research includes year eight secondary school children who might find it difficult to discriminate between many responses. As a result, it was considered appropriate to use four response options for the level of agreement questions (strongly agree, agree, disagree and strongly disagree), five response options for the level of association questions and five response options were also used with the frequency questions. For the one single choice questions only one question with five options was used.
To calculate the results, considering the Likert scale may contain positive and negative items, the items were scored objectively. On the level on agreement questions it proceeded as follows:

a) A positive items scores four and one is assigned to strongly agree and strongly disagree, respectively.

b) For negative items the scores are reversed, therefore the values one and four to strongly agree and strongly disagree are assigned respectively.

To calculate the results of frequency questions it preceded as follows:

a) A positive items scores five and one is assigned to always and never, respectively.

b) For negative items the scores are reversed, therefore the values one and five to never and always are assigned respectively.

To calculate the results of the level of association questions each item is different, this will be explained in the statistical analysis below.

Due to the characteristics of each geographical group and the different weather of each country, it was necessary to make some questions different for each group. However, for every question that was based on the climate in one country, an equivalent was used for the other country, with the same equivalence in its content. For example, item 2.9 (Honduras): to be

cleaner it is necessary to bathe in hot water, item 2.9 (Germany): to have clean hands it is absolutely necessary to use hot water.

With the first nine items (1.1 to 1.9) of the survey, the respondents were asked questions relating to their use of energy at home. The nine items are grouped in the first category of analysis “energy efficient behavior”. With the nine items the respondents had the option of selecting the most appropriate answer for themselves, choosing between five possible answers in a frequency scale from "never" to "always “. To establish a scale of “energy efficient behavior” and to avoid a misinterpretation of the results, it was necessary to define an objective justification for “energy efficient behavior”. This is required to create a boundary for each question. This border will help us to delimit “energy efficient behavior”. The following paragraphs described the boundaries that were designated for each of the nine items.

3.5 Materials; Framework of the questionnaire

With the first nine items (1.1 to 1.9) of the survey, the respondents were asked questions relating to their use of energy at home. The nine items are grouped in the first category of analysis: “energy-efficient behavior”. With the nine items, the respondents had the option of selecting the most appropriate answer for themselves from five possible answers, in a frequency scale from "never" to "always “. To establish a scale of “energy efficient behavior” and to avoid a misinterpretation of the results, it was necessary to define an objective justification for “energy efficient behavior”. This is required to create a boundary for each question. This boundary will help us to delimit “energy efficient behavior”. The following paragraphs described the boundaries that were designated for each of the nine items.

Question 1.1 asked about turning the lights off when leaving a room for a short time (we assume a short time is a period of no longer than five minutes) considering that for a desk lamp an incandescent bulb is typically used, taking into account that this electrical appliance has a power consumption of 60W(it means that it will consume electrical energy at the rate of 60 joules per second) so the amount of electrical energy consumed by this electrical appliance on an absence of five minutes, will be 5Wh. On the other hand, if an LED lamp is used, with a power consumption of 12W, the electrical energy consumed in this period of time

would be considerably lower; nevertheless, energy efficient behavior is understood in the context of this work as to always remember to turn off the light when leaving a room.

Question 1.2 asked the respondents about switching off the radio or the TV when they are not using them. There are also people who usually leave the radio and the television on when leaving home but these behaviors come at a cost, considering a TV with a power consumption of 120W and taking two to four hours as a period of time in which this electrical appliance is used, the amount of electrical energy consumed will be then 240Wh to 480Wh. Although it is not such a large amount, in terms of energy efficient behavior it is compulsory to always remember to turn off these devices when they are not needed.

Question 1.3 was made to find out whether the participants turn off the water in the shower while soaping their bodies. Assuming that a person consumes on average between 20 and 60 liters of warm water per day, this corresponds to an energy requirement of 0.8 to 2.2 kWh If we now calculate the energy needs for an entire year, a person would need an average of 280 to -770 kWh. Since turning off the water while soaping their bodies save energy, in terms of energy efficiency it is required to always remember to turn off the water when it is not needed.

Question 1.4 aimed to find out if the light in the bedroom is turned off when people go to sleep. Assuming that a person needs on average eight hours sleep and inside the bedroom an LED lamp is used with a power consumption of 12 Wh, in eight hours of sleep 96 Wh will be consumed. Since one does not rely on a light source during the sleep process, in terms of energy efficiency it is required to always turn off the lights when one goes to sleep.

Item 1.5 intended to find out if electrical appliances that are not used, or are on standby, are switched off completely by respondents. Many electrical devices are now sold with a standby mode which also consumes electricity, though they are not actively used. Although newer appliances, can consume a maximum of 1 Wh in standby mode, in terms of an efficient energy behavior this is a waste of energy. Despite the low power consumption, it should always be made sure that all the devices that have a standby mode need to be completely turned off when not in use.

Question 1.6 asked whether the respondents defrost their freezers. The temperature in the freezer should be about -18°C. Over the period of operation of this device, a formation of ice on the internal walls, the inner ceiling, and floor may occur. Depending on the thickness of the ice, the freezer requires between 15 and 45 percent more energy to maintain the temperature inside the cabinet. Due to the high energy saving potential, the owner of such a device should always make sure to defrost the freezer from time to time. A possible ideal time for defrosting the device is when it will be not used for an extended period.

Question 1.7 specified whether cold water is used to wash hands. Since the objective of the washing process is to kill the bacteria present on the hands, the impression may arise that this works particularly well with warm water. However, considering that the temperature of the water is not essential to clean hands and leave them bacteria-free but instead it is the quality of the soap that is important, to have energy efficient behavior here the hand washing process should always be done with cold water.

Heating in German households accounts for more than half a home´s energy consumption. Around 87% of a household's total energy is consumption in this task; 75% of energy consumption is used for space heating and the other 12% is used for hot water. Questions 1.8 and 1.9 were made to find out the energy behavior of the respondents in heating their home. By answering question 1.8 (In winter are you aware that your bedroom never needs a temperature over 16°C?) it is possible to measure the degree of awareness that the respondents have by using the heating in winter. Referring to the fact that 16°C is a comfortable temperature in a room, there is no need to increase the heat. By not always doing so would represent non-energy efficient behavior.

Question 1.9 asked whether respondents put a sweater on to be warm in a room or if they opt to turn up the heating. If you were in such a situation and prefer to raise the temperature by 2°C to ensure a comfortable indoor environment instead of wearing a sweater, it is clearly inappropriate energy behavior in terms of energy efficiency, since the amount of energy would increase by 12% with this behavior. To save energy, it would be necessary rather than increasing the room temperature to always wear a sweater.

Questions 1.7, 1.8 and 1.9 are different due the different weather conditions in both countries. For Hondurans students questions 1.7 has the following statement: Do you bathe in cold water? 1.8 for Hondurans students has the following statements: Are wet clothes ironed in your house? And 1.9 for them is: If you've got (or if you had) air conditioning in your home do you prefer to wear lighter clothes instead of turning up the air conditioning? To define at what level a person behaves concerning energy efficiently it was necessary to specify a limit for the nine questions. By doing so it is possible to indicate for each question whether a person is energy efficient or not. Since there are only two responses in the use of energy (energy efficient or not energy efficient) from now on the items will be treated as dichotomous. In this way a person will score a point for each energy efficient behavior that they achieve. At the end, if a person answers all nine questions they have the opportunity to achieve a score of between zero and nine points. By the calculation of a specific level, it is possible to distinguish the different scores. As the attributes of energy efficient behavior of respondents are set out, it will be named from now on a “behavior score”.

The questionnaire that was used with the secondary school children in Honduras has exactly the same number of questions. But due to the climatic characteristics of the country the questions related to heating and cold water in Germany were replaced in the Honduran questionnaire with questions related to tropical weather. In this manner, the two questions about heating, in Germany were replaced by questions about air conditioning, and the question about washing hands with warm water was replaced by a question about the use of hot water for bathing. In the end, each question in both questionnaires means exactly the same regarding energy efficient behavior, and the scores of respondents can perfectly be compared for both Germany and Honduras. The two questions made in the Honduran questionnaire are presented in table one at the end of this section.

To get information for the second category “preconceptions about energy efficiency,” three levels of agreement questions were made. The questions are aimed to define what preliminary knowledge the participants have about the topic energy efficiency. Considering the first question, the respondents were asked whether it is advisable to deactivate electronic devices and equipment when they are not used. Since it is completely necessary in terms of energy efficiency, always turning off electronic equipment and devices when they are not

used would be desirable, giving "strongly agree" as an answer. As with question 2.1, four points are assigned here for the most desirable answer and one point to the answer "strongly disagree". The second question intended to collect information about preliminary knowledge in the use of electricity at home, as it is known that indeed it is important to turn off lights when they are not in use. Regardless of the amount of energy that is wasted by keeping lights on, doing this at home always represents a waste of energy. In this regard, in terms of energy efficiency, the desirable answer for this question is "strongly agree". Question number 2.9 is different in Germany to that in Honduras due to the different climates of both countries. In the Honduran survey the statement is "To be cleaner it is necessary to bathe in hot water". In Germany the statement is "To have clean hands it is absolutely necessary to use hot water". As has already been explained, it is not the temperature of the water but the quality of the soap which is crucial in cleaning hands properly. In this manner, in terms of energy efficiency, the desirable response will be strongly disagree. Since item 2.9 is negative in terms of the Likert scale, it is necessary to take this into account in the assignation of a score. Therefore, the highest score of four points is given to the answer "strongly disagree". Adding up the scores for each item, any person has the possibility of achieving a knowledge score of between 3 and 12 points. It would mean that a person with a score of six has a poorer knowledge of energy efficiency compared to a person with a knowledge score of ten.

The third category of analysis was named as "level of concern ". In this regard, two questions were grouped in this category; question 2.5 (It is worrying that fossil energy sources are limited and will be consumed more in a shorter time.) and question 2.10 (Inefficient use of energy is the main cause of climate change). If a person strongly agrees with both questions, then we can attribute to the reaction pattern of this person a high level of consternation and anxiety. The reason for this is that this person perceives that a lot of energy being consumed is not only a very worrying situation but that climate change is promoted by the inefficient use of energy. By giving four points to the answer "strongly agree" a very concerned person would get a score of eight points. A person who, however, has no concerns regarding the consumption of fossil fuels and does not believe that the inefficient use of energy is the main reason for climate change would strongly disagree with both questions. This would mean that this person would obtain an opinion score of two points.

If a person is very concerned in question 2.5 about the situation illustrated but not of the opinion that inefficient use of energy is the main reason for climate change, this person is given a score of five points. Taking into account another case where a person represents the opposite response pattern, this person would not be concerned and, however, would see inefficient energy consumption as the main cause of the climate change, then that person would also get an opinion score of five points. There is a problem if it is assumed that two people get the same score with two different opinions and response patterns. But because here it is not about an explicit opinion of the people with these two questions, but rather the focus is on the degree of concern, it is arguable that in the two mentioned cases the two people with different opinions get the same score. With the two questions the respondents have the opportunity to achieve a score opinion of between two and eight points.

“Level of responsibility” is the fourth category, and five level of agreement questions are grouped. They were intended to define whether the respondents are willing to take action in order to use energy efficiently and to ascertain their grade of responsibility by taking these actions. The first question from this category aimed to discover the opinions of the respondents about climate change. The respondents were asked if they agree or disagree with the following statement: “Climate change is the biggest global challenge”. The second question had the statement: “Efficient use of energy is a free and an individual decision”. The third question from this category aimed to get to know the opinion of the participants about the environmental situation and its future. They were asked to agree or disagree with the following statement: “By carefully analyzing climate problems the climate situation is improving”. Question 2.4 of the survey was made to find out whether the respondents agree or disagree with the statement: “Science and industry can alone solve energy problems". Question 2.6 is different for both countries. In Germany the participants had to agree or disagree with the sentence: “In Germany, several energy efficiency measures in relation to individuals should be improved, for example, building renovation and, modernization of heating systems.” In the Honduran survey the statement was made taking into account the characteristics of the country. The Honduran participants were asked to agree or disagree with the statement: “The government should implement new measures in households regarding the efficient use of energy, for example, with energy saving light bulbs or eco-stoves.”

By analyzing the data for this category it is possible to give an action and responsibility ranking, by giving a value from one to four to each of the options from strongly agree to strongly disagree. But in contrast to the previous category of the questionnaire, to calculate the results of this kind of question it is necessary to consider that the Likert scale may contain positive and negative items. The items were scored objectively as follows:

a) For a positive item, four and one points are assigned to strongly agree and strongly disagree, respectively.

b) For negative items, the scores are reversed, therefore the values one and four to strongly agree and strongly disagree are assigned respectively.

Question 2.1 "Climate change is the biggest global challenge" is a positive item in which an answer of strong agreement could mean a higher score in actions and responsibilities regarding energy efficiency. Since item 2.4 ("Science and industry can alone solve energy problems") is reversed, the higher score does not correspond to the answer "strongly agree", instead this answer corresponds to the lower score. By means of this procedure, it is possible to summarize the points of each question in order to calculate an action and responsibility score between 5 and 20 points for each person.

"Level of exposure to information" is the fifth category and has three frequency questions. The aim of the first question in this category was to find out whether the respondents get information at school about the topic "energy efficiency". The second question was related to the information that the respondents get at home. The third question in this category asked the respondents if they like to read ecological articles. This category aimed to find out whether the respondents are exposed to information regarding the efficient use of energy and environmental problems. The respondents had the chance to choose between five possible answers in a frequency scale from "always" to "never". Assigning a score from one to five to each of the five possible answers it is possible to calculate a score for each person's exposure to information. To the option "always" was assigned the score of "five" and to the option "never" was assigned the score of "one". This makes it possible to achieve an information score of between 3 and 15 points: A higher score indicates that they are exposed to more information about energy efficiency than those with a lower score.

Turning now to question 3.16 which was included in category number six: “Level of importance of the issue of energy efficiency”. In order to determine the level of importance of the topic of energy efficiency, the response options start with “extremely important” as the number one option and “not at all important” as the number five option. In order to determine a score, to answer number one was given five points and to answer number five one point. By adding the number of points given to each answer it is possible to know the level of importance of energy efficiency of a group.

Category seven is the degree of willing to know more about the subject. In order to get information about the last question of the instrument a single choice question was used. The respondents were asked if they would wish to know more about energy efficiency. The option answers were given as follows: “yes, much more”, “yes more”, “a little bit more”, “rather not” and “no”.

Apart from the categories, the survey also included five association questions. The first one was designed to determine which of the given words have the strongest and the weakest association with energy efficiency. The task of the respondents consisted in giving to each term a grade of connection from 1 (extremely connected) to 5 (not at all connected). Thus with the data obtained, a ranking list could be made. With this item each level of association should be distributed only once, so the respondents indicate which term has the strongest or the weakest connection with the term energy efficiency. If the aim is to know which concept is combined as the strongest and as the weakest by a group, it is reasonable not to give a so-called association score for each person but instead it would make more sense to do so for each term. To elaborate it, a ranking was assigned, giving to the strongest connection five points and to the weakest connection one point.

Questions 3.6 to 3.10 are the next association questions, aimed to find out which of the named extracurricular after school clubs had the highest attractiveness for the respondents. The respondents had the opportunity to choose the grade of attractiveness from 1 “extremely attractive” to 5 “not at all attractive”. As with the first five association questions, each possible level of attractiveness can be assigned only once. Furthermore, to the answer “extremely attractive” five points is given and to the answer “not at all attractive” one point.

With the following association questions 3.11 to 3.15 it is possible to determine which are the most frequent sources of information on topics related to the environment. In order to deliver a ranking of the most popular sources of information, each source of information should have a different connection. Level 1 as the first source of information and level 5 as the weakest source of information. By giving points to each answer it is possible to create a ranking. To the first source of information was given five score points and the last source of information was given one score point.

To find out in which subject at school the topic of energy efficiency is most likely taught, questions 3.17 to 3.21 were made for their associations. The respondents have to choose from five answers; from 1 “extremely treated” to 5 “not at all”. As in the previous association, all questions were given five points for the strongest connection, and one point for the weakest connection, so a score for each subject can be calculated. With the association questions 3.22 to 3.25 the respondents were asked which of the given light sources with the same brightness consumes the most energy. Referring to the four specified light sources, it is possible to assign to the lamp with the highest consumption the number one and to the lamp with the lowest consumption the number five. By adding up the points it is possible to produce with these answers a knowledge scale.

To know the size of the apartment in which the participants of the pilot study live in, question 4.1 was made; as possible answers a range of 7 sizes were given from which the respondents had to choose, ranging from 40m^2 to 120-140m^2. With question 4.2 the respondents were asked how many people live in their household. To answer the question, the respondents could indicate whether in a range of one individual to more than ten people were living with the family. Overall, the respondents could choose from eleven predetermined options.

Due to their education level, the university students’ questionnaire had nine different questions from the secondary school questionnaire (three frequency questions, four level of agreement questions and two association questions). The first three different questions were made in order to collect information about the use of energy in environments where the students are involved, these would be: school, university and home. To know the level of engagement that the university students as future teachers have regarding the efficient use of energy the respondents were asked whether they agree or disagree with the following two

statements on a scale ranging from “strongly disagree” to “strongly agree”: 2.5 “The efficient use of energy should be treated more than before at school” and 2.6 “Would you teach the subject of energy efficiency at school?”. These two questions will be included in the category “action and responsibility”, assigning scores to each possible answer as described before, thus it is possible to achieve an “action and responsibility score”.

To collect information about preconceptions (apart from the questions included for the secondary school children) the respondents were asked if they agree or disagree with the following statements: “Energy efficiency means exactly the same as energy saving” and “Energy consumption in private households increases with the size of the space”. The allocation of points to these questions follows the same rules explained above for the category “preconceptions about energy efficiency”.

Two association question differs from the secondary school children's questionnaire; questions 3.15 to 3.19 aimed to find out the opinions of respondents about the causes of the waste of energy in households. This question had five options “people do not know how to use energy efficiently,” “people have too little environmental awareness”, “little interest”, “it is uncomfortable to use energy efficiently” and “it is too expensive”. The target of this question is to give a ranking of the respondents’ opinions. As in the last association question, five points to the first option and one point to the last option were given. With questions 3.20 to 3.24 the respondents were asked to indicate why they would use energy more efficiently. As with the others association questions they were asked to rate the options on a five-point scale, where each option should be assigned only once. In order to give a ranking a score on each option was given. To option number one was given five points and to option number five was given one point. The amount of points given to each option is used to give a ranking about the reasons that the respondents have to use energy efficiently.

The university students’ questionnaire did not include the association question about after school clubs. At university clubs are not part of t extracurricular activities. Another question that was not included in the students' questionnaire was the one referring to the teaching of energy efficiency at school.

3.6 Analysis

The results of the Likert scale survey were analyzed following a quantitative approach. The analysis of the frequency questions, the level of agreement questions and the single choice questions was made by grouping the answers into categories. To each possible answer is giving an amount of points, by adding up the amount of points of each item it is possible to reach a category-score.

Each group had the chance to achieve a category-score. The data analysis was made by grouping the item results in the following categories, next to the name of each category is the amount of points that was possible to achieve by answering all the questions in the category, this amount of points is given as the range of the scale.

I.- Category: Energy efficient behavior, scale (0-9)

1.1 If you sit at your desk and then you shortly have to leave, do you turn the light on your desk off?

1.2 Do you turn off the TV and the radio if you are not using them?

1.3 Do you turn off the water in the shower while you are soaping?

1.4 Do you sleep with the light on?

1.5 Do you put the electrical appliances in your home on standby mode when they are not in use?

1.6 How often is the refrigerator in your house defrosted?

1.7 (Honduras) Do you bathe in cold water?

1.7 (Germany) Do you wash your hands with cold water?

1.8 (Germany) In winter are you aware that your bedroom never needs a temperature over 16 °C?

1.8 (Honduras) Are wet clothes ironed in your house?

1.9 (Honduras) If you have got (or if you had) air conditioning in your home do you prefer to wear lighter clothes instead of turning up the air conditioning?

1.9 (Germany) Before you turn the heater up, do you prefer to put on a sweater instead of a shirt?

II. Preconceptions about energy efficiency, scale (0-12)

2.7 It is very important to completely disconnect electrical appliances such as a radio or a TV when you finish using them.

2.8 It is very important to turn off the light every time you leave a room.

2.9 (Honduras) To be cleaner it is necessary to bathe in hot water.

2.9 (Germany) To have clean hands it is absolutely necessary to use hot water.

III. Level of concern, scale (0-8)

2.5 It is worrying that fossil energy sources are limited and will be consumed more in a shorter time.

2.10 Inefficient use of energy is the main cause of climate change.

IV. Level of responsibility, scale (0-20)

2.1 Climate change is the biggest global challenge.

2.2 Efficient use of energy is a free and individual decision.

2.3 By carefully analyzing climate problems the climate situation is improving.

2.4 Science and industry can alone solve "energy problems".

2.6 (Germany) In Germany, should several energy efficiency measures in relation to individuals be improved, for example, building renovation, and modernization of heating systems?

2.6 (Honduras) In Honduras, should the government implement new measures in households regarding the efficient use of energy, for example, with energy saving bulbs or eco-stoves?

V. Level of exposure to information, scale (0-15)

1.10 Is energy efficiency spoken about at your home?

1.11 Is energy efficiency spoken about at your school?

1.12 Do you like reading ecological articles?

VI. Level of importance of the topic energy efficiency, scale (0-4)

3.16 How important for you is the topic of energy saving?

VII. Level of willing to know more about the topic energy efficiency, scale (0-4)

4.3 Do you want to learn more about energy efficiency?

3.7 The Wilcoxon Rank-Sum Test

The investigation aims to compare each participating group which each other as well as on an international level. To find out whether the groups are distinguishable by scoring in a particular category or in an association question the Wilcoxon Rank-Sum Test was used. The survey used to collect the required information was made by using the Likert scale; as was mentioned before in section 3.3, data of a Likert scale survey are considered as ordinal. Due to the characteristics of the data, to find out whether two different samples are significantly different from each other, we have two choices: The Mann-Whitney Test and the Wilcoxon Rank-Sum Test. These tests are the non-parametric equivalent of the independent t-test, so both tests can be considering as equal. [26]

"The median is the preferred measure of central tendency for data from an ordinal scale"(Gravetter & Wallnau, 2009) p. 98 ."The strict level of measurement rule is that means should never be computed on ordinal data"(Weisberg, 1992) p. 37. Regarding the statistical tests used in data analysis, for ordinal scale yield it is advised to use non-parametric test.

"Nominal and ordinal scales yield non- parametric data, i.e. data from populations, where few or no assumptions are made about the distribution of the population or the characteristics of that population"(Cohen, Manion, & Morrison, 2000) p.77.

Non-parametric hypothesis tests are characterized by working with the rank positions instead of the values of each measure, which is why the median are not sensitive to possible outliers. It should also be noted that non-parametric hypothesis tests can also be used if the

[26](Field, 2005) p. 522

existing data is not exclusively interval but also ordinal-scaled. Together with these characteristics of non-parametric tests it should also be mentioned that these non-parametric tests can also be used when the data is normally distributed. In contrast to parametric tests, non-parametric tests have an accuracy of 95% in such situations.[27]

"The test relies on scores being ranked from lowest to highest, therefore the group with the lowest mean rank is the group with the greatest number of lower scores in it. Similarly, the group that has the highest mean rank should have a greater number of high scores within it" (Field, 2005) p 530. By looking at the values of the ranks, we can also see how the groups differ; the groups with the highest score will have the highest ranks.[28]

In the present investigation the Wilcoxon Rank-Sum Test is used to find out whether two groups can be distinguishable with respect to a particular category or with respect to a particular association question. The groups will be compared with each other according to their level of education and on an international level. The three participating groups from Germany will be compared which other taking into account their level of education, and the same will be done with the three Honduran groups. Together with the comparison in each country, the groups will be compared on an international level, that is, both groups of year eight secondary school children from Germany and Honduras will be compared with each other, both groups of year eleventh secondary school children from both countries will also be compared, as will the university students from both countries.

By using the Wilcoxon Rank-Sum Test, also known as the Mann-Whitney Test, it is possible to find out whether the groups can be distinguishable in their energy efficienct behavior But it is also possible to find out whether the groups can be distinguishable in their preconceptions about the efficient use of energy, the level of concern about environmental problems and the efficient use of energy and so on with the other categories of analysis and association questions as well.

[27] (Bühl, 2008) p .317ff
[28](Field, 2005) p.533

3.8 Spearman's Rank Correlation Coefficient

After the comparisons within the groups, the present investigation aims to find the relations between the categories of analysis. As explained previously, the data in the present investigation is ordinal; according to (Borradaile, 2003) the Spearman's Rank Correlation Coefficient is used with non-numerical data to which is assigned an ordinal or rank. This is a non-parametric statistic test that works by first ranking the data and then applying a Pearson equation to those ranks.[29]

Since the Spearman Rank Correlation Coefficient is a non-parametric method, the coefficient is not calculated taking into account the values of the individual variables, but by means of the ranks assigned to the individual values, although the test can be used even if there are outliers within the data set.[30]

In the present investigation, the procedure for doing the Spearman correlation is made by SPSS; in the program when two variables are tested with the Spearman's Rank Correlation a matrix is displayed giving the correlation coefficient between the two variables and the significance value for this correlation coefficient. The present investigation will conclude that two variables are correlated only when the significance value for the coefficient correlation is less than 0.05. This correlation will give us the chance to find out which categories could influence energy efficient behavior. From the correlation between the categories it is also possible to make conclusions on how an attitude influences another one, for example, if the category level of responsibility is positively correlated with the category level of exposure to information, the results could lead us to conclude that the more informed a person is, the more responsible this person is in recognizing the effect of their actions related to climatic problems. The correlations will be made in each group; this will give us the opportunity to distinguish whether the same correlations are found in each group and in each country.

To evaluate the usefulness of the instrument by collecting information for the research in the two countries a pilot study was made. It took place both in Germany and in Honduras. The pilot study was intended to evaluate not only the effectiveness of the instrument in collecting

[29] (Field, 2005) p.129
[30] (Zöfel, 2007) p.126

data but also the cross-cultural equivalence of the instrument, the evaluation of responsiveness and the evaluation of psychometric properties. As the Likert scale requests, this pilot study was carried out with at least 100 respondents among the three groups in each country. Conducting the survey and analyzing both its development and its contents, the necessary changes were made. In the process of validation of the instrument with the pilot study, a Master's thesis by a physics student of the Europa-Universität Flensburg was also conducted and whose contributions will be mentioned on the next chapter.[31]

The conclusions of the pilot study regarding the use of the Wilcoxon Rank-Sum Test and the Spearman's Rank Correlation Coefficient are not conclusive about the differences between the participating groups; the conclusions only show us whether the Wilcoxon Rank-Sum Test and the Spearman's Rank Correlation Coefficient are useful for data analysis in the main study.

[31](Reinhardt, 2015)

4. Pilot Study

4.1 Introduction

The pilot study was made to evaluate the usefulness of the questionnaire as an instrument for collecting information for the research. The objectives of this study were to evaluate the effectiveness of the instrument by collecting the required information, assess which questions of the instrument needed improvements, find out the quality and relevance of the instrument and assess whether difficulties emerge by answering the questionnaire. Together with this, as the Likert scale requests, the pilot study was used to validate the reliability of the instrument. Parallel to this and using the data collected for the pilot study a Master's thesis was written (Reinhardt, 2015) by Erik Reinhardt, a physics student at the Europa-Universität Flensburg. Although both works pursue different goals and this chapter has clear differences on its presentation, as a result of this cooperation, a parallel exist between both works regarding the data, the analysis of the collected data, their methodological evaluation and the common discussion of the results.

4.2 Method

4.2.1 Participants

The Pilot study was made with a sample of approximately 10% of the number of participants that were intended to be included in the main study. In this manner, the study included five different groups of participants. A total of 179 participants took part in it, with 87 participants from Honduras and 92 participants from Germany being surveyed. Looking at the 87 respondents from Honduras more precisely, the participants are divided into the following groups: 39 year eight secondary school children, 33 year eleven school children and 15 natural science students from the Universidad Pedagógica Nacional Francisco Morazán in San Pedro Sula. Within Germany, there were a total of 92 respondents surveyed, 43 year eight secondary school children, 38 year eleven school children and 11 physics students from the Europa-Universität Flensburg.

4.2.2 Implementation of the questionnaire

To conduct the questionnaires in Honduras it was necessary to send the number of questionnaires required there by mail. The electronic submission of the questionnaire was not possible because of the lack of facilities at Honduran schools. Most of Honduran public schools do not have any access to the internet, therefore paper sheets for the questionnaire were used, but the program used to analyze the instruments (the EvaSys system) must have a standard measure, unfortunately it was impossible to find paper sheets with this measure in Honduras. In the end, it was decided to send the requested questionnaires by mail. Once the questionnaires were in Honduras, a legal representative in the country was in charge. To collect the requested information from both groups of secondary school children, the instrument was applied at the Centro de Investigation e Innovacion Educativa (CIIE) in Tegucigalpa. Regarding the university students, the instrument was applied at the Universidad Pedágogica Nacional Francisco Morazán in San Pedro Sula. In Germany, after obtaining the necessary regulatory approvals and consents for the pilot test, it took place at two schools: one in Scheeßel and the other in Kiel. For the university students, the pilot study was conducted at the Europa-Universität Flensburg.

4.2.3 Hypothesis

The pilot study was made to evaluate the usefulness of the questionnaire as an instrument for collecting information for the research. To assess which of the first nine questions of the instrument needed improvements and to evaluate the effectiveness of the instruments to collect information about energy efficient behavior, two conflicting hypotheses were tested: H_0: items 1.1 to 1.9 are suitable for evaluating energy efficient behavior; H_1: items 1.1 to 1.9 are not suitable for evaluating energy efficient behavior. To test the hypothesis, the Rasch model was used. The following two conflicting hypotheses were assessed to evaluate the international usefulness of the instrument: $H_{0:}$ participants from Honduras and Germany cannot be distinguished by their energy efficient behavior and $H_{1.}$ participants from Honduras and Germany can be distinguished by their energy efficient behavior.

To assess which association questions needed improvements three hypotheses were made. The first one was related to extracurricular after school clubs. The statement was as follows:

“Members of the energy efficient group” and “Members of the not energy efficient group” find an after school working club equally attractive. The second association question used in this assessment was the one regarding the connections that the participants make with energy efficiency. It was intended to find whether an “energy efficient group” and a “not energy efficient group” can be distinguished by associating a list of words with energy efficiency. The hypothesis made in this assessment was: the “energy efficient group” and the “not energy efficient group” associate the same words with energy efficiency. The third hypothesis in the evaluation of the association questions was: the informed group and the not informed group use the same sources of information. Because the data is ordinal, to test the hypothesis on the differences between the two different groups of participants, the Wilcoxon Rank-Sum Test, also known as the Mann-Whitney Test, was used.

To assess if there was any relation between the categories, two conflicting hypotheses were evaluated. As a null hypothesis the following statement was made: $H_{0:}$ “Energy efficient behavior” is related to preconceptions about the efficient use of energy. And as a research hypothesis this statement was made: $H_{1:}$ “Energy efficiency behavior” is not related to preconceptions about the efficient use of energy. To find a relation between the categories, the Spearman Rank Correlations Coefficient was used.

By testing the hypothesis, we did not aim to establish any conclusion about the use of energy by the participants, rather the usefulness of the questionnaire in collecting information for the research and the methods (the Wilcoxon Rank-Sum Test and the Spearman Rank Correlation Coefficient) for analyzing the data were evaluated. From the results it will be decided whether the methods are useful for analyzing the data in the main study.

4.3 Results

4.3.1 Evaluation with the Rasch model

“A central feature of the Rasch model is a table of expected response probability designed to address the key questions: when a person with this ability (number of items correct) encounters an item with this difficulty (number of persons who succeed on the items), what is the likelihood that this person gets this item correct? Answers: The probability of success

depends on the difference between the ability of the person and the difficulty of the item" (Bond & M. Fox, 2015) p. 11.

In the present investigation the Rasch model was used to determine the usefulness of nine items in measuring energy efficient behavior. Due to the fact that the items were dichotomous, it was possible to use such a method. "The necessary requirement to calibrate a Rasch scale is that the items must fit the unidimensional scale. Items that do not fit the scale must be deleted in calibration"(Afrassa, 2005) p.67.

The Rasch model was used to evaluate which of the first nine questions of the instrument needed improvements and to evaluate the effectiveness of the instrument by collecting information about energy efficient behavior. As the items are dichotomous it is suitable to use such a method. In this manner, two conflicting hypotheses were used: H_0: items 1.1 to 1.9 are suitable for evaluating energy efficient behavior and H_1: items 1.1 to 1.9 are not suitable for evaluating energy efficient behavior. Since items 1.8 and 1.9 were missing in the Honduran questionnaires, the assessment there only included items 1.1 to 1.7. In analyzing the data with the Rasch model it is possible to assess whether difficulties emerge by answering the questionnaire.

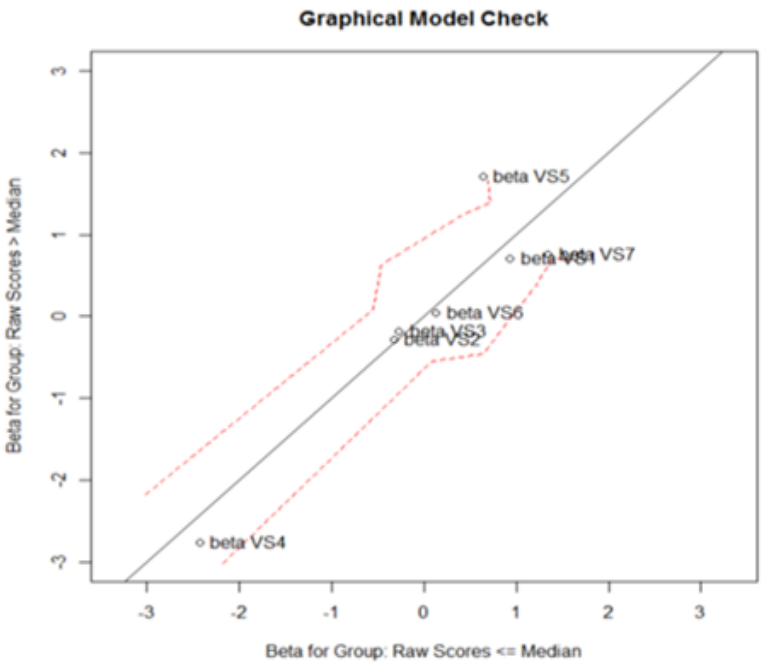
Item	Estimated value
1.1	-0,739
1.2	0,316
1.3	0,238
1.4	2,494
1.5	-1,402
1.6	-0,059
1.7	-0,847

Table 4- 1 Results of the Easiness parameter

The results of the easiness parameter for each item are presented in table 4-1. As can be seen in the table, item 1.4 (Do you sleep with the light on?) was found to have the lowest level of difficulty, while item 1.5 (Are your electric appliances in standby mode when not in use?) had the highest level of difficulty. From the results in table 4-1 it can be concluded that item 1.4 was the easiest to answer and item 1.5 was the most difficult one to answer.

To evaluate whether the Rasch model was able to describe the items in the questionnaire, a graphic control for the model was made. Graph 4-1 represents the location of each item in the graphic control of the Rasch model.

It can be seen on the graph that items 1.1 to 1.4 as well as item 1.6 can be described as model compliance with the Rasch model since



Graphic 4- 1 Location of the items according with the Rasch model

they are located within the 95% confidence interval and they are a short distance from the 45° line. Although item 1.7 was located within the confidence interval of 95% and was found to be compliant with the Rasch model, it is necessary to consider this item in more detail since it is very close to the lower limit of the confidence interval. Item 1.5 was found to be not model compliance with the Rasch model, therefore it is inadequate to describe this item with the Rasch model.

To test the previous assumptions, the Wald-Test was used Table 4-2 illustrates that the Wald-Test value from items 1.1 to 1.4 as well as items 1.6 and 1.7 are located within the confidence interval [-1.960; +1.960], while the test-value of item 1.5 is located outside the confidence interval. As a conclusion of the Rasch model, it can be said that items 1.1 to 1.4 as well as items 1.6 and 1.7 can be described by the Rasch model, while item 1.5 was found to be difficult to be described by the model.

Item	Test-value
1.1	-0,519
1.2	0,165
1.3	0,287
1.4	-0,588
1.5	2,580
1.6	-0,246
1.7	-1,193

Table 4- 2 Wald-Tests for the items in the category energy efficient behavior

The results in table 4-1 show that item 1.4 was the easiest to answer, while item 1.5 was the most difficult one to answer. In addition to this, on Graph 5-1 item 1.5 appears to be at large distance from the 45° line. Although on graph 4-2 item 1.7 was very close to the lower limit of the confidence interval, based on the results of the Wald-Test for this item, the evidence is sufficient to support the conclusion that item 1.7 can be described with the

Rasch model. Based on this assumption, it can be concluded that item 1.7 can be used to measure energy efficiency behavior.

From the results of the Rasch model and the Wald-Test, item 1.4 was found to be unsuitable for the main study, therefore the item was removed from the questionnaire. Although item 1.5 was found to be outside the confidence interval for the Rasch model, the information that the item aims to collect is crucial for the development of the research, thus the item was included in the main study.

From the evaluation of the first conflicting hypotheses with the Rasch model, the evidence was enough to accept the null hypothesis for items 1.1 to 1.3, as well as for items 1.5 to 1.7, concluding that these items are suitable for evaluating energy efficient behavior. Regarding item 1.4, the evidence is sufficient to accept the H_1 for this item, concluding that 1.4 is not suitable for evaluating energy efficient behavior.

Due to the fact that items 1.8 and 1.9 were not included in the Honduran questionnaire, these items could not be evaluated with the Rasch model. Even though item 1.8 (In winter are you aware that your bedroom never needs a temperature over 16 °C?) was not analyzed by the Rasch model, due to the number of invalid answers of the item in the results of the German groups the item was considered too difficult to answer. In this regards the evidence was sufficient to support the conclusion that item 1.8 is not suitable for evaluating energy efficient behavior. Instead to measure the use of energy by heating at home a new item was included which aims to collect information about the use of the heating system at nights. The item has the following statement: Do you turn down the heating at night? Item 1.9 (Before you turn up the heating do you prefer to wear a sweater instead of a shirt?), on the other hand was also not analyzed with the Rasch model, nevertheless the information that the item aimed to collect was found to be required for the development of the research. For this reason, the item was included in the main study.

To optimize the different instruments, the number and order of the items in the questionnaire for the main study is the same in the four questionnaires. To measure “energy efficient behavior” the final version of the instrument has the following questions with the following sequence in the four surveys:

1.1 If you sit at your desk and then you shortly have to leave, do you turn off the light on your desk?

1.2 Do you turn off the water in the shower while you are soaping?

1.3 Do you turn off the TV and the radio if you are not using them?

1.4 Do you put the electrical appliances in your home on standby mode when they are not in use?

1.5 How often is the refrigerator in your house defrosted?

1.9 (Honduras) Do you bathe in cold water?

1.9 (Germany) Do you wash your hands with cold water?

1.10 (Honduras) If you've got (or if you had) air conditioning in your home, do you prefer to wear lighter clothes instead of turning up the air conditioning?

1.10 (Germany) Before you turn up the heating do you prefer to put on a sweater instead of a shirt.

1.11 (Honduras) If you've got (or if you had) air conditioning in your home, do you lower the intensity at night?

1.11(Germany) Do you turn the heating down at night?

4.3.2 The Wilcoxon Rank-Sum Test

The Wilcoxon Rank-Sum Test was used to test whether the groups are distinguished in energy efficient behavior. The test was not used to establish conclusions about the efficient use of energy of the participants. The test was used to measure the usefulness of the survey by evaluating energy efficient behavior, and the usefulness of the test to establish differences between the different groups. Furthermore, due to the number of participants in the pilot study, the assumptions made regarding the energy efficient behavior of the groups are not conclusive. These assumptions are made to assess the usefulness of the survey for the main study.

The Wilcoxon Rank-Sum Test was used to evaluate the following two conflicting hypotheses: H_0: People from Honduras and Germany cannot be distinguished by their energy efficient behavior. H_1: People from Honduras and Germany can be distinguished by their energy efficient behavior. The comparison was made between year eight and year eleven secondary school children both in Germany and Honduras and university students both in Germany and Honduras. A regional comparison between both Germany and Honduras was also carried out.

Diagram 4-1 illustrates the results of the Wilcoxon Rank-Sum Test and the median for the energy efficient behavior score of the groups.

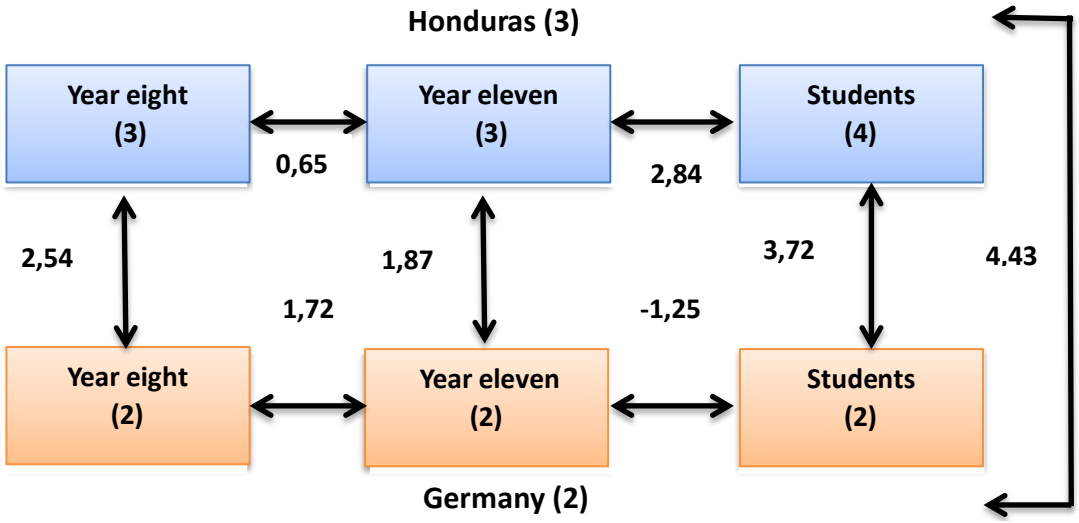


Diagram 4- 1 Honduras and Germany, the Wilcoxon rank-sum test, energy efficiency behavior

As can be seen in Diagram 4-1, the Honduran year eight secondary school children and the Honduran year eleven secondary school children could not be distinguished in respect to their energy efficient behavior while the Honduran year eleven secondary school children and the Honduran university students can be distinguished with respect to their performance in the use of energy. Although the test showed a difference between both groups, it was necessary to analyze the median to find out which group has a "better" performance.

Due to the fact that the median for the university students was higher by one point than the median for the year eleven secondary school children, it can be said that Honduran university students have "better energy efficient behavior" when they were compared to the Honduran year eleven secondary school children. Regarding the German groups, the data show that all of the groups can be distinguished in respect to their energy efficient behavior.

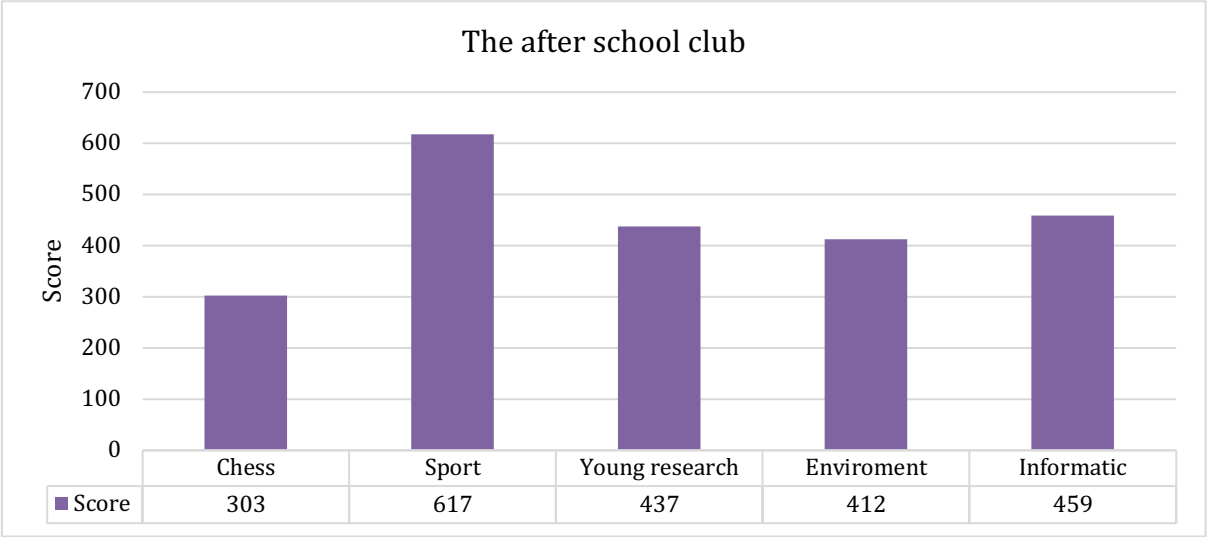
By comparing the regions, by the results of the test and the results of the medians, it was found that the year eight secondary school children and the university students from Honduras reportedly have a higher energy efficiency score when they were compared to their partners in Germany. It can be said that these two Honduran groups have "better energy efficient behavior". By comparing year eleven of both regions, the groups were found not to be indistinguishable in their energy efficient behavior. By comparing all participants by

regions, the evidence was sufficient to accept the research hypothesis used in this evaluation. The evidence supports the conclusion that people in Honduras and Germany can be distinguished by their energy efficient behavior. By comparing the median, the group from Honduras appeared to perform "better" in terms of energy efficiency.

4.3.3 Attractiveness of an after school club

The data of the association questions was analyzed to assess which questions needed to be improved. The target was not to make conclusions about the data, but to evaluate the usefulness of the questions in the questionnaire. To make the evaluation, the data of all participants from both countries was analyzed.

The question related to after school clubs was only included in the questionnaire of the secondary school children. The hypothesis was as follows: "energy efficient people" and "not energy efficient people" find an after school club equally attractive. As a first step, a ranking of the answers of the participants was given. Graph 4-2 illustrates the most attractive after school club for the secondary school children from both countries.

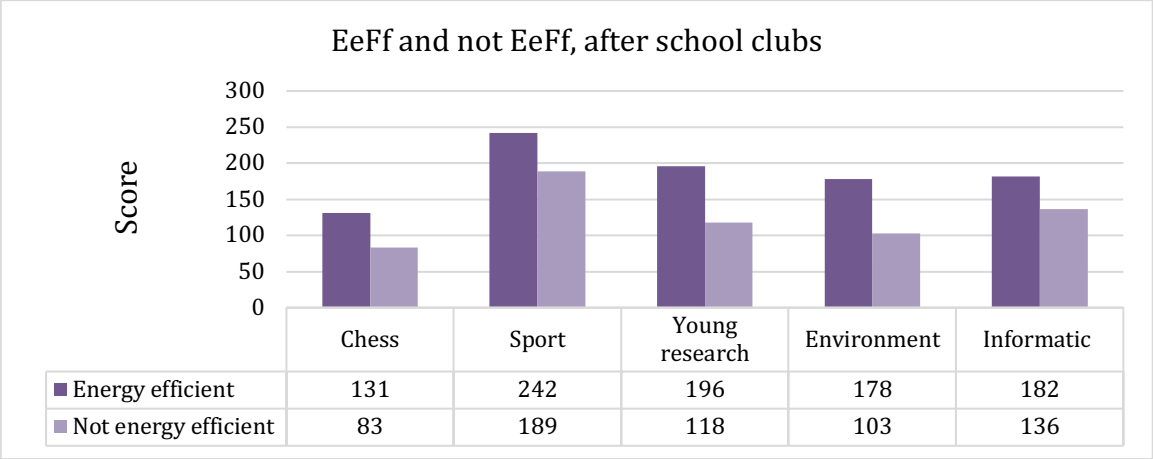


Graphic 4- 2 Ranking of the working clubs

As can be seen on Graph 4-2, the most attractive club for the secondary school children of both countries was sport, the least attractive club was chess. In the second favorite spot was informatic. While science club or young research and environmental studies were selected as the second from last and the last respectively.

In order to group the participants into “energy efficient” ones and “not energy efficient” ones a median split was made of the results of the category energy efficient behavior. It was decided to name as “energy efficient” the participants who scored above the median and to name as “not energy efficient” the respondents who scored under the median. To distinguish the energy efficient and the not energy efficient in respect to their score on the energy efficiency scale, the respondents who scored right in the median were not included in any of the two groups. Due to the fact that they are right in the median they can not be considered either as energy efficient nor as not energy efficient.

From the results of the median split, 64 participants were put together into the “energy efficient group” and 45 participants into the “not energy efficient group”. On Graph 5-3 are shown the results of evaluating the hypothesis: “Members of the energy efficient group” and “Members of the not energy efficient group” find an after school club equally attractive.



Graphic 4- 3 Ranking of the working clubs, by group, energy efficient not energy efficient

By comparing the rankings on Graph 4-3, it can be seen that both groups differ in their choices by ranking the science club or young research and information technology or informatic, while sport, environmental studies and chess appear to have the same position in the ranking of both groups.

To evaluate whether there is any significant difference between both groups in selecting a club the Wilcoxon Rank-Sum Test was used. Diagram 4-2 illustrates the results of the test and the median for both groups.

It can clearly be seen in Diagram 4-2 that the energy efficient group differs from the not energy efficient group by selecting the environmental studies club.

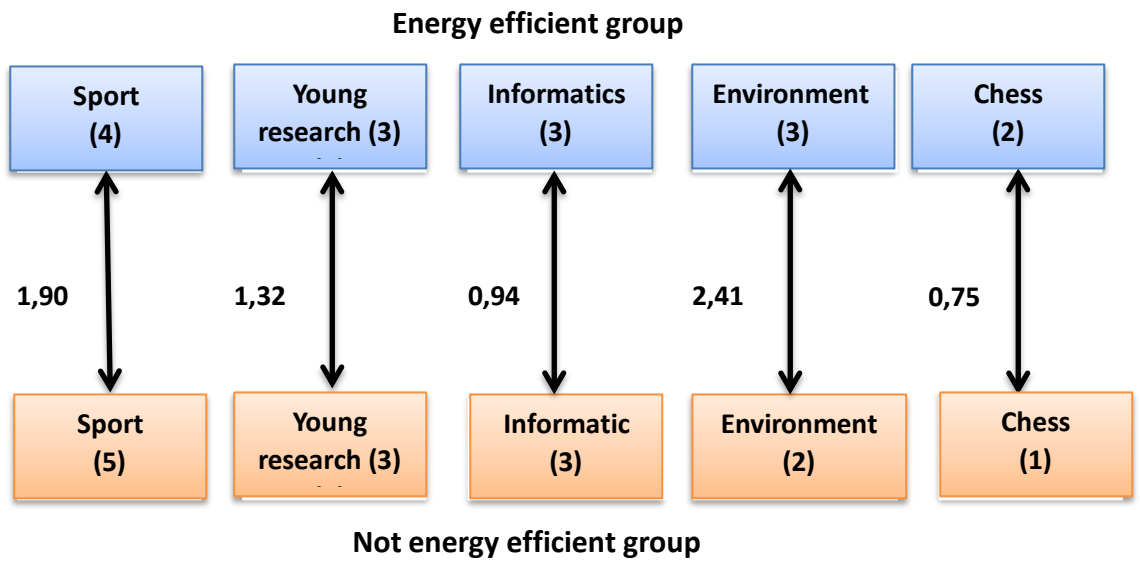


Diagram 4- 2 Wilcoxon rank-sum test, the working clubs, by group, energy efficient and not energy efficient

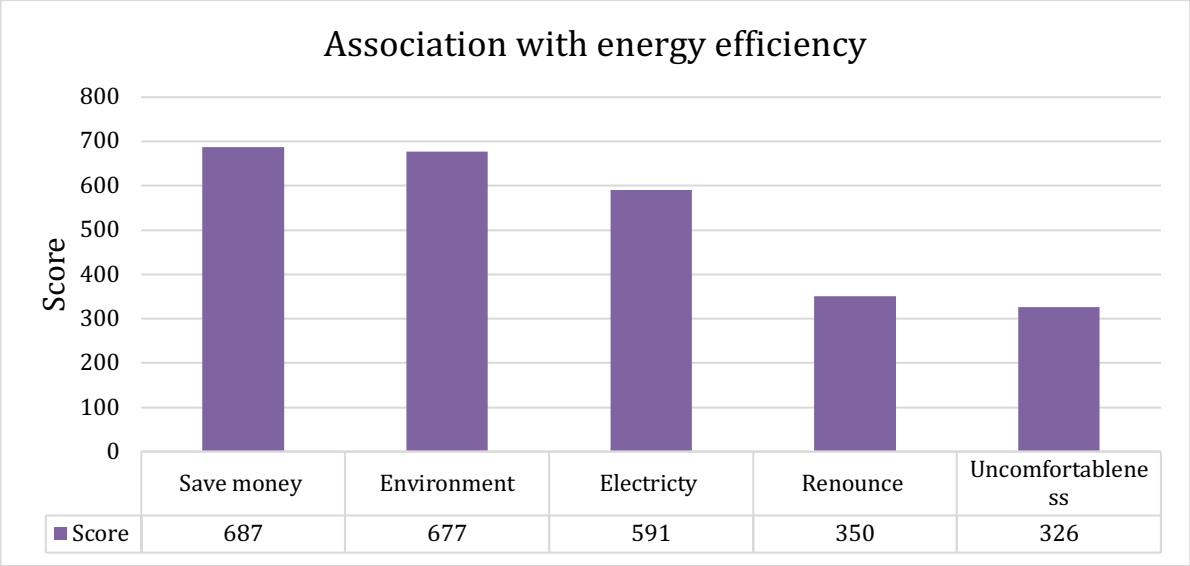
By analyzing the median of both groups, the results show that the environment studies club was selected more often by the energy efficient group.

Although both groups differ only by selecting one club, the evidence is enough to reject the hypothesis that the "energy efficient group" and the "not energy efficient group" find equally attractive an after school club.

4.3.4 Associations with Energy Efficiency

In the evaluation about the associations that the participants make with energy efficiency, the following hypothesis was made: The "Energy efficient group" and the "Not energy efficient group" associate the same words with energy efficiency. Due to the fact that the question is in all the questionnaires, the analysis was made for all the 179 participants. Graph 4-4 illustrates the ranking of the words most related to energy efficiency for the entire group of participants.

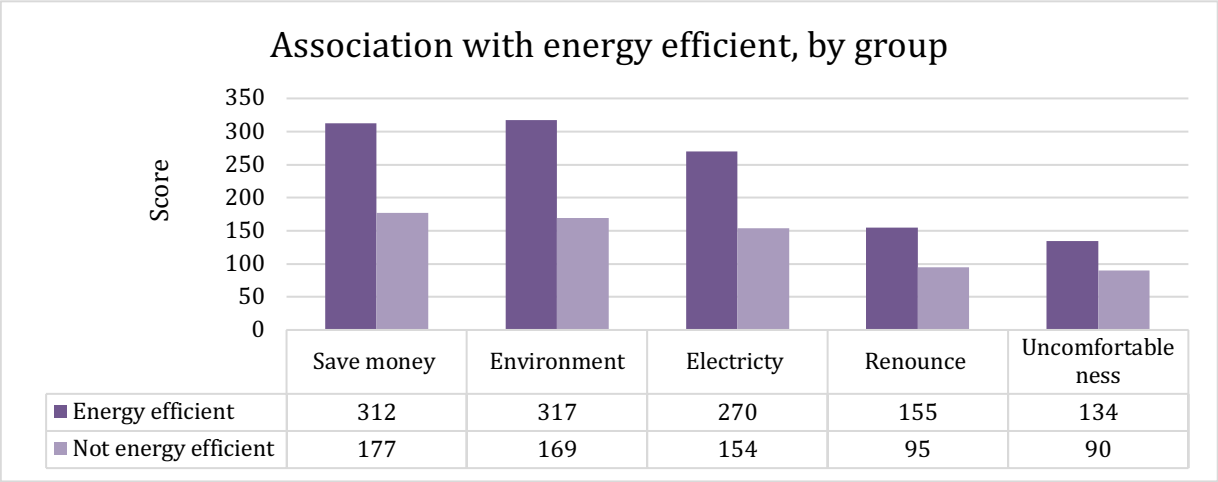
As seen on Graph 4-4, the word most associated with energy efficiency that the 179 participants have given was save, followed by environment. In third place the participants have given electricity, while the two words least associated with energy efficiency was renounce and uncomfortableness.



Graphic 4- 4 Ranking of the association with energy efficiency

Once the ranking of the associations with energy efficiency was made, the following step was to find out whether the energy efficient group and the not energy efficiency group could be distinguished with respect to their associations with energy efficiency. Due to the fact that the question was in all the questionnaires, the number of valid answers taken into account with this question increased. The analysis was made for all of the 179 participants; in this manner, by making a median split the two groups were identified: the energy efficient one with 79 participants and the not energy efficient one with 49 participants. The number of participants in the energy efficient group and the not energy efficient group differ from the question about after school clubs because the question about after school clubs was only in the survey of the secondary school children, while the question about the associations with energy efficiency was in all the questionnaires. That is, the question was also in the university students' questionnaire which increased the number of participants in the question about associations with energy efficiency. Since some questions were not answered, clearly due to missing or incorrect response patterns, it will be briefly stated during the presentation of the rankings how many people have provided a useable response.

As seen on Graph 4-5, the energy efficient group has given environment as the word most associated with energy efficiency. With a difference of 5 points, the second most associated word with energy efficiency for this group was *save;* wherein two answers have not been taken into account due to the lack of or ambiguous responses.



	Save money	Environment	Electricty	Renounce	Uncomfortable ness
Energy efficient	312	317	270	155	134
Not energy efficient	177	169	154	95	90

Graphic 4- 5 Association with energy efficient, by group, energy efficient and not energy efficient

The word *electricity* is in third position with 270 points from 78 participants, while in fourth position with a difference of more than 100 points from the third place is the word *renounce;* the score was given by 77 participants. The word least associated for the energy efficient group was *uncomfortableness* with 134 points from 77 participants.

To the not energy efficient group, the word most associated with energy efficiency was *save* with a score of 177 points from 45 participants. The word *environment*, with a difference of 8 points from the first position, was given as the second most associated word with energy efficiency; the score was reached by analyzing 44 participants. The last three words of the rankings were the same as the ones made by the energy efficient group, *electricity* is in third spot with 154 points from 46 participants, followed by *renounce* in fourth position with 95 points from 41 respondents and in last place in the ranking with 90 points from 44 participants is the word *uncomfortableness*.

The Wilcoxon Rank-Sum Test was used to evaluate if the differences between both groups are significant and accept or reject the hypothesis: the "Energy efficient group" and the "Not energy efficient group" associate the same words with energy efficiency.

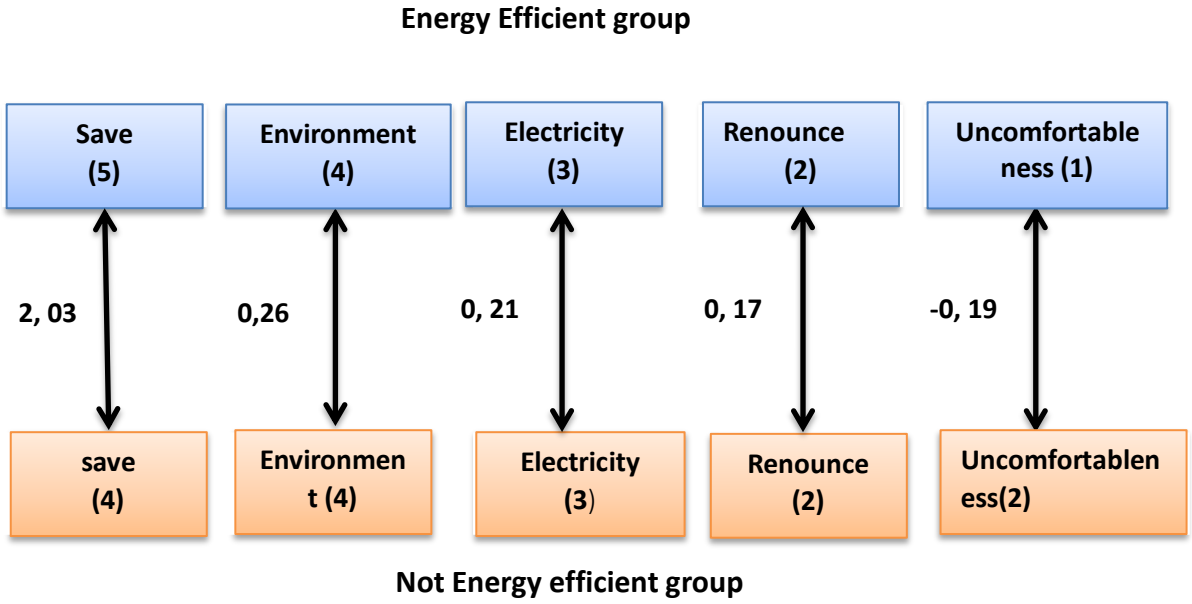


Diagram 4- 3 Association with energy efficiency, by group

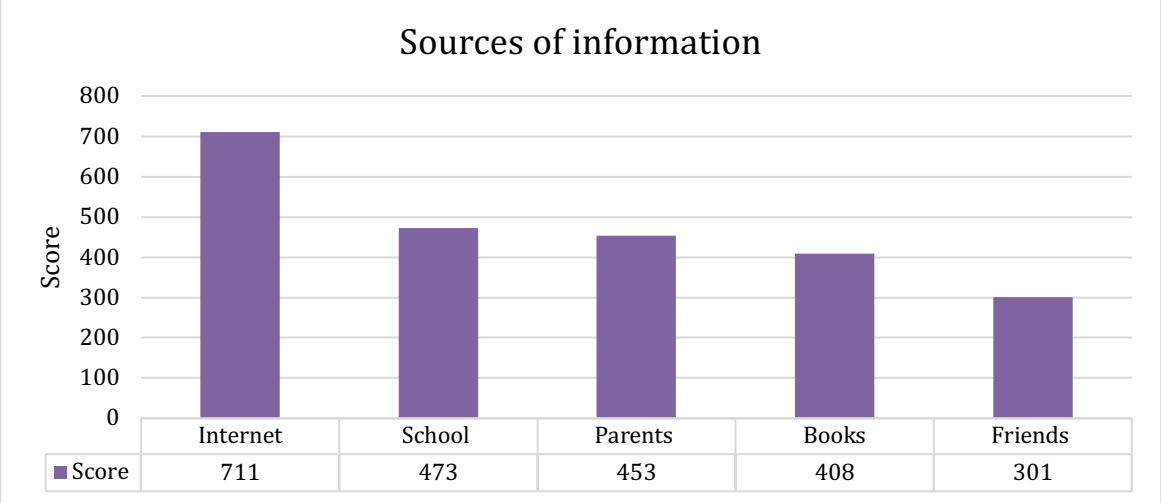
It can be seen in Diagram 4-3 that both groups differ in their associations with energy efficiency. The energy efficient group reportedly made a stronger association between the word save and energy efficiency. The results of the Wilcoxon Rank-Sum Test for the other four words show no significant differences between both groups. Although the two groups differ only in the association of one word, the following hypothesis had to be rejected: the "Energy efficient group" and the "Not energy efficient group" associate the same words with energy efficiency.

4.3.5 Sources of information about environmental topics

To find out which is the most used source of information by the respondents, the following question was made: what are your main sources of information on environmental topics? Level 1 is the main source of information, level 5 is the weakest source of information. The options were: books, parents, friends, internet and schools. Together with this, the aim was to find out whether the informed group and the not informed group give the same rankings with respect to their sources of information. In the evaluation the following hypothesis was involved: the informed group and not informed group use the same sources of information.

To make the assessment, 153 questionnaires from secondary school children in Honduras and Germany were analyzed. In the evaluation of this question the results of the university students were not taken into account since the question had different options in the student questionnaire.

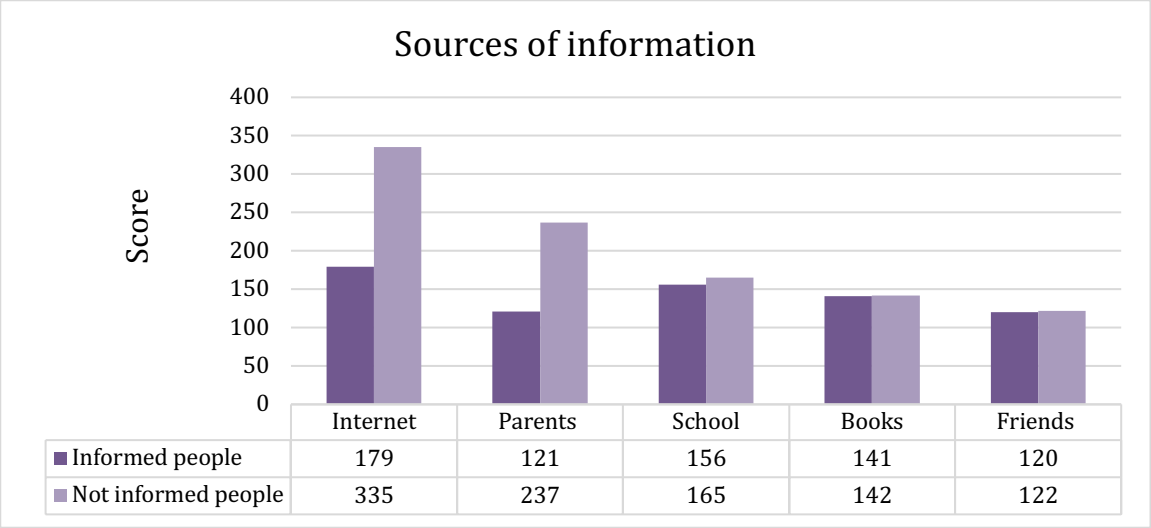
Graph 4-6 illustrates the ranking of the most used sources of information for the participants.



Graphic 4- 6 Ranking of the sources of information

As can be seen on the graph, the most used sources of information for the respondents was the internet with 711 points. 238 points separated the first and the second source of information, school. In third position was parents, with 453 points. The difference between the second and the third position was 20 points; it was lower than the difference between the first and the second position. In fourth spot was books with 408 points, while friends with 301 points was the least used source of information for the respondents.

To evaluate if informed people and not informed people use the same sources of information a median split was made, giving as a result two groups: the informed people with 40 persons and the not informed people with 71 persons. To give the ranking of both groups from the 153 analyzed questionnaires, the results of 42 participants were not taken into account sincthese participants have an information score equal to the median. Graph 4-7 shows the ranking of the sources of information by both groups, the informed people and the not informed people.



	Internet	Parents	School	Books	Friends
Informed people	179	121	156	141	120
Not informed people	335	237	165	142	122

Graphic 4- 7 Raking of sources of information, by group

Graph 4-7 shows that the first source of information for the uninformed people was the internet, with 355 points from 70 participants. Separated by a gap of almost 100 points was parents as the second source of information, scoring 237 points from 68 questionnaires. In the middle of the ranking as the third source of information for the uninformed people was school, with 165 points from 67 questionnaires, and at the end of the ranking were books and friends. Books with 142 points from 68 questionnaires and friends with 122 points from 68 questionnaires. For the informed people, no unsuitable questions were found; each position was given by the 40 persons in the group.

By analyzing both rankings it can be concluded that for both groups the first and the last source of information are the same, while they have not given the same positions to books, school, and friends. The data shows that the informed people get information from school more often than the not informed people. For the informed people books are the third source of information and for the uninformed people, books are the fourth source of information. In order to determinate if there is a significant difference between both groups and accept or reject the hypothesis, the Wilcoxon Rank-Sum Test was used. Diagram4-4 shows the value of the Wilcoxon Rank-Sum Test of the most used source of information of each group.

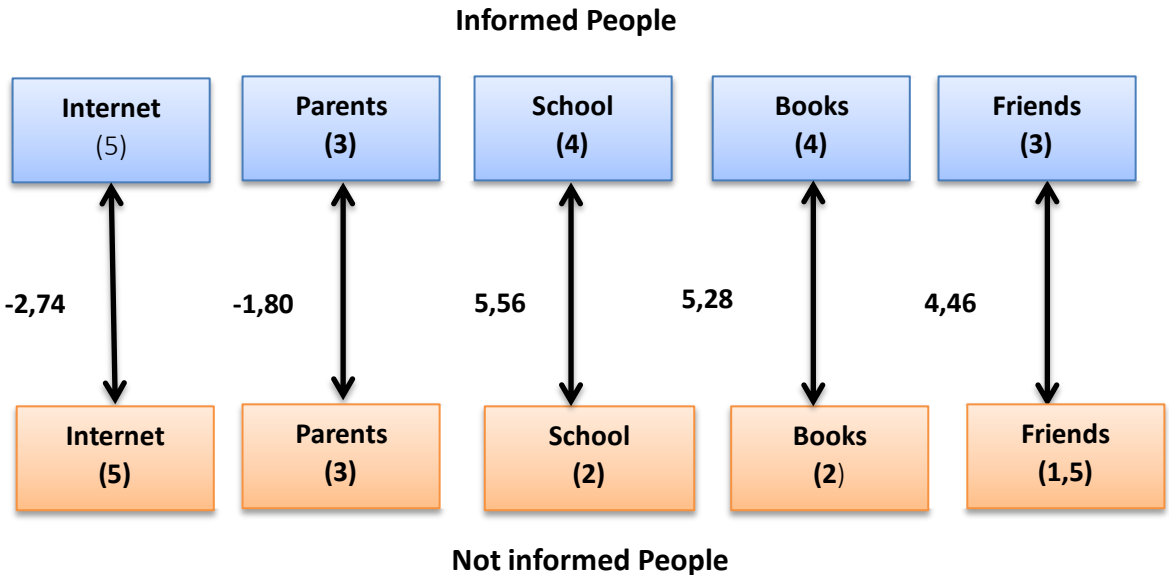


Diagram 4- 4 Sources of information, by group, informed people and uninformed people

From the results on Diagram 4-4 it can be concluded that the internet as a source of information seems to have a significant difference in both groups. Due to the fact that the median for both groups has the same value, it is necessary to analyze the dispersion of the data to decide the importance of the internet as a source of information for each group. Since the distribution of the not informed group has less dispersion than the distribution of the informed group, it can be assumed that the internet is a more important source of information for uninformed people. With parents as a source of information, there is no significant difference between both groups.

For school as a source of information, the z-value shows a significant difference between both groups. Since the median for the uninformed people is lower by two points than the median for the informed people, it can be said that school is a more important source of information for informed people. Books are a more important source of information for informed people than for not informed people. This argument is based on the z-value= 5.28 and on the median of both groups. The same statement can be made for friends as a source of information. The z-value shows a significant difference between both groups and the median of both groups helped us

conclude that friends as a source of information is more important for informed people than for not informed people. The results have made us reject the hypothesis: "Informed people and not informed people use the same sources of information regarding environmental topics."

4.3.6 Relation between "Energy efficient behavior" and "Preconception about the efficient use of energy"

The last evaluation to be made was the one regarding the usefulness of the Spearman Rank Correlation Coefficient as a method to find any relation between the categories. To evaluate the method, the relation between the category "energy efficient behavior" and the category "preconceptions about the efficient use of energy" was analyzed. In the assessment the following two conflicting hypotheses were involved: H_0: "Energy efficient behavior" is related to preconceptions about the efficient use of energy and the alternative hypothesis: H_1: "Energy efficiency behavior" is not related to preconceptions about the efficient use of energy.

Group	Rho
All groups	0,34
Year 8	0,24
Year 11	0,32
Student	0,64
Honduras	0,46
Year 8	0,38
Year 11	0,52
Student	0,3 7
Germany	0,11
8.grade	0,04
11.grade	0,03
Student	0,53

Table 4- 3 Spearman Rank Correlation Coefficient

In the category of "preconceptions about the efficient use of energy" the statement "To get clean hands, you necessarily need warm water" was not taken into account because this question was not in the Honduran questionnaire. Table 4-3 illustrates the value of the Spearman Rank Correlation Coefficient. for the participating groups.

For the secondary school children and the university students from Honduras no relation between the two categories was found, thus the value of the Spearman Rank Correlation Coefficient of the groups was below 0.5. While for the Honduran year eleven group with a ρ=0.52, the relation between the two categories seems to be strong and positive. For the participants of the German groups, only in the results of the university students was a relation between the categories found. By analyzing all participants together, the results of the university students show a strong positive relation between the two categories.

The evidence is enough to accepts the hypothesis: *H_0: "Energy efficient behavior" is related to, preconceptions about the efficient use of energy*, for the following groups: year eleven secondary school children from Honduras and the university students from Germany. When the groups of each country were put into one, that is, both groups of year eight secondary school children from Honduras and Germany were put into one single year eight secondary school children group, and so on with the other groups, a correlation between energy efficient behavior and preconceptions about energy efficiency in the results of the university students was found.

The evidence in Table 4-3 is enough to accept: *H_1:"Energy efficient behavior" is not related to preconceptions about the efficient use of energy* for the rest of the participating groups that were not mentioned above.

4.4 Summary and Outlook

4.4.1 Summary

The pilot study was made to evaluate the usefulness of the questionnaire in finding information about the efficient use of energy. The main goal was to evaluate the reliability of the questionnaire, to this end, the survey was conducted in Honduras and in Germany with approximately 10% of the participants that the main study aimed to include. In this section, the main findings are summarized and put into the context of our current understanding of the results.

The four Likert-scale surveys used in the pilot study are differentiated by the number of items, by the order of the items and distinguished by the use of some different items. To explain the common questions in the four questionnaires, the number of the items given in this report corresponds to the German secondary school questionnaire.

In section 4.2.3 the categories in which the questions of the survey were grouped are described, these are: energy efficient behavior, preconceptions about the efficient use of energy, the level of concern about environmental problems and the efficient use of energy.

The hypotheses to evaluate the usefulness of the survey are explained in section 4.2.4. To evaluate which of the first nine questions of the instrument needed improvements two conflicting hypotheses were involved: H_0: items 1.1 to 1.9 are suitable for evaluating energy

efficient behavior. $H_{1.}$ items 1.1 to 1.9 are not suitable for evaluating energy efficient behavior. The second two conflicting hypotheses were made to evaluate the international effectiveness of the survey in collecting information for the research. The two conflicting hypotheses had the following statements: H_0: People of Honduras and Germany cannot be distinguished by their energy efficient behavior, and H_1: People of Honduras and Germany can be distinguished by their energy efficient behavior.

For the association questions three hypotheses were evaluated. The first one is related to after school clubs. The statement was as follows: the "energy efficient group" and the "not energy efficient group" find an after school club equally attractive. The second one is about the associations that the participants make with energy efficiency. It evaluated whether the energy efficient group and not energy efficient group associate the same words with energy efficiency. The last hypothesis for the association question is related to the degree of information about environmental topics. The statement was: the informed group and the not informed group use the same sources of information. The last hypothesis to be evaluated with the pilot study was: "energy efficient behavior" does not have any relation to preconceptions about the efficient use of energy.

The results of the pilot study are described in section 4.3. To evaluate the first hypothesis, the Rasch model was used (4.3.1). As a result, it was found that items 1.1 to 1.4 as well as items 1.6 and 1.7 can be described by the Rasch model, while item 1.5 was found to be difficult to be described by the model. It was also found that item 1.4 and item 1.8 were not useful for evaluating energy efficient behavior. Therefore, to improve the survey for the main study, items 1.4 and 1.8 were removed from the questionnaire. In order to find information about heating at home, item 1.8 was improved. In the final version of the questionnaire the item is number 1.11 and has the following statement: Do you turn the heating down at night? As a conclusion of the first assessment, the evidence was enough to support the null hypothesis for items 1.1 to 1.3, as well as for items 1.5 to 1.7 and item 1.9. The final version of the questionnaire has eight questions for evaluating energy efficient behavior.

To find out whether two groups can be distinguished with respect to their energy efficient behavior the Wilcoxon Rank-Sum Test was used[32]. By comparing the results of the German groups it was concluded that they could not be distinguished by their energy efficient behavior. Unlike the situation in Germany, the Honduran groups could be distinguished in their energy efficient behavior. The results of the Wilcoxon Rank-Sum Test in the comparison between regions gave us the conclusion that the German group and the Honduran group can be distinguished with respect to their energy efficient behavior.

By evaluating the hypothesis regarding the association questions, it was found that the most attractive club for the secondary school children was sport and the least attractive club was chess. With the Wilcoxon Rank-Sum Test it was found that the environmental studies club is more attractive to take part in for the energy efficient group. Although both groups differ only by selecting one club, the hypothesis: the "energy efficient group" and the "not energy efficient group" find an after school club equally attractive was rejected.

The results showed that for the energy efficient group the word environment is most associated with the topic energy efficiency and save is the second one. While for the not energy efficient group save was the word most associated with energy efficiency and environment was the second one. The evidence was enough to reject the hypothesis: the "energy efficient group" and the "not energy efficient group" associate the same words with energy efficiency.

In section 4.3.5 the findings of the most used source of information are discussed, giving as a result that the most used source of information was the internet and the least used one was friends. By comparing the rankings of the informed and uninformed people, it was found that the internet is a more important source of information for the not informed people, while the informed people get their information from school and books more often than the not informed people. Friends as a source of information is also more important for informed people than for not informed people. Parents, on the other hand, appear to have the same importance to both groups.

[32] The Intention of the pilot study is to test the usefulness of the instrument, the findings are not conclusive due to the small sample, the conclusion in the pilot study are hypotheses for the main study.

After evaluating the last two conflicting hypotheses in section 4.3.6 from the results of all the participants, a strong correlation between the efficient use of energy and preconception about energy in the university students' results was found. While in the results of the secondary school children this relation was nonexistent.

4.4.2 Outlook.

As mentioned in previous sections, the results of the pilot study are not aimed at making conclusions about the investigation. From the results conclusions are made regarding the usefulness of the survey in collecting information for the investigation.

The results of the pilot study showed that the survey is useful in assessing the energy efficient behavior of a group.

The reliability of the instrument in measuring the efficient use of energy was demonstrated in section 4.3.1. From the results it was found that the Wilcoxon Rank-Sum is useful in testing the differences between two groups. The Likert scale survey gives us ordinal data from which the Spearman Rank Correlation Coefficient can find relations between the categories. The results lead us to conclude that the survey represents an innovative method of evaluating energy efficient behavior. But not only that, the survey can also assess affective characteristics which have to be included in "preconceptions about energy efficiency" due to the interdisciplinary of the topic.

From the results of the pilot study the following modifications were made:

- Energy efficient behavior

Pilot study, scale (0-9)	Main study, scale (0-8)
1.1 If you sit at your desk and then you shortly have to leave, do you turn the light on your desk off?	**1.1** If you sit at your desk and then you shortly have to leave, do you turn off the light on your desk?
1.3 Do you turn off the water in the shower while you are soaping?	**1.2** Do you turn off the water in the shower while you are soaping?
~~**1.4** Do you sleep with the light on?~~	**1.3** Do you turn off the TV and the radio if you are not using them?
1.5 Do the electrical appliances in your home stay in standby mode when they are not in use?	**1.4** Do the electrical appliances in your home stay in standby mode when they are not in use?
1.6 How often is the refrigerator in your house defrosted?	

1.7 (Honduras) Do you bathe in cold water?
1.7 (Germany) Do you wash your hands with cold water?
~~**1.8 (Germany)** In winter are you aware that your bedroom never needs a temperature over 16C.~~
~~**1.8 (Honduras)** Are wet clothes ironed in your house~~
1.9 (Honduras) If you've got (or if you had) air conditioning in your home do you prefer to wear lighter clothes instead of turning up the air conditioning?
1.9 (Germany) Before you turn the heater up, do you prefer to put on a sweater instead of a shirt.

1.5 How often is the refrigerator in your house defrosted?
1.6 (Honduras) Do you bathe in cold water?
1.6 (Germany) Do you wash your hands with cold water?
1.7 (Honduras) If you've got (or if you had) air conditioning in your home do you prefer to wear lighter clothes instead of turning up the air conditioning?
1.7 (Germany) Before you turn the heater up, do you prefer to put on a sweater instead of a shirt.
1.8 (Honduras) If you have (or if you had) air conditioning in your house do you reduce the intensity at night?
1.8 (Germany) Do you turn down the heating at night?

In the category energy efficient behavior:

- In section 3.4 the elicitation of items was explained and section 3.5 described the materials, framework of the questionnaire and the categories in which the items were grouped. The results of the pilot study were fully discussed in the different colloquiums in the Department of Physics, its didactic and its history.

- From the results of the pilot study (the Rasch model in question 1.4 and the data dispersion of question 1.8) two questions in the survey were removed, item 1.4 and item 1.8. Question 1.3 was added: Do you turn off the TV and the radio if you are not using them? And question 1.8 (Honduras): If you have (or if you had) air conditioning in your house do you reduce the intensity at night? 1.8 (Germany): Do you turn down the heating at night?
- The numbering of the questions was standardized in the six questionnaires.
- The scale in the final version of the survey goes from 0 to 8 points.

- Energy efficiency preconceptions

Pilot study, scale (0-12)	Main study, scale (0-8)
2.7 It is very important to completely disconnect electrical appliances such as the radio or TV when you finish using them. **2.8** It is very important to turn off the light every time you leave a room. **2.9 (Honduras)** To be cleaner it is necessary to bathe in hot water **2.9 (Germany)** To have clean hands, it is absolutely necessary to use hot water	**2.10** It makes sense to completely disconnect electrical appliances such as the radio or TV when you finish using them. **2.11** It makes sense to turn off the light every time you leave a room. **2.12 (Honduras)** To be cleaner it is necessary to bathe in hot water **2.12 (Germany)** To have clean hands, you absolutely need hot water. **2.13 (Honduras)** If a room has an air conditioning system it is necessary to keep the doors and windows of that room closed while the air conditioning is on. **2.13 (Germany)** While ventilating a room, the radiators should be turned off.

In the category energy efficiency preconceptions

- Following discussions in the different colloquiums in the Department of Physics, its didactic and its history it was decided to change the score given to each answer Criticism was raised because initially each answer got a score no matter if the answer means a “not good” preconception, for example, a disagreement with the statement in item 2.10 means in this research that the respondents agree that to turn off electrical appliances does not make any sense, which could mean a “not good” preconception. In this manner it was decided to change the scores; the changes were as follows: in the pilot study each answer got a score point, but in the main study only the answer that indicated that students agree with the statement gets a score point, and so on if the answers are reversed. For example, question 2.10: if the respondents choose the option strongly agree, they get 2 score points, while the option I rather agree, gets 1 score point; both answers mean an agreement but on two different levels. The other two options, rather disagree and strongly disagree, mean a disagreement with the statement, which means in this regard a “not good” preconception. By answering all four questions of the category the respondent had the chance to achieve a score of between 0 and 8 points. A question regarding air conditioning

in Honduras and heating in Germany was added, because it was found that this area was not included in the pilot study.

- Level of concern

Pilot study, scale (0-8)	Main study, scale (0-9)
2.5 It is worrying that fossil energy sources are limited and will be consumed more in a shorter time. **2.10** ~~Inefficient use of energy is the main cause of climate change.~~	**2.1** Climate change is the biggest global challenge. **2.3** By carefully analyzing climate problems, the situation with the climate is improving. **2.5** It is worrying that fossil energy sources are limited and are coming to an end.

In the category level of concern:

- From discussions on different occasions when the pilot study was presented, it was decided to change the score given to each question. In the pilot study each option got a score point from 1 to 4 and the respondents had the chance to achieve a maximum of 8 score points. Due to the fact the answer strongly agree means a full disagreement with a statement, it was decided that the option strongly disagree should get 0 score points, (contrary to item 2.3). For example, item 2.1: if the respondents answer strongly agree, it means that they completely agree that climate change is serious and we have to take it as the biggest global challenge, suggesting that they are worried about it. The answer gets the maximum score of 3 points. Rather agree 2 score points and rather disagree 1 score points. By answering all the three question the respondent had the chance to achieve a score of between 0 and 9 points.
- In order to find the level of concern of the respondents regarding the currently climate situation and the danger of climate change question 2.1 and question 2.3 were added.

- Level of responsibility

Pilot study, scale (0-20)	Main study, scale (0-18)
2.1 ~~Climate change is the biggest global challenge.~~ **2.2** The efficient use of energy is a free and individual decision.	**2.2** The efficient use of energy is a free and individual decision. **2.4** Science and industry alone can solve "energy problems".

2.3 ~~By carefully analyzing climate problems, the climate situation is improving.~~

2.4 Science and industry can alone, solve "energy problems"

2.6 (Germany) In Germany, several energy efficiency measures in relation to individuals should be improved, for example, building renovation and, modernization of heating systems.

2.6 (Honduras) In Honduras the government should implement new measures in households regarding the efficient use of energy, for example, with energy saving light bulbs or eco-stoves.

2.6 Inefficient use of energy is the main cause of climate change

2.7 Human beings can still stop climate change.

2.8 (Honduras) In Honduras the government should implement new measures in homes in relation to the efficient use of energy, for example, with light bulbs or eco-stoves

2.8 (Germany) In Germany the government should implement new measures in homes in relation to the efficient use of energy, for example, building renovation or heating modernization.

2.9 (Honduras) The living standards of industrialized countries should continue to grow even if it means they consume more energy than now.

2.9 (Germany) Should the emerging countries continue to increase their livelihoods, even if they need more energy?

In the category level of responsibility:

- Although both items could be considered to be useful in the category level of responsibility, after analyzing the correlation between the items and from discussions emerging in the presentation of the results of the pilot study, it was decided that item 2.1 and item 2.3 were more suitable in measuring a level of concern. The decision was based on the following arguments: when a respondent agrees with the statement that climate change is the biggest global challenge, it does not mean that they agree to be willing to take actions and responsibility. An agreement with the statement could be interpreted as the respondents taking climate change seriously and are concerned enough to consider this as the biggest global challenge; they consider climate change bigger than all the other problems on earth. In this regards the item is considered as a measure of the level of concern. Item 2.3 was grouped in the category level of concern for the following reasons: when the respondent agrees with the statement "by carefully analyzing climate problems, the situation with the climate is improving", then due to the fact that the item is reversed, an agreement with the statement could mean that the respondent is of the opinion that climate problems are not

that big and that the "situation" is not that bad, that is, they are not worried about the current situation of climate change. In this regard, the item is useful in measuring a level of concern.

- Items 2.6 and 2.7 were added to the category. Item 2.6 aims to find out whether the respondent accepts the responsibility that human beings are the cause of climate change. And item 2.7 aims to find out if the respondent is willing to take the responsibility for human beings to solve the problem of climate change.

- The scores given to each option of the answers were modified following the argument mentioned in the category level of concern, that is, by answering the six questions the respondents had the chance to achieve a score of between 0 and 18 points.

  - Level of exposure to information

Pilot study, scale (0-15)	Main study, scale (0-12)
1.10 Is energy efficiency spoken about at your home?	**1.6** Is energy efficiency spoken about at your home?
1.11 Is energy efficiency spoken about at your school?	**1.7** Is energy efficiency spoken about at your school?
1.12 Do you like to read ecological articles?	**1.8** Do you like to read ecological articles?

- In the category level of exposure to information, no item was either added nor removed.

- The score given to each item was modified, following the argument explained in the category level of responsibility. In the main study the category has a minimum score of 0 points and a maximum score of 12 points.

  - Level of importance of the topic "energy saving"

Pilot study, scale (0-4)	Main study, scale (0-4)
3.6 How important is the topic of energy saving for you?	3.6 How important is the topic of energy saving for you?

- The category level of importance of the topic "energy saving" was not modified either in the question nor in the scale.

- Level of willing to know more about energy efficiency

Pilot study, scale (0-4)	Main Study, scale (0-4)
4.1 Do you want to know more about energy efficiency?	4.1 Do you want to know more about energy efficiency?

- The category level of willing to know more about energy efficiency was not modified either in the question nor in the scale.

Association questions

Pilot study, score (1-5)	Main study, score (1-5)
3.1 Association with energy efficiency.	**3.1** Association with energy efficiency.
~~**3.6** Attractiveness of an after school club.~~	**3.22** Reasons to make efficient use of energy.
3.11 Sources of information.	**3.12** Sources of information.
~~**3.17** Classes in which energy efficiency is taught.~~	**3.17** Reasons why people do not make efficient use of energy.
3.22 Light sources.	**3.7**Light sources.

From the data analysis of the association questions, the question about association with energy efficiency and the question about sources of information did not undergo any change. While the question about after school clubs was removed from the questionnaire, due to the fact that the question was only in the secondary school children's questionnaire it was not possible to use the information provided from the question to compare the secondary school children and the university students. The question about classes in which energy efficiency is taught at school was also removed from the questionnaire for the same reason. To be able to make a suitable comparison between the secondary school children and the university students, for the secondary school children were added two questions that in the pilot study were only in the university students' questionnaire, the one regarding the reasons the respondents could have to make efficient use of energy and the one regarding the reasons why people do not make efficient use of energy. After the changes made to the pilot study, the

four questionnaires have the same number of association questions, and the scoring in the association questions did not undergo under any change.

The data of the university students in the pilot study has more categories; the category “waste of energy” and the category “level of engagement as a future teacher”. The two categories did not undergo any change.

5. I - Energy efficiency preconceptions in Germany and Honduras

Following the information in the previous chapters, the present chapter reports the results of the investigation carried out with the students (year eight and year eleven secondary school children and university students) in Germany and Honduras. The results are divided into three parts: by group, by country and by level of education. As mentioned before, the investigation aims to compare the students' preconceptions about energy efficiency, emphasizing the differences by their level of education and by country. In this regard, the results by level of education and by country are described, underlining similarities and differences between the groups, taking into account the socioeconomically situation in each country where the study was targeted.

5.1 Year Eight secondary school children, Honduras

In this section, the results of a survey which was targeted at 227 year eight secondary school children from Honduras are described. The results will be given in seven categories and four association questions. In each category it will be explained how the number of valid answers correspond. Invalid answers mean in this context that the participant has not answered at least one question in the category. To get a score in each category, the adding up of the score of each of the questions that are in the category is made. In this case, he/she should have answered all the questions of the category to consider the answer as a valid one.

The group of participants has been divided into two sub-groups (the energy efficient group and the not energy efficient group) which was possible by making a median split in the category energy efficiency behavior; the participants who were under the median were grouped into the not energy efficient group and the ones who scored above the median were grouped into the energy efficient group. The participants who scored right in the median do not belong to any of the two groups. The results of each category and each association question will be presented by a group, in this case 8H, and by sub-groups: the energy efficient group and the not energy efficient group.

The results of the category “Energy efficiency behavior” are also described by question achievement. Question achievement of a group is measured by adding up each participant's achievement in the question. Question achievement is presented as a percentage and not as an absolute number, this is done like this because each sub-group has a different number of participants, and if question achievement is presented with absolute values the comparison between the sub-groups would be incorrect. For example, question 1.1 of the questionnaire (If you sit at your desk and then you shortly have to leave, do you turn off the light on your desk ?) (See appendices A, B, C and D)The possible answers to the question are (always, very often, sometimes, rarely and never). By answering “always” the participant gets one score point, the rest of the answers (very often, sometimes, rarely and never) get zero score points. Assuming that 203 participants have answered the question, multiplying the number of valid answers (203) by the question's maximum score (1) this question would have a maximum score of 203 points. These 203 score points are 100% of question achievement. By using the cross multiply, we are going to have the group question achievement as a percentage. Following the example with question 1.1 if the group achieves with this question 60 score points, to have the question achievement as a percentage the following formula is used: ((60/203) *100) = 29,55 %, 60 being the question's achieved score and 203 the question's maximum score, so the question achievement of the group here is 29,55%.

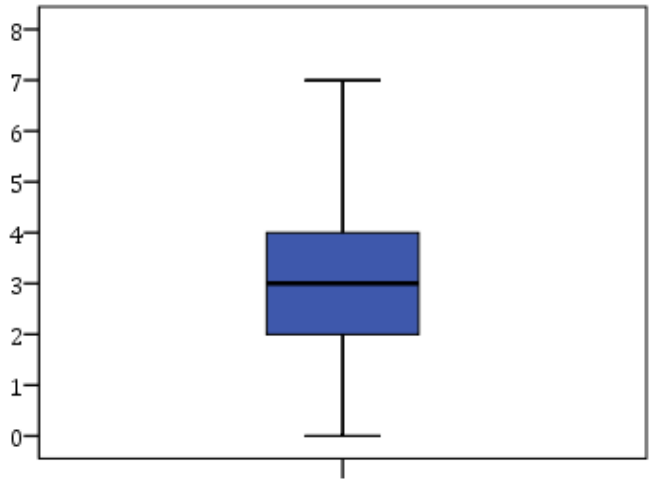
In the first section the seven categories will be described, as well as the correlation between the categories, in case they exist. At the end of the first section the results of the association question will be explained.

5.1.1 8H-Energy efficiency behavior

In this section, the energy efficiency behavior of the year eight secondary school children from Honduras is described. In the category “Energy efficiency behavior” the results of eight questions were put together. As it was explained in the pilot study, by answering each of the eight questions each participant had the chance to achieve a maximum score of 8 points. The minimum score is 0. Each question describes a behavior in the use of energy, for example, if question 1.1 of the survey (If you sit at your desk and then you shortly have to leave, do you turn off the light on your desk?) was “correctly” (the word “correctly” is used only to say that

the answer is valid for the analysis, it does not mean that there is a correct or incorrect question) answered by the respondent, he/she gets a score point, the amount of this score point depends on the given answer. The eight questions of this category were made with a Likert scale of five possible answers.

The reasons for giving this amount of points is explained in the pilot study. By adding up the score of all questions included in this category, the respondents had the chance to achieve a total score from 0 to 8. From 227 participants in this group 47 answers were considered as invalid. Graphic 5-1 illustrates the results of 180 year eight secondary school children from Honduras in the category energy efficiency behavior.



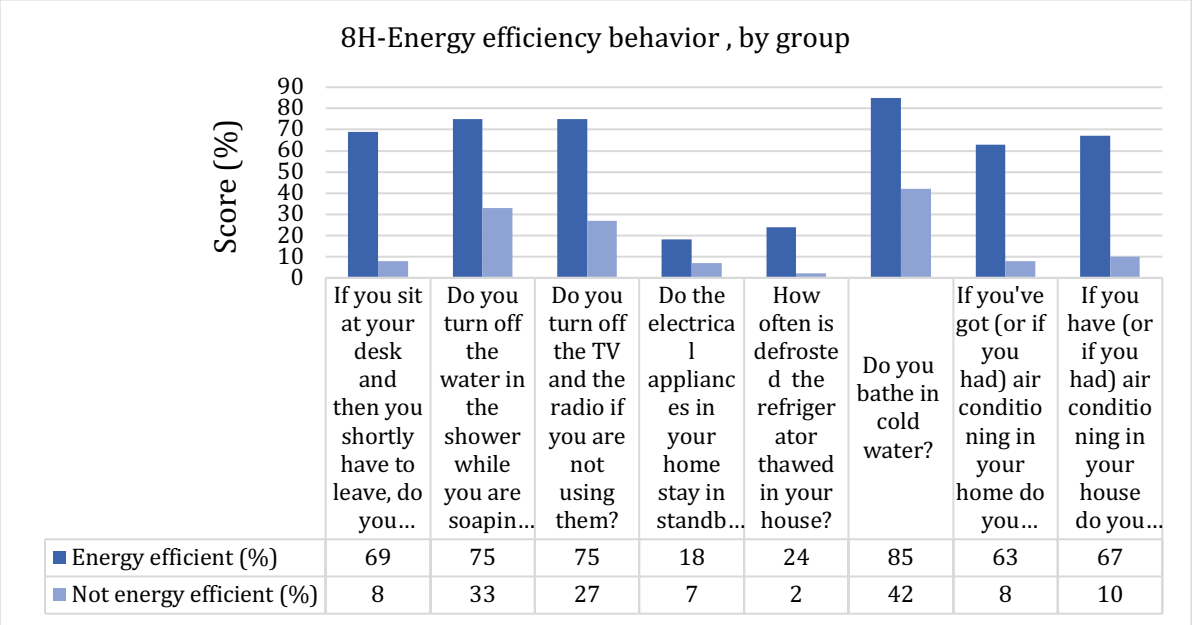
Graphic 5- 1 8H-Energy efficiency behavior

As it can be seen on graphic 5-1, the data's distribution in the category energy efficiency behavior spread from 0 to 7, and shows very varied energy efficiency behavior across the group. The pattern's distribution suggests that the groups is heterogenic in the category energy efficiency behavior. The 50% of the data accumulated in the middle of the distribution ranges from 2 to 4 and shows a high level of agreement between them. In the quarter with the lowest score across the group some of the participants could never use energy efficiently. With a skewness of 0,433, we can say that the data is approximately symmetric.

The results of this category were also analyzed dividing the participants into two groups; by making a median split on the data it was possible to group the participants into the “energy efficient” ones and the “not energy efficient” ones. From the 180 valid answers in this category 84 participants were grouped into the not energy efficient, 51 into the energy efficient and 45 of them do not belong to any either of the two groups because they were

located exactly in the median. The results by comparing both group in the category energy efficiency behavior is presented in graph 5-2.

Graph 5-2 shows the difference between both groups in each category question. The groups can be distinguished in each item of the category. By using the Wilcoxon-Mann-Whitney-Test,



Graphic 5- 2 8H-Question achievement in energy efficiency behavior, by group

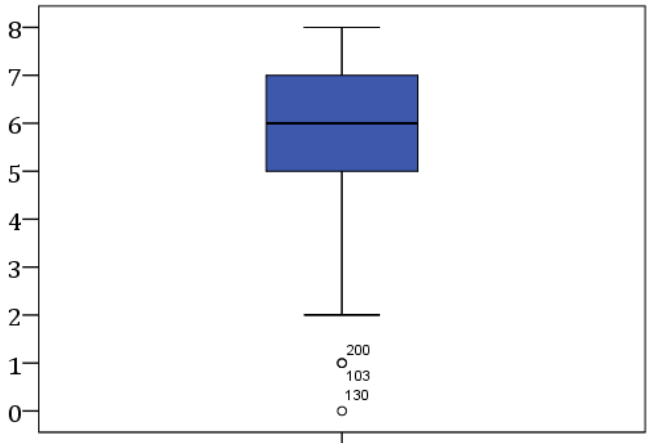
a statistically significant result was found, which made us conclude that both groups can be distinguished in their energy efficiency behavior. From now on the results of each category and each associated question will be given by explaining the results of all participants together and also by using sub-groups. These sub-groups hereinafter will be named as the "energy efficient" and the "not energy efficient".

5.1.2 8-H-Energy efficiency preconceptions

The scoring of this category includes the sum of four level of agreement questions. By using the Likert scale, each question has four possible answers: strongly agree, somewhat agree, somewhat disagree and strongly disagree. To each possible answer a score point was given. In this category two score points to the answer strongly agree and one score point to the answer somewhat agree were given; the answers somewhat disagree and strongly disagree could mean that the respondents disapprove of the proposal, hence, for this reason, these two possible answers get zero score points. If the question is reversed, the answer strongly

disagree gets two score points and the answer somewhat disagree gets one score point. In this case the answers that do not get any score points are strongly agree and somewhat agree. For example, the question in this category that is reversed is: To be cleaner it is necessary to wash with hot water? If the respondent answers the question with strongly disagree he or she gets two score points, by answering with somewhat disagree they get one score point and the other two possible answers strongly agree and somewhat agree do not get any score points.

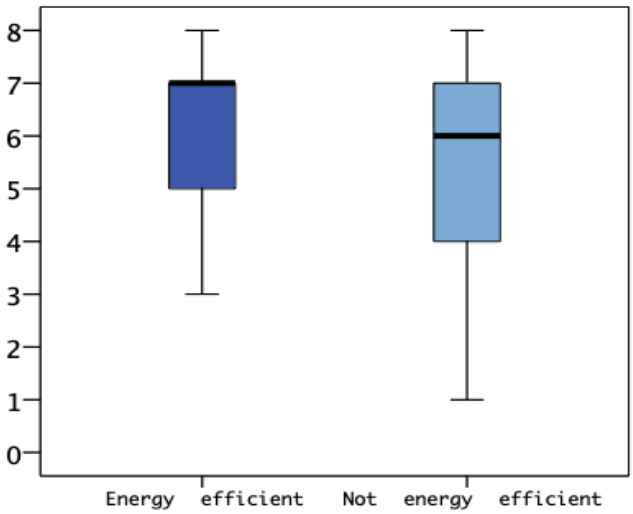
By answering all the four question the respondents had the chance to achieve a score from 0 to 8 points. Graphic 5-3 shows the data distribution for the category "Preconceptions about energy efficiency". 22 of the participants have given invalid answers in this category. An invalid answer in this case means that the participants have at least not answered one of the four questions included in this category, a valid answer means that the participant answers the four questions included in this category. Graphic 5-3 represent the analysis of 205 participants.



Graphic 5- 3 8H-Energy efficiency preconceptions

As it can be seen on graph 5-4, the dataset spreads across the entire scale, this suggests very varied views across the group, showing that the group is heterogenic in the category preconceptions about energy efficiency. 75% of the participants that can be named as the top performers scored 5 or more on the scale, the data's distribution in this upper three quarters also shows a high level of agreement between the participants. Only a quarter of the group score five or less on the scale. There are three outliers in the category which could require special attention in future conclusions. A skewness of -0,801 make us conclude that the dataset is moderately skewed up in the scale.

The analysis of this category by groups (the energy efficient and the not energy efficient) has given as a results 48 valid answers for the energy efficient group and 79 for the not energy efficient group. The results are shown in graphic 5-4. By comparing the location of the data, the median of those who are energy efficient is greater than that of those who are not energy efficient. The overall range of the dataset is greater for the not energy efficient group, as shown by the distance between the ends of the whickers for each distribution. Both patches of data appear to be skewed up and the batch for the energy efficient is slightly more skewed than that for those who are not energy efficient. The skewed is not particular marked in either case; the sample skewness for the energy efficient is -0,640 and for the not energy efficient is -0,528. Both skewnesses are negative; the value for the not energy efficient is rather larger, corresponding to more lack of symmetry, but neither skewness is particularly large. From the values we can concluded that both data's distributions are moderately skewed up in the scale. Although there appears to be some differences between the data's distributions of both groups, the value of the Wilcoxon-Mann-Whitney-Test for two independent samples (z= -1,836, *p*-value= 0,066) make us conclude that the energy efficient group and the not energy efficient group cannot be distinguished in the preconceptions about energy efficiency category.

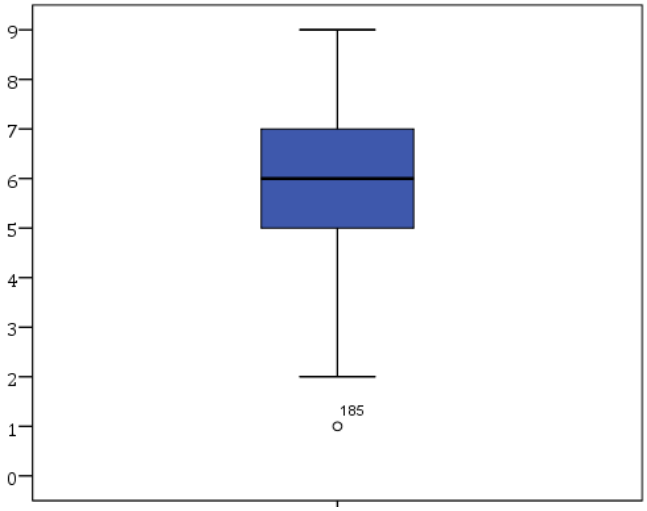


Graphic 5- 4 8H Preconceptions about energy efficiency by group

5.1.3 8H-Level of concern

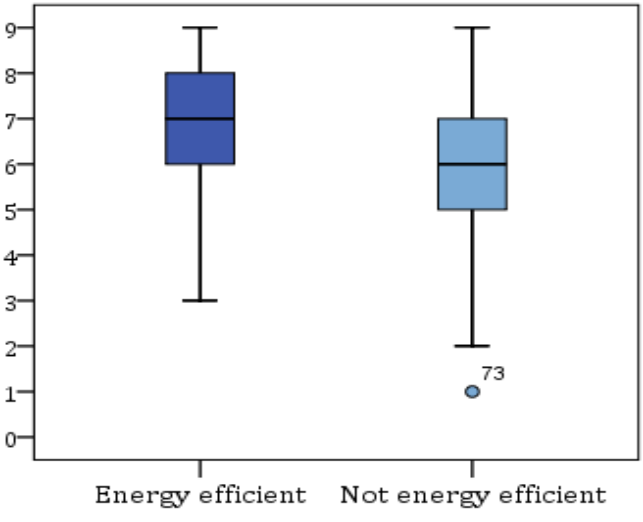
This category was aimed to identify whether the participants are concerned about topics related to climate change and the efficient use of energy. In the category three level of agreement questions were put together. By using the Likert scale, each question had four possible answers; strongly agree, somewhat agree, somewhat disagree and strongly disagree. In this category to the answer strongly agree three points was given, somewhat agree two points and somewhat disagree one point. If the respondent answered with strongly disagree

he or she gets zero score points. The answer strongly disagree means in this category that the participant is not concerned at all about topic related to environmental protection, climate change and the efficient use of energy. By answering all three questions of this category the participants had the chance to achieve a "concern-score" from zero to nine; zero being the lowest score and nine the highest score.



Graphic 5- 5 8H-Level of concern

The data analysis of this category was made taken into account 209 valid answers. Graphic 5-5 deals with the results of this category. The dataset ranges from 1 to 9 in the scale, and illustrates very varied levels of concern among the group, showing that the group is heterogeneous in the category level of concern. 75% of the group ranges from 5 to 9 in the scale. 50% of the data is accumulated in or around the median, ranges from 5 to 7; this 50% also appear to have a high level of agreement with each other. There is also an outlier at the end of the scale which could require special consideration later. A skewness of -0,423 make us conclude that the data's distribution is approximately symmetric.



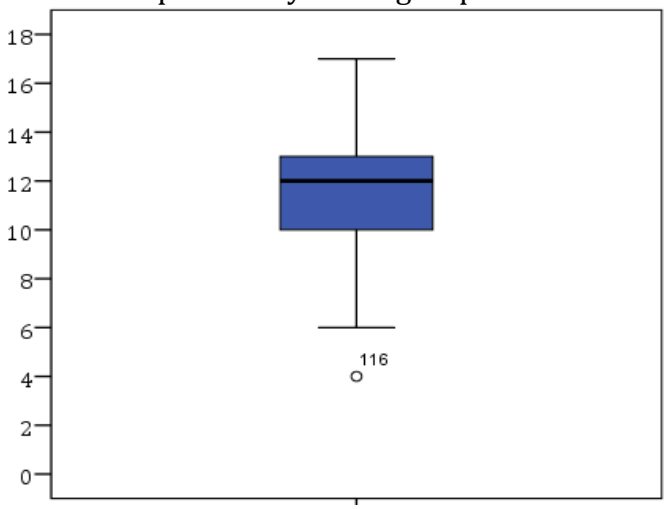
Graphic 5- 6 8H -Level of concern, by group

To find out if the level of concern about environmental problems differs by groups, were analyzed 80 valid answers for the not energy efficient group and 48 valid answers for the energy efficient group: As graphic 5-6 shows, both groups appear to be heterogeneous in the category level of concern. The median for the energy efficient group is greater by one point than for those who are not energy efficient but the interquartile range is reasonably similar for both groups; the overall range of the dataset

is slightly higher for those who don't behave energy efficiently. Although both data distributions appear to be skewed up, and the energy efficient group seems to be slightly more skewed than the not energy efficient group, the skewness is not clear in either case. In fact, the skewness for the energy efficient group is -0333 and for the not energy efficient group is -0,397, so we can say that both distributions are approximately symmetric. Both groups appear to differ on some parts of the scale. This assumption was tested by using the Wilcoxon-Mann-Whitney-Test. From the value of the test (z= -2,583, *p*-value= 0,010) we can conclude that both groups are distinguished in the category level of concern. By analyzing the data's distribution, it is clear that the median of the energy efficient group is greater; in this way we can say that the energy efficient group has a higher level of concern than the people who do not behave energy efficiently.

5.1.4 8H-Level of responsibility

In this category we were trying to find whether the participants take responsibility in topics related to the efficient use of energy, climate change and environmental protection. In this category six levels of agreement questions were analyzed. Each question had four possible answers. By answering with strongly agree they get three score points, somewhat agree two score points, somewhat disagree one point and the answer strongly disagree gets zero points. By answering the six questions of the category each participant had the chance to score between 0 and 18 points. By the data analysis of 196 valid answers it was possible to find the level of responsibility of the group.



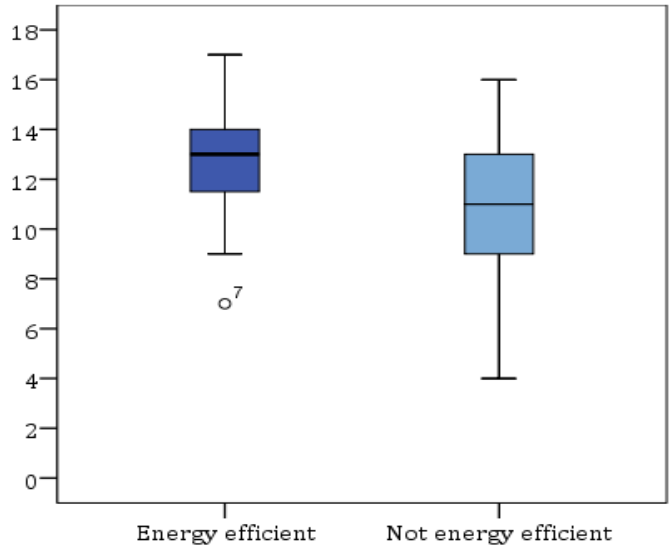
Graphic 5- 7 8H-Level of Responsibility

As graphic 5-7 shows the dataset spread from 4 to 17 in the scale, suggesting a very varied level of responsibility across the group, that is, the group is heterogeneous in the category level of responsibility. The median is located at 12 points in the scale of 18 points, meaning that 50% of the group scored 12 or more. The 50% of the data located in the middle of the

distribution is where the students seems to have a level of more agreement with each other. There are outliers that could need special attention in the future. With a sample skewness of 0,318 we can conclude that the data's distribution is approximately symmetric.

By making the analysis of this category by group (the energy efficient and the not energy efficient) it is possible to find out whether both groups can be distinguished at the level of responsibility. To find any significant difference between the groups, 47 valid answers for the energy efficient group and 74 valid answers for the not energy efficient group were analyzed.

Graphic 5-8 shows the median of the energy efficient group is considerably higher. Although the dataset of the energy efficient group is more skewed up, the skewness is not particularly marked in either case. In fact, the sample skewness for the energy efficient is -0,479 and for the not energy efficient is -0,105.



Graphic 5- 8 8H-Level of responsibility, by group

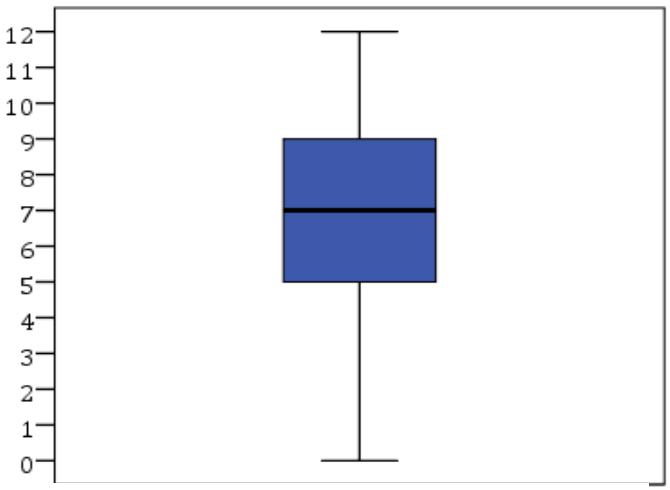
Both skewnesses are negative, showing a tendency to the upper side of the scale. The value of the not energy efficient group largely corresponds to a more marked lack of symmetry, but both values are in the range that corresponds to a distribution that is approximately symmetric. In order to test if the differences between both groups are significant the Wilcoxon-Mann-Whitney-Test was used. From the test value (z= -2,974, *p*-value= 0,03) it is clear that both groups can be distinguished in the category of level of responsibility regarding environmental protection, climate problems and the efficient use of energy. By analyzing the data distributions of both groups we can concluded that the energy efficient group performed higher in the level of responsibility than the not energy efficient group.

Overall the two data distributions are approximately symmetric, but three quarters of the not energy efficient group are in or under the median of the energy efficient group, and vice versa

three quarters of the energy efficient group are in or over the median of the group that is called not energy efficient.

5.1.5 8H-Level of exposure to information

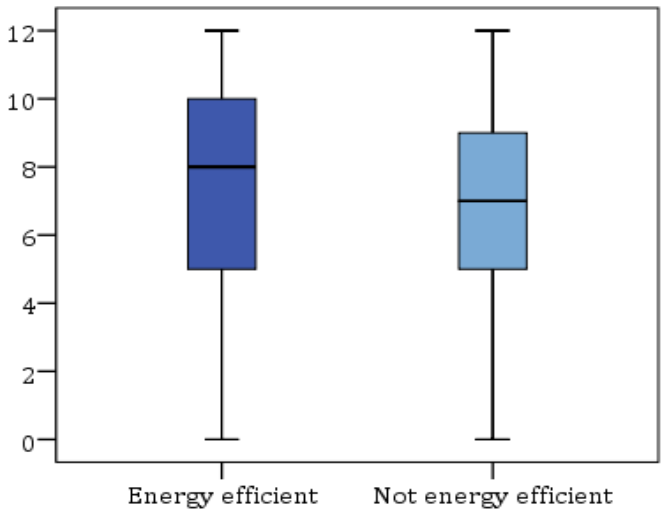
In this category we are trying to find out whether the respondents are exposed to information about the efficient use of energy and environmental problems. To achieve the target three frequency questions were put in the category. Each question had five possible answers: always, very often, sometimes, rarely and never. By answering the question each possible answer gets a score point. By answering with always the respondent gets four score points, very often three score points, sometimes two score points, rarely one point and the answer never gets zero score points. The answer never gets zero score points because it means that the respondents are never exposed to information. For example, one question in the category asked the respondents: "Is energy efficiency spoken about at your home?" If the respondent answers the question with never it means that he or she do not receive any information about the topic at home; in this regard the answer never gets zero score points. By answering the three question of the category the respondent had the chance to score between 0 and 12 points. After analyzing 204 valid answers the results of this category are shown in graphic 5-9.



Graphic 5- 9 8H-Level of exposure to information

As graphic 5-9 illustrates, the dataset in this category spread across the entire scale from 0 to 12. This suggests a very varied levels of exposure to information in the group, that is, the group is heterogeneous in their level of exposure to information. Half of the group scored 7 or more in the level of information scale. A sample skewness of -0,279 leads us to conclude that the data distribution in the category level of exposure to information is

approximately symmetric. Achievement in this category was also analyzed by sub-groups: the energy efficient and the not energy efficient.



Graphic 5- 10 8-H Level of exposure to information, by group

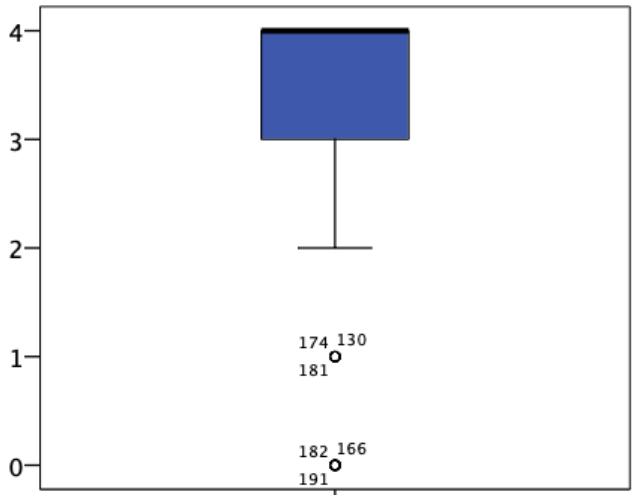
The data analysis of 50 valid answers for the energy efficient group and 78 valid answers for the not energy efficient group are presented on graphic 5-10. As the graph 5-10 shows, both groups are heterogeneous in their level of exposure to information; the dataset spreads across the entire scale in both groups. The median of the energy efficient group is one point greater, though the overall range of the data is equal for both groups. The sample skewness for the energy efficient group is -0,396 and for the not energy efficient group it is -0,402, so the skewness is not particularly marked in either case. From the values we can say that both data distributions are approximately symmetric. Overall, the two datasets look as if they were distributed in a similar way, but the Wilcoxon-Mann-Whitney-Test (z= -1,99, *p*-value= 0,046) leads us to conclude that the groups can be distinguished in the category level of exposure to information. Due to the fact the median for the energy efficient group is higher, we can conclude that the energy efficient group has a higher level of exposure to information.

5.1.6 8H-Level of importance of the topic "energy saving"

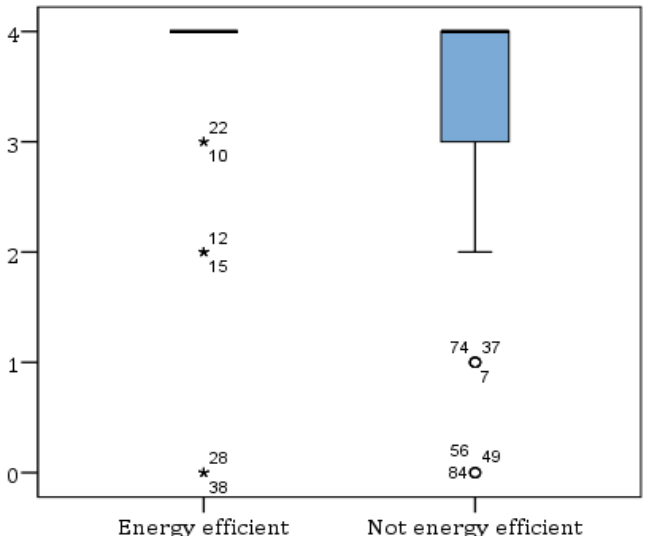
This category was trying to find out how important the topic "energy saving "is for the respondents. The category has only one question: How important is energy saving for you? To answers the question, the respondents had to choose between five possible answers. The answers were given in a scale of importance as follows: extremely important, very important, important, not important and not important at all. By answering with extremely important the respondent gets four score points, very important, three score points and so on until the

answer not important at all gets zero score points. In this category 212 valid answers were analyzed.

Graphic 5-11 shows the data analysis for this category. As graph 5-11 illustrates, the dataset spreads across the entire scale, showing varied opinions across the group. At the end of the scale are 6outliers, 3 of them scored 1 on the scale and 3 of them scored 0 on the scale. From its location on the scale, it can be inferring that for these 6 people the topic energy efficiency is not important or not important at all. The median of the group is located at the end of the scale, and shows that the upper 50% of the group have a high level of agreement with each other. A skewness of -1,989 leads us to conclude that the distribution is highly skewed to the top of the scale. Graphic 5-12 shows the results by group. The data analysis of graphic 5-12 was made with 47 valid answers for the energy efficient group and 81 valid answers for the not energy efficient group. Though the median is located at the same level on the scale, the data distribution is different for both groups.



Graphic 5- 11 8-H Level of importance of "energy saving"



Graphic 5- 12 8-H Level of importance of "energy saving" by group

The sample skewness for the energy efficient group is -2,645 and for the not energy efficient group is -1,811; which leads us to concluded that both distributions are highly skewed up. We can say that the level of importance of energy efficiency for both group leans toward up on the scale.

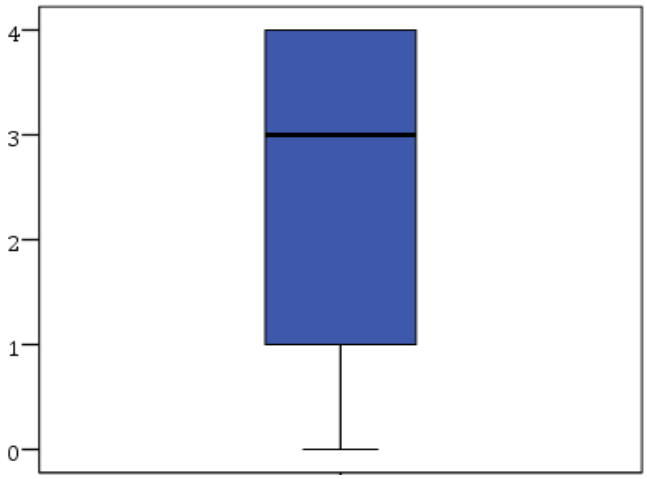
Though both groups have some differences in the data distribution, the Wilcoxon–

Mann–Whitney (z= -1,859, *p*-value= 0,063) leads us to concluded that both groups are indistinguishable in the category level of importance of energy saving.

5.1.7 8H-Level of willing to know more about energy efficiency

The name of the category explains itself. With this category we were trying to find out whether the respondents would like to know more about energy efficiency. But not only that, the data analysis offers us the possibility to know the scale of wanting to know more about the topic. The category has a simple question: Do you want to learn more about energy efficiency? To answer the question, the respondents had to choose an answer from five possible ones: yes, very much more, yes, much more, a little bit more, less more, no. By answering, yes, very much more the participant gets four score points and so on with the other possible answers.

By answering that they do not want to know more about the topic they get zero score points. So the scale in knowing more about the topic goes from zero to four score points. The data analysis from 207 valid answers are presented in graphic 5-13. The graph shows the level of willingness to know more about the topic energy efficiency of 207 participants that are on the year eight course at secondary school in Honduras. Different levels can be seen on the graphic.

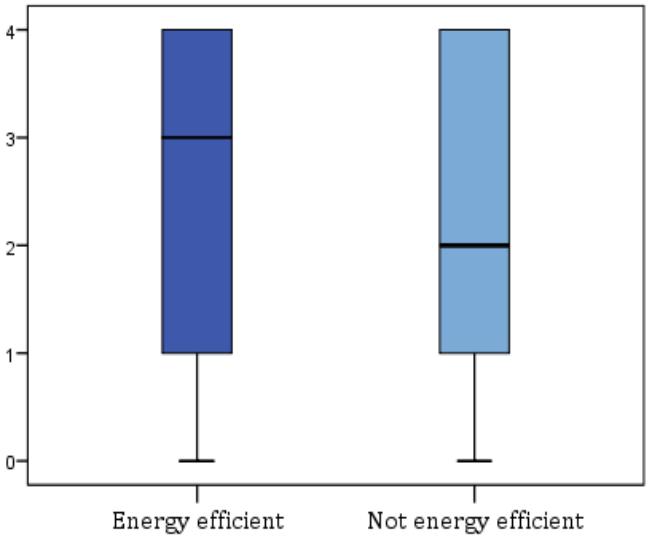


Graphic 5- 13 8H level of willingness to know more about energy efficiency

The dataset spreads across the scale from 0 to 4, showing very varied views across the group. It can clearly be seen that the group is heterogeneous in the category "level of willingness to know more about the topic energy efficiency". The 50% above the median shows a higher level of agreement with each other, ranging from 3 to 4. A sample skewness of -0,349 leads us to concluded that the distribution is approximately symmetric.

To see if a significant difference appears between the energy efficient and the not energy efficient 48 surveys for the first group and 79 for the second group were analyzed.

Graphic 5-14 shows that he data distribution spreads across the entire scale, showing very varied views across the groups. Both groups are heterogeneous in willing to know more about energy efficiency. The overall range of the dataset is equal for both groups but the median of the energy efficient is higher. A sample skewed of -0,616 for the energy efficient group and 0,168 for the not energy efficient group leads us to concluded that both distributions are moderately symmetric. Although, overall, both groups are heterogeneous and the overall range is equal for both groups, it was found that both groups have a statistically significant difference. The Wilcoxon–Mann–Whitney test (z= -2,0641, *p*-value= 0,039) leads us to concluded that both groups can be distinguished in the category: want to know more about energy efficiency. Due to the fact that the median for the energy efficient group is higher by one point, we can say that the groups can be distinguished in willing to know more about energy efficiency.



Graphic 5- 14 8H-Want to know more about energy efficiency, by group

5.1.8 8H-Relations between the categories

Following the targeted investigation, the relations between the categories were analyzed. By using the Spearman's rank correlation coefficient or Spearman's rho, some correlations between the categories were found. These correlations are explained in diagram 5-1

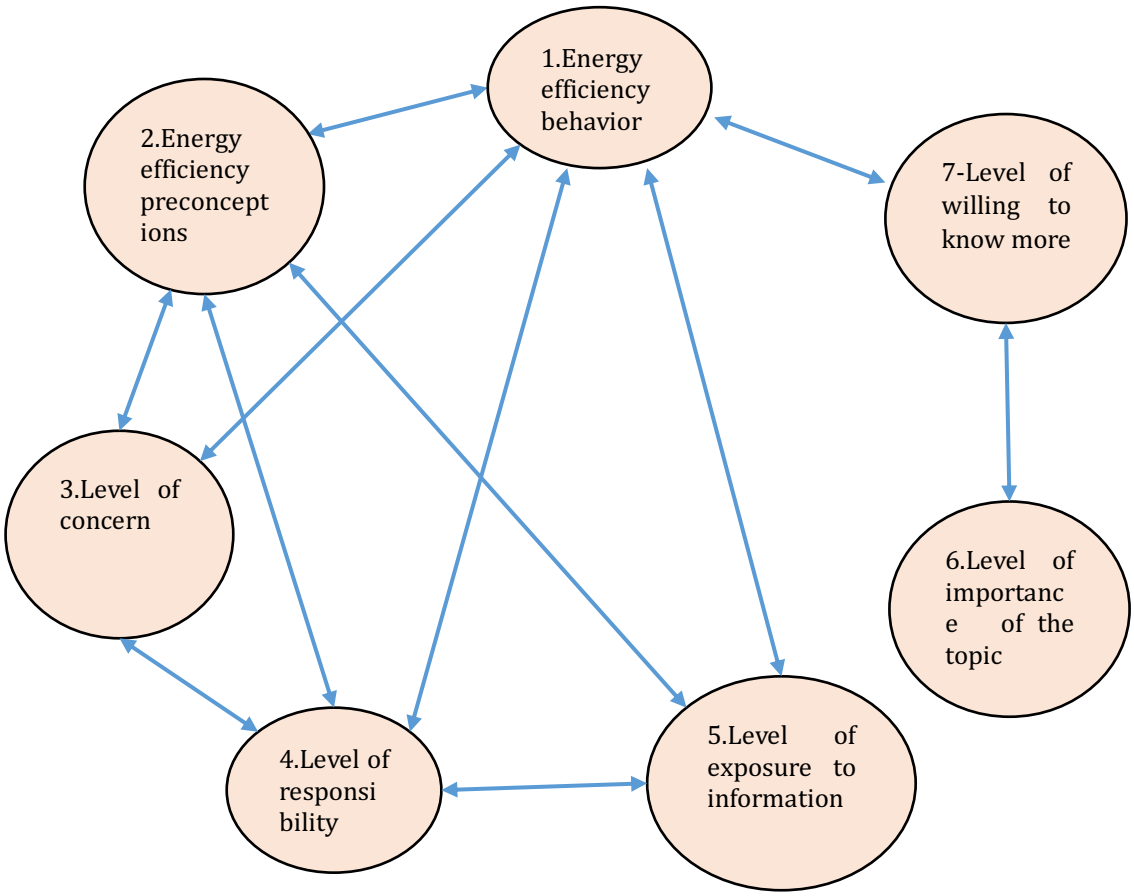


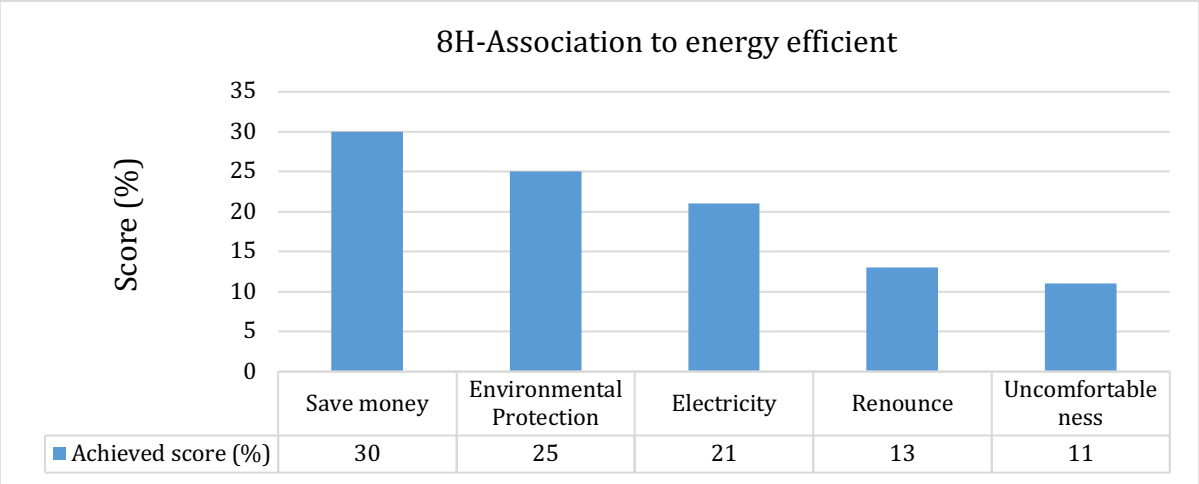
Diagram 5- 1 8H-Correlations between the categories

Once the results of the seven categories were described, the results of the association questions will be analyzed in the following section.

5.1.9 8H-Association to energy efficiency

In the first association question of the questionnaire five words were given to the participants. The participants had the chance to give to each word a different level of association (from one to five) to energy efficiency, by doing so it was possible to make a ranking of the group's most and least associated word to energy efficiency.

It was shown on the pilot study that these type of questions are a little confusing to answer. But the information provided for the questions was crucial for the investigation. For this reason, the association questions were not removed from the questionnaire. After analyzing 148 valid answers, graphic 5-15 shows the group's associations to energy efficiency. As the graph shows, the most associated word to energy efficiency for the year eight secondary schools children in Honduras is save money, while environmental protection is under save money but over electricity.

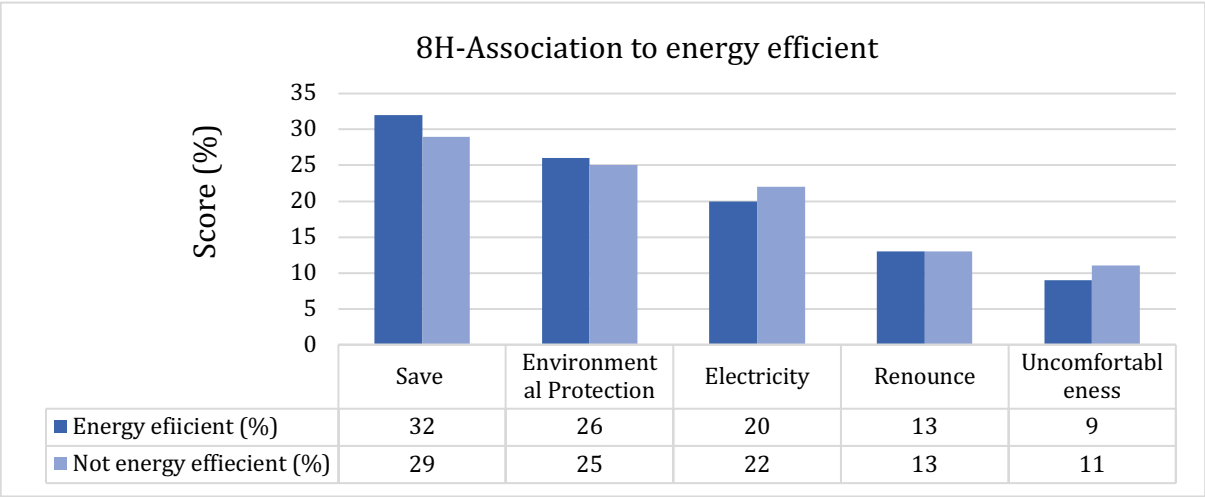


Graphic 5- 15 8H-Association to energy efficiency

The least associated words to energy efficiency are renounce in the second from last place and uncomfortableness as the word least associated to energy efficiency.

To identify differences between the energy efficient group and the not energy efficient group a ranking by sub-group was made. Graphic 5-16 shows the analysis of 33 valid answers for the energy efficient group and 55 valid answers for the not energy efficient.

Although, as can be seen on the graph, the ranking for both groups is the same as the one from the entire group, save money is the most associated word to energy efficiency and uncomfortableness is the least. Both groups slightly differ in the percentage of achievement for each word. For example, the percentage of achievement for save money and environmental protection is slightly higher for the energy efficiency group.



Graphic 5- 16 8H-Asscociation to energy efficiency, by group

Even though the results of the Wilcoxon–Mann–Whitney (save, z= -1,557, *p*-value= 0,961, Environmental protection z= -0,961, *p*-value= 0,337, Electricity, z= -1,537, *p*-value= 0,124 renounce z= -0,744, *p*-value= 0,457, Uncomfortableness z= -1,644, *p*-value= 0,1) leads us to concluded that both groups are indistinguishable by ranking the most associated word to energy efficiency.

In this way we can consider that the ranking made for both groups is the same as the one from the entire group, in future comparisons the rankings made by the entire group will be used; save money in first place, environmental protection in second place, electricity in third place and renounce and uncomfortableness in the last places.

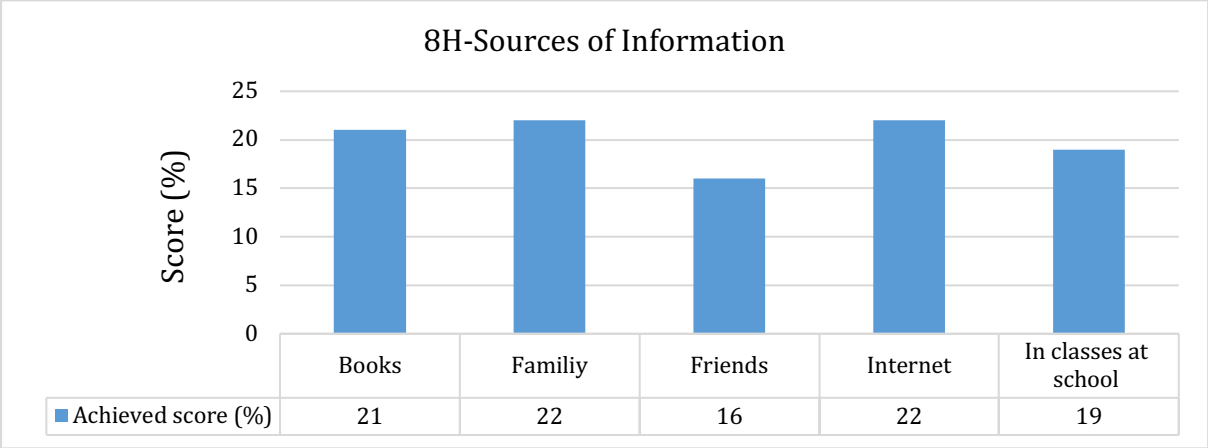
5.1.10 8H-Sources of information

With this association question we were trying to find out which is the most and the least used source of information for the respondents, in other words, where do they get information about environmental topics from. In the question five sources of information were given to the respondents.

As it was explained before, they should make a ranking by giving a number from one to five to each source of information.

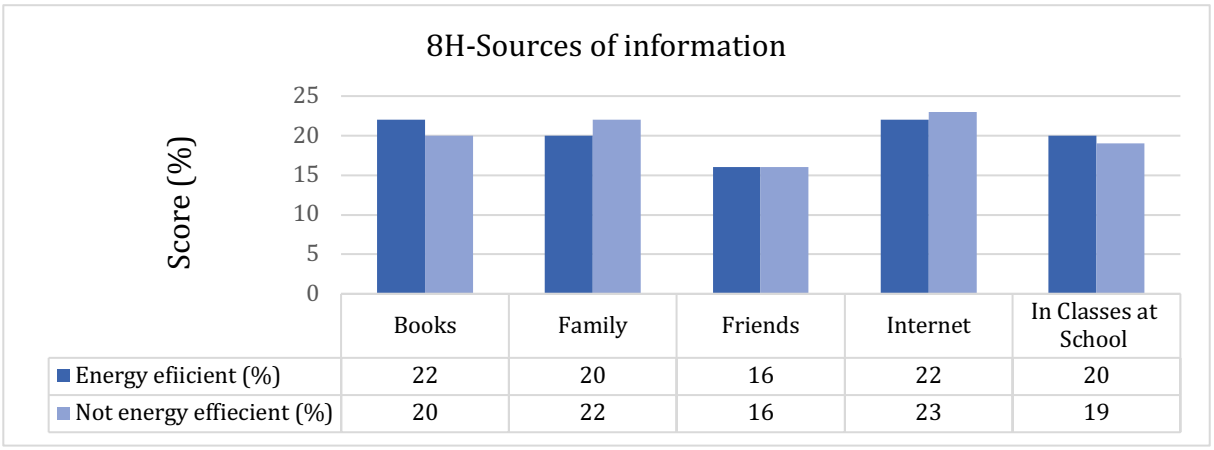
Graphic 5-17 shows the rankings of the most and the least used sources of information for

131 respondents attending year eight secondary school in Honduras.



Graphic 5- 17 8H-Sources of information

It seems that this group of children get information about environmental topic from family and internet in joint first place, right after that comes books with 1% less in achievement. In classes at school is in fourth place and in last place are friends as a source of information. To find whether the energy efficient group and the not energy efficient group make the same ranking of sources of information 33 valid answers for the energy efficient group and 47 for the not energy efficient group were analyzed.



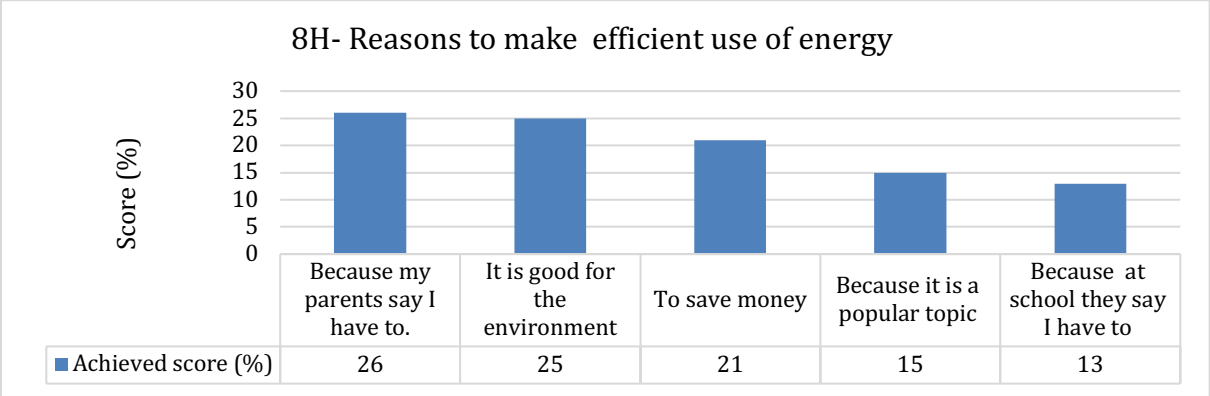
Graphic 5- 18 8H- Sources of information, by group

As graphic 5-18 shows, both groups slightly differ in the percentage of achievement for each word. Even though the results of the Wilcoxon–Mann–Whitney (Books, z= -0,709, *p*-value= 0,478, Family z= -0,843, *p*-value= 0,399, Friends, z= -0,228, *p*-value= 0,819 Internet z= -0,903, *p*-value= 0,366, In classes at School z= -0,37, *p*-value= 0,711) leads us to concluded that both groups are indistinguishable by ranking the most used source of information.

In this way we can consider that the ranking made for both groups is the same as the one from the entire group, in future comparisons the ranking made by the entire group will be used. Internet is the first source of information, family is in second place, books is in third place, in classes at school is the fourth most used source of information and friends is the least used source of information.

5.1.11 8H-Reasons to make efficient use of energy

In the survey an association question to find which are the respondents' main reasons to make an efficient use of energy was made. Graphic 5-19 shows the results of 137 valid answers to the question.

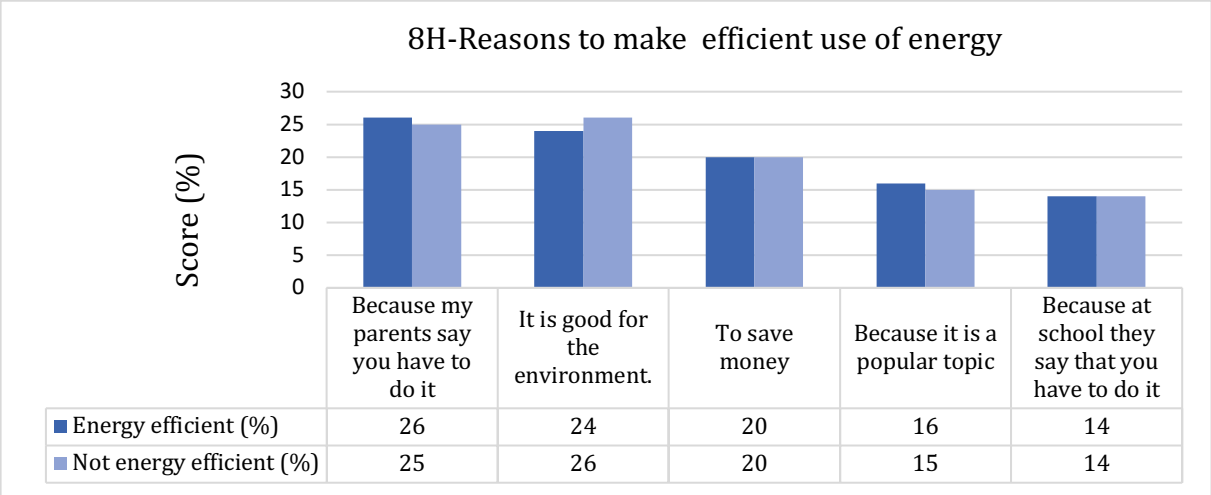


Graphic 5- 19 8H-Reasons to make an efficiently use of energy

As the graph illustrates, because their parents say they have to is the main reason to use energy efficiently and in second place is because of the environment.

To save money is below environment protection but over because it is said so at school. The last reason to use energy efficiently for this group was because it's a popular topic.

To identify if the energy efficient make the same ranking as the not energy efficient 27 answers for the not energy efficient and 53 for the not energy efficient were analyzed. From the graph we can see that by ranking the main reasons to make an efficient use of energy both groups slightly differ.

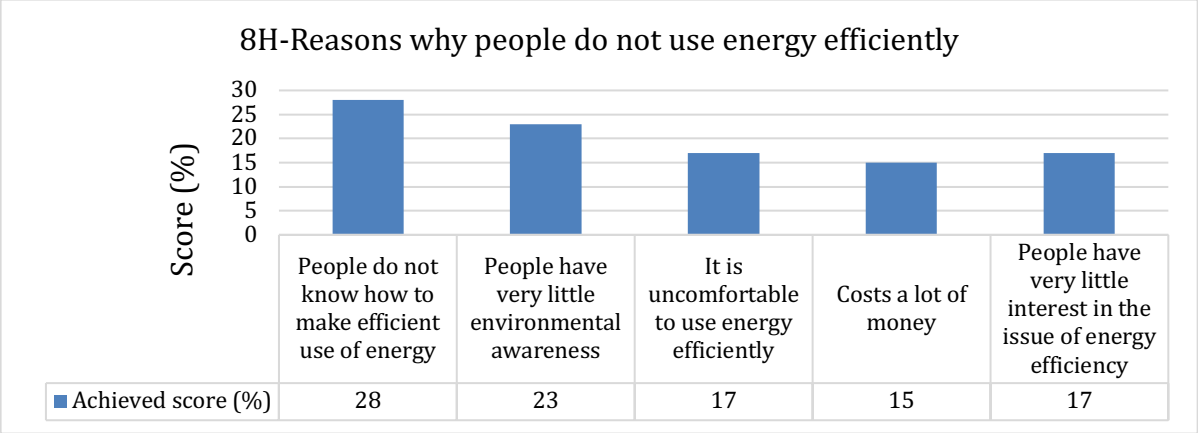


Graphic 5- 20 8H-Reasons to make efficiently use of energy, by group

Even though the results of the Wilcoxon–Mann–Whitney test (Because my parents say you have to do it, z= - 0,935, *p*-value= 0,35, It is good for the environment. z= -0,997, *p*-value= 0,319, To save money, z= -0,131, *p*-value= 0,896, Because it is a popular topic z= -0,659, *p*-value= 0,51, Because at school they say that you have to do it z= - 0,096, *p*-value= 0,923) leads us to concluded that both groups are indistinguishable by ranking the reasons to make an efficient use of energy. For this reason, we will use the graphic made by the entire group in future comparisons.

5.1.12 8H-Reasons why people do not make an efficient use of energy

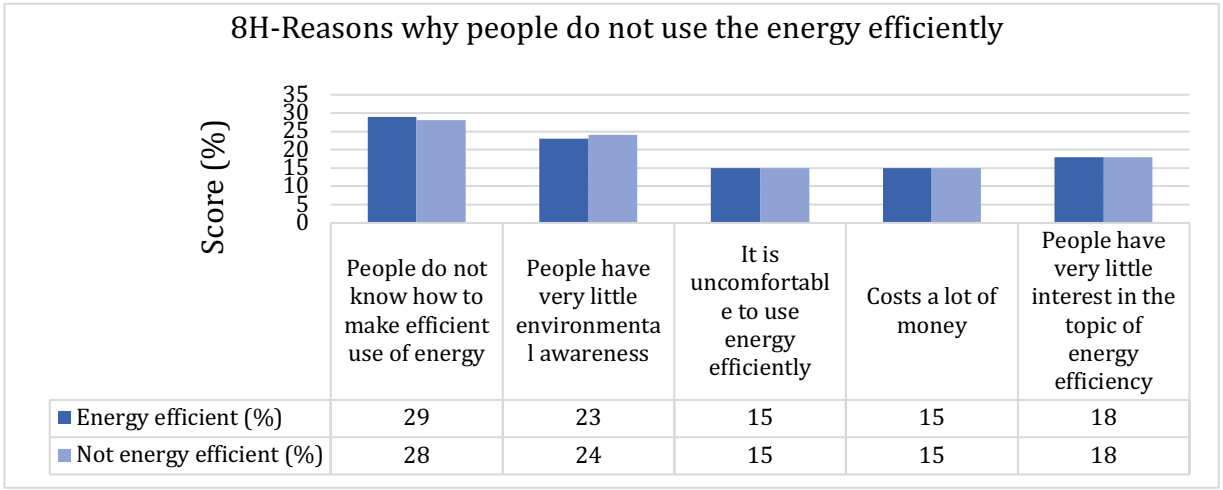
The last association question is aimed at finding out the group's opinion about people's reasons for not making an efficient use of energy. Five reasons were given to them and, as with the other association questions, they should rank them from one to five. The analysis of 129 valid answers give as a result the following ranking:



Graphic 5- 21. 8H-Reasons why people do not use energy efficiently

As graphic 5-21 shows, according to the year eight secondary school children from Honduras, the main reason why people do not make an efficient use of energy is because they do not know how to. In second place they think that it is because of people's poor environmental awareness. Because it is uncomfortable and because of a low interest in the topic are ranked above the costs involved in the efficient use of energy. To identify differences between the energy efficient group and the not energy efficient group, 27 valid answers for the first and 52 for the second were analyzed.

As graphic 5-22 shows, both groups appear to differ only in the first and the second place of the rankings.



Graphic 5- 22 8H-Reasons why people do not use energy efficiently, by group

Due to the results of the Wilcoxon–Mann–Whitney test (People do not know how to make efficient use of energy, z= -0,48, *p*-value= 0,631, People have very little environmental awareness. z= - 0,519, *p*-value= 0,604, It is uncomfortable to use energy efficiently, z= - 0,186,

p-value= 0,852, costs a lot of money z= -0,356, *p*-value= 0,722, People have very little interest in the topic of energy efficiency z= -0,148, *p*-value= 0,882) it is considered that there are not significant differences between the groups regarding the reasons why people do not use energy efficiently. In future comparisons we are going to use the ranking made by the entire group.

5.2 Year Eight secondary school children, Germany

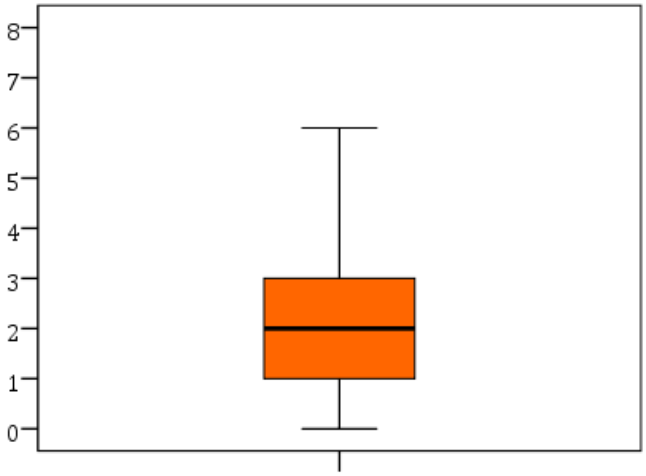
In this section the results of a survey targeted at 197 year eight secondary school children from Germany are described. The study was made in Schleswig Holstein. As in the previous section, the results are presented in seven categories and four association questions. Each category has a certain number of questions. Each question has an amount of score points and by adding them up it is possible for each group to achieve a score per category.

To get a score in one category, the score of each question belonging to each category is added up. In this case the participant should have answered all the questions in the category in order to consider the participant's answer as a "valid answer". If the participant does not answer at least one question of the category, this participant's answer is considered as an invalid answer for the group. In each category it will be stated how many valid answers are taking into account.

In each category and association question the results by group and by sub-group (energy efficient and not energy efficient) are described. The first category to be described is "energy efficiency behavior".

5.2.1 8G-Energy efficiency behavior

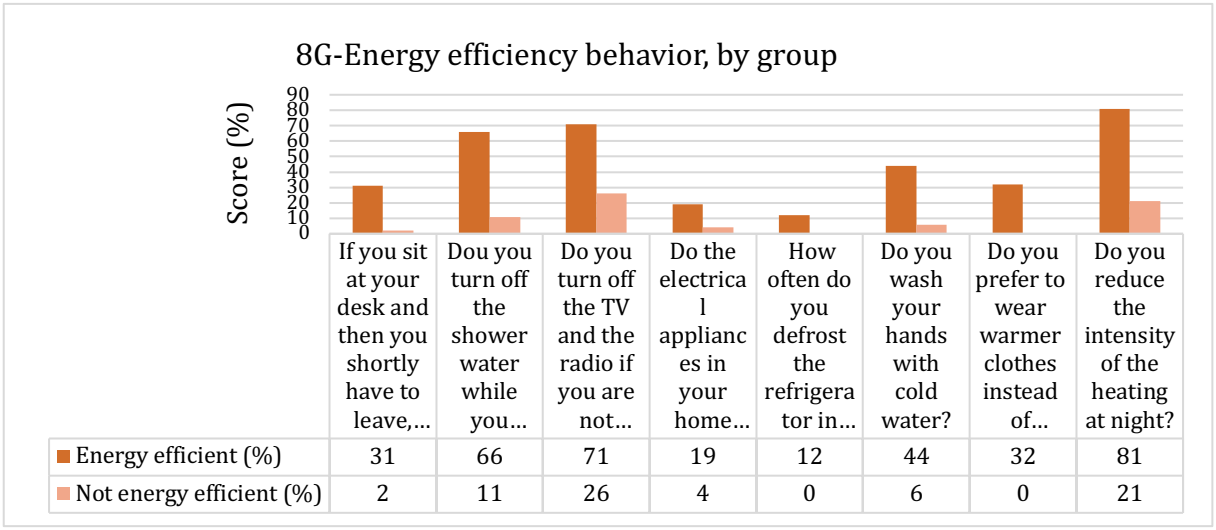
In this segment the energy efficiency behavior of 153 (with 44 invalid answers) year eight secondary school children from Germany is described. In the category the results of eight questions were put together. Graphic 5-23 shows that the data spread from 0 to 6 in the category energy efficiency behavior.



Graphic 5- 23 8G-Energy efficiency behavior

The group can then be considering as heterogeneous in the category. The dataset is accumulated at the beginning of the scale, showing that over 75% of the group scored 3 or lower on the scale. The sample skewness for this category is 0,446, the distribution is considered approximately symmetric from 0 to 6.

Making a median, split the group was divided into two sub-groups: the energy efficient group with 59 participants and the not energy efficient group with 47 participants. The other 47 participants are exactly in the median (two score points), for this reason they do not belong to any of the two sub-groups. In order to see if both groups differ in each question of the category, graphic 5-24 shows the score achieved by each group in each question of the category energy efficiency Behavior.



	If you sit at your desk and then you shortly have to leave,...	Dou you turn off the shower water while you...	Do you turn off the TV and the radio if you are not...	Do the electrical applianc es in your home...	How often do you defrost the refrigera tor in...	Do you wash your hands with cold water?	Do you prefer to wear warmer clothes instead of...	Do you reduce the intensity of the heating at night?
Energy efficient (%)	31	66	71	19	12	44	32	81
Not energy efficient (%)	2	11	26	4	0	6	0	21

Graphic 5- 24. 8G-Energy efficiency behavior, by group

As the graphic 5-24 shows, both groups appear to differ in each question of the category. When the respondents were asked if they turn off the light on their desk when they were not using it the difference between the groups is remarkable, although the energy efficient group did not get a high score in this question, the not energy efficient group achieved only 2% of

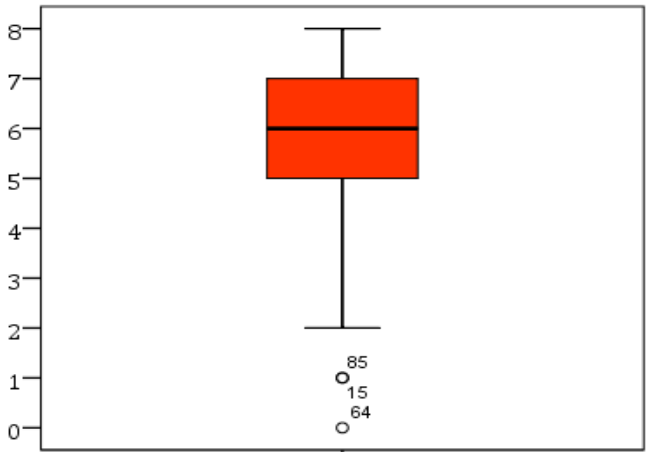
the question's maximum score. By using hot water in the shower the difference in achievement between the groups is more than 50%.

In each question of the category the difference in achievement between the groups goes from 10% up to almost 60%. The groups can be distinguished in each question of the category. From now on the results of each category and each association question for this group will be presented by showing the achievement of the energy efficient and not energy efficient sub-groups in each category.

5.2.2 8G-Energy efficiency preconceptions

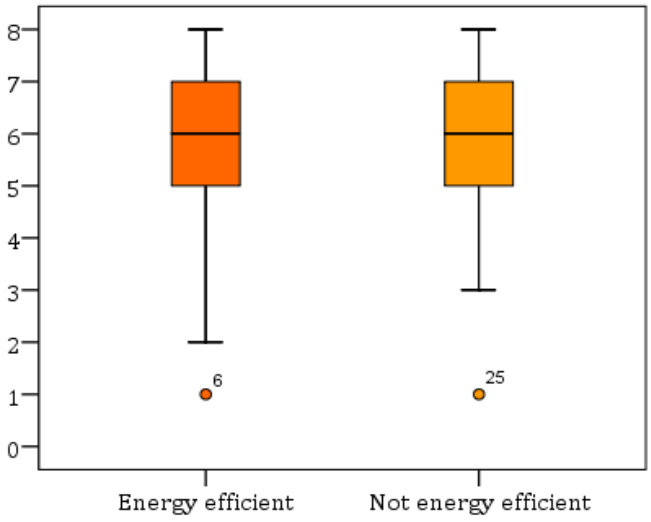
In the category energy efficiency preconceptions four level of agreement questions were put together. By answering each of the four questions the respondent gets an amount of points. The criteria for the score were already explained in section 5.1.1. In the category energy efficiency preconceptions, the group had the chance to achieve a score from between zero and eight points. Graphic 5-25 shows the data distributions for the year eight secondary school children from Germany in the category preconceptions about energy efficiency.

Graph 5-25 shows very varied views in the category energy efficiency preconceptions. The dataset spreads across the entire scale, that is, the group can be consider heterogeneous in this category. The graph shows that the students have similar views in the upper three quarters. 75% of the group scored 5 or more. The dataset had three outliers which may deserve special consideration in future conclusions. Due to the fact that the dataset spreads across the entire scale, the sample skewness also includes the entire scale, that is, from 0 to 8. A sample skewness of -0,909 makes us concluded that the dataset is moderately skewed up.



Graphic 5- 25 8G-Energy efficiency preconceptions

The dataset of this category was also analyzed by sub-groups: the energy efficient and the not energy efficient. Graphic 5-26 shows the results of 48 valid answers from the energy efficient group and 41 valid answers from the not energy efficient group.

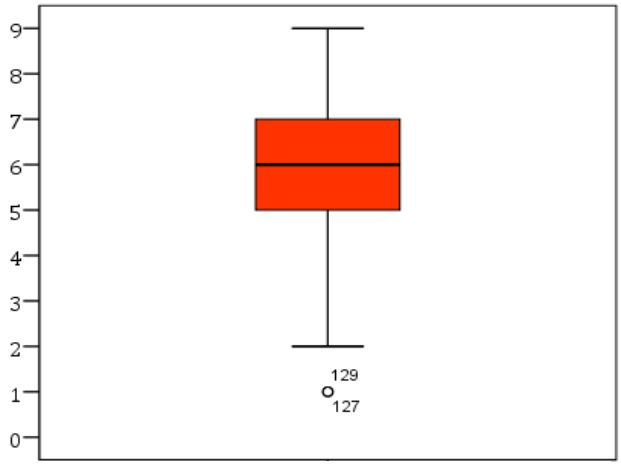


Graphic 5- 26 8G-Preconceptions about energy efficiency, by group

By comparing the dispersion of both datasets, the interquartile ranges are reasonably similar, but the overall range of the dataset is greater for the not energy efficient group. By comparing the location of the data, the median of both groups are on the same level on the scale. Though both datasets are skewed up, a skewedness of -0,942 for the energy efficient group and -1,037 for the not energy efficient group makes us conclude that the dataset of the not energy efficient group is more highly skewed up. The absolute value for the not energy efficient group is greater, corresponding to a more marked lack of symmetry. Although both groups slightly differ at the overall range of the dataset and the symmetry of the data is slightly different for both groups, by using the Wilcoxon-Mann-Whitney-Test (z= -0,367, p-value= 0,713) we can conclude that both groups cannot be distinguished in the category preconceptions about energy efficiency.

5.2.3 8G-Level of concern

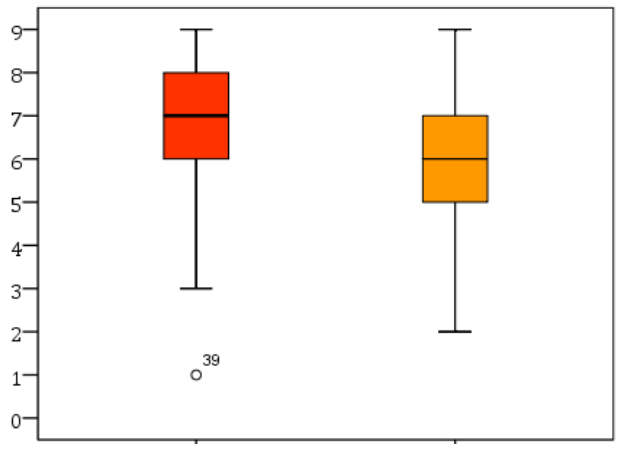
This category has three level of agreement questions. By answering the three questions of this category the participants had the chance to achieve a "concern-score" from zero to nine; zero being the lowest score and nine the highest score. Graphic 5-27 shows the data distribution of 162 year eight secondary school children from German



Graphic 5- 27 8G-Level of concern

The graph shows that the students have very different opinions in the category level of concern. The dataset spread from one to nine, taking into account the outliers, shows that the group is completely heterogeneous in their level of concern. The 50% in the middle of the distribution is where the students got a more similar score. A skewness of 0,577 leads us to concluded that the dataset is moderately skewed up, from one to nine in the scale.

The distribution by group is shown on graphic 5-28. The dataset represents 48 valid answers for the energy efficient group and 42 valid answers for the not energy efficient group. By comparing the data dispersion of both groups, the pattern of the two distributions shows a range variation from 1 to 9 in the energy efficient group and from 2 to 9 in the not energy efficient group. The interquartile range is reasonably similar for both groups but the overall range of the dataset is greater for the not energy efficient group.



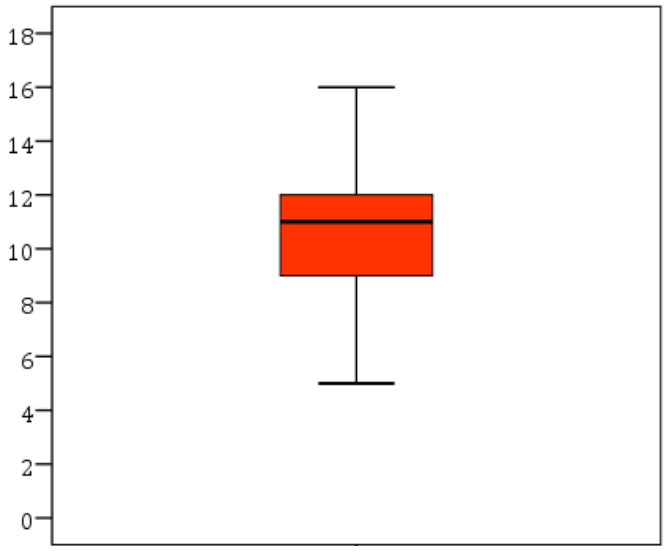
Graphic 5- 28 8G-Level of concern, by group

By comparing the location of the data, the median of the energy efficient group is greater than that of those who do not use energy efficiently. Both datasets appear to be skewed up and the dataset of the energy efficient group is slightly more skewed; a skewness of -1,470 for the energy efficient group and -0,778 for the not energy efficient group leads us to concluded that the dataset for the energy efficient group is highly skewed up and has a more marked lack of symmetry than the dataset of the not energy efficient group, the energy efficient group is then less skewed up, from 0 to 9 in the scale.

Although both groups appear to have some differences, From the results of the Wilcoxon-Mann-Whitney-Test (z= -1,535, p-value= 0,125) it was found that the energy efficient group and the not energy efficient group cannot be distinguished in the category level of concern.

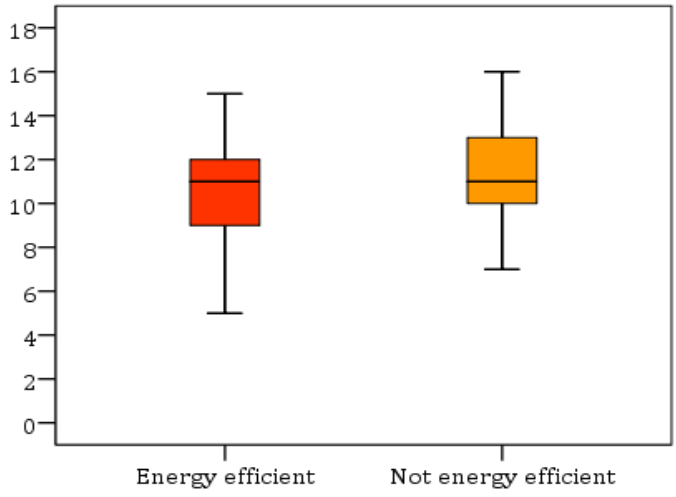
5.2.4 8G-Level of responsibility

In the category level of responsibility, the results of six questions were added up; the category has a range from 0 to 18 points. Graphic 5-29 shows the data distribution from 143 year eight secondary school children from Germany.



Graphic 5- 29 8G-Level of responsibility

As the graph shows, the dataset spreads from 5 to 16 on the level of responsibility scale, this suggests students hold quite different levels of responsibility. The 50% in the middle of the scale seem to have a similar level of responsibility with each other. The 50% in the middle of the scale also shows that they have a high level of agreement with each other, ranging from 9 to 12 on the scale. The median of the distribution is located on the upper half of the scale. A sample skewness of -0,082 leads us to concluded that the dataset is approximately symmetric from 5 to 16 on the scale. The data distribution was also analyzed by sub-groups.



Graphic 5- 30 8G-Level of responsibility , by group

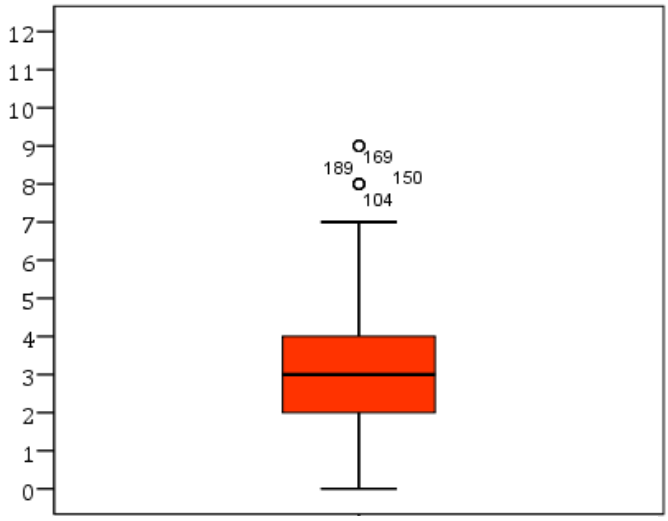
Graphic 5-30 shows the data of 45 valid answers for the energy efficient group and 36 valid answers for the not energy efficient group. By comparing the dispersion of both data distributions, the overall range of the dataset is greater for the not energy efficient group, where the minimum is 7 and the maximum is 16, while the dataset of the energy efficient group spreads from 5 to 15 on the scale.

The medians are all at the same level, 11, on the level of responsibility scale. A sample skewness of -0,194 for the energy efficient group and -0,021 for the not energy efficient group leads us to concluded that both distributions are moderately symmetric, in the range from 5 to 15 for the energy efficient group and from 7 to 16 for the not energy efficient group.

Although the distribution patterns seem to be different for both groups, by using the Wilcoxon-Mann-Whitney-Test (z= -0710, p-value= 0,477) no statistically significant difference was found between the groups. From this we can conclude that both groups, the energy efficient and the not energy efficient, cannot be distinguished in the category level of responsibility.

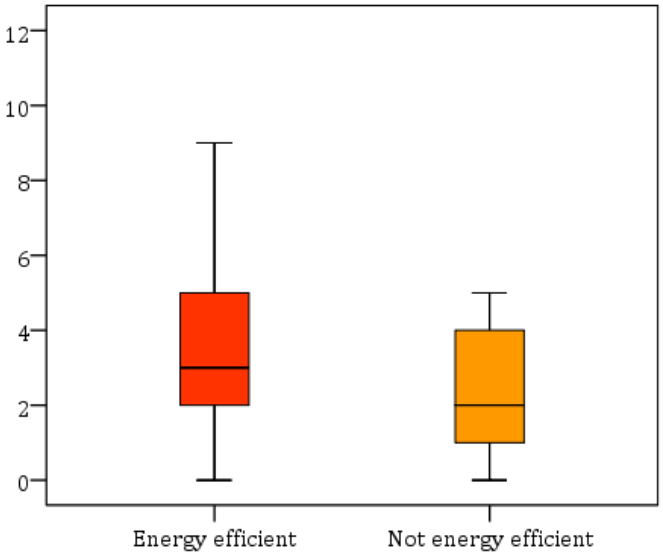
5.2.5 8G-Level of exposure to information

In this category three frequency questions were put together. By answering the three question of the category the respondents had the chance to score between zero and 12 points. Graphic 5-31 illustrates the results of 168 valid answers given by year eight secondary school children from Germany in the category level of exposure to information about environmental topics and the efficient use of energy. The data distribution spreads from 0 to 9 on the scale level of exposure to information. This suggests a varied level of exposure to information across the group. 50% of the respondents scored 3 or less in the category. The graphic also shows a skewed down pattern where most of the data is concentrated at the beginning of the scale; a sample skewness of 0,686 leads us to concluded that that the dataset is moderately skewed down, from 0 to 9 on the scale. The dataset has 4 outliers, which could need further analysis in the future.



Graphic 5- 31 8G-Level of exposure to information

The data of this category was also analyzed by the sub-groups: the energy efficient and the not energy efficient. Graphic 5-32 shows the results of 54 valid answers for the energy efficient group and 43 valid answers for the not energy efficient group. The graphic shows two different patterns of distribution.



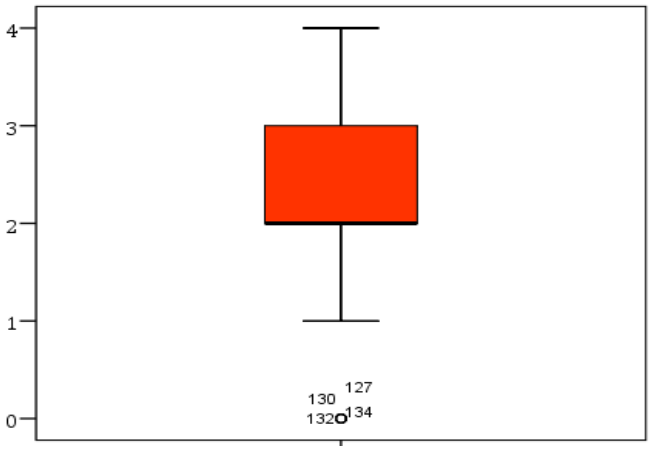
Graphic 5- 32 8G-Level of exposure to information, by group

By comparing the data dispersion of both groups, the interquartile range. The overall range of the dataset of the not energy efficient group is greater. By comparing the data location, we can see that the median is higher for the energy efficient group.

The distribution for the energy efficient group seems to be more skewed down, while the distribution of the not energy efficient seems to be more symmetric, but neither skewness is particularly marked. In a range from 0 to 5 the distribution of the not energy efficient group is more symmetric. While in a range from 0 to 9, the distribution of the energy efficient group is moderately skewed down. Both groups appear to differ the most in the upper quarters and the energy efficient group seems to be higher in the scale. But by using the Wilcoxon-Mann-Whitney-Test (z= -1,763, p-value= 0,078) no significant difference was found between the groups, leadinging us to concluded that both groups, the energy efficient and the not energy efficient, cannot be distinguished in the category level of exposure to information.

5.2.6 8G-Level of importance of "energy saving"

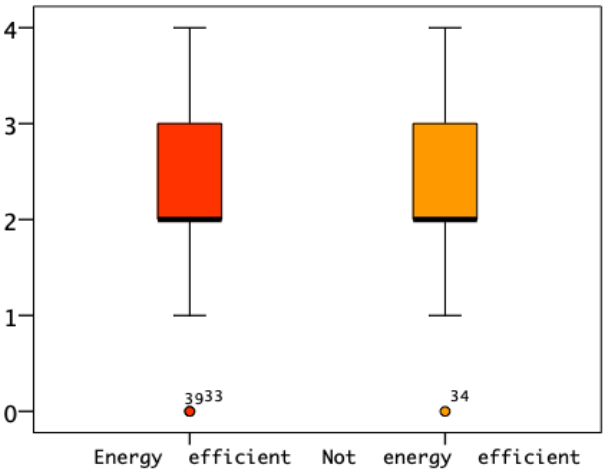
This category was analyzed by taking into account the results of one question. By answering the question, the respondent had the chance to achieve a score between 0 and 4 points on the scale level of importance of energy efficiency. Graphic 5-33 shows the results of 181 valid answers.



Graphic 5- 33 8G-Level of importance of "energy saving"

The dataset spread across the entire scale showing very varied views across the group. This suggests that the group is heterogeneous in the category level of importance of energy saving. 75% of the group scored 2 or more. Although most of the data seems to be located at the end of the scale, a sample skewness of -0,231 leads us to concluded that the pattern distribution is moderately symmetric. There are four outliers in the category that will require special attention in future conclusions. The results of this category were also analyzed by sub-groups: the energy efficient and the not energy efficient.

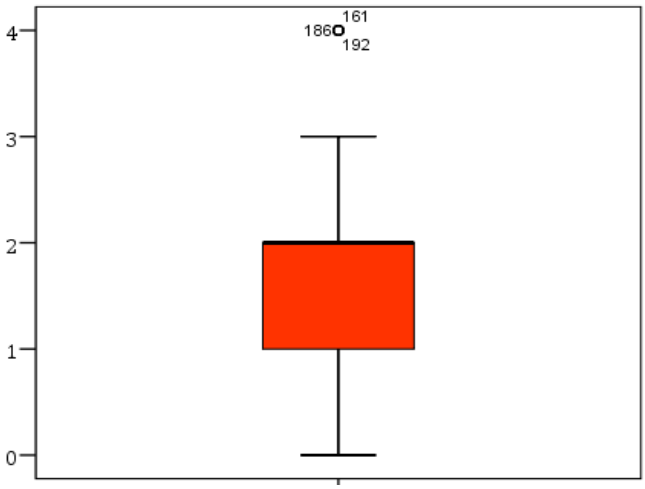
Graphic 5-34 shows the data distribution for 55 valid answers from the energy efficient group and 43 valid answers from the not energy efficient group. By comparing the data dispersion, both groups seem to be reasonably similar within the interquartile range and within the overall range. The answers from both groups seem to be accumulated at the ends of the scale; the skewness is not particularly large in either case. In fact, the sample skewness for the energy efficient group is -0,214 and for the not energy efficient group is -0,02. Both skewness's are negative, both distributions are moderately symmetric from 0 to 4 in the scale. The Wilcoxon-Mann-Whitney-Test (z= -0,194, p-value= 0,846) leads us to concluded that the energy efficient group and the not energy efficient group cannot be distinguished in the category level of importance.



Graphic 5- 34 8G-Level of importance of "energy saving"

5.2.7 8G-Level of willing to know more about energy efficiency

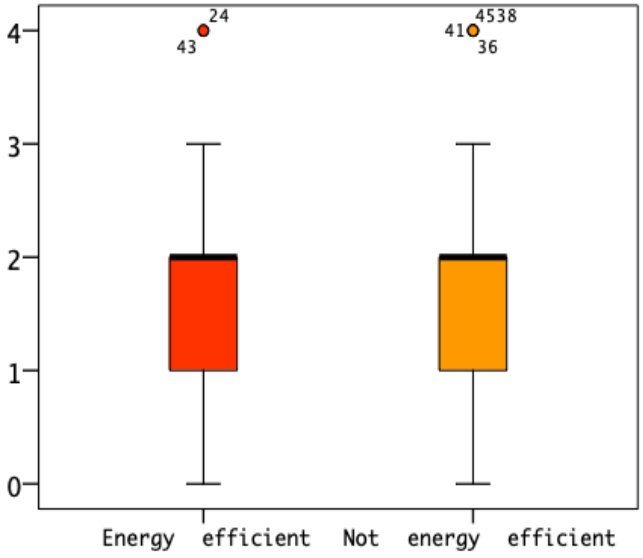
This category has just one question; by answering the question the participant had the chance to achieve a score between zero and four.



Graphic 5- 35. 8G-Level of willing to know more about energy efficiency

Graphic 5-35 shows the data distribution, taking into account the answers of 169 year eight secondary school children from Germany. The graphic shows a distribution spreading across the scale, suggesting some varied opinions among the group. That is, the group can be considered heterogeneous in this category. The median is located in the middle of the scale, showing that 50% of the groups scored 2 or less. A sample skewness of -0,058 leads us to concluded that the data distribution is moderately symmetric.

To find out whether there is a difference between the energy efficient group and the not energy efficient group about willing to know more about energy efficiency, 47 valid answers from the energy efficient group and 41 valid answers from the not energy efficient group were analyzed.



Graphic 5- 36 8G-Level of willing to know more about energy efficiency by group

Graphic 5-36 shows the data distribution for both groups. By comparing the dispersion of both datasets, it can clearly be seen that both groups are reasonably similar within the interquartile range and within the overall range.

They both can be consider as heterogeneous in the category. The sample skewness for the energy efficient group is 0,092 and for the not energy efficient group is 0,162. From the values, both distributions are considered

moderately symmetric on a range from 0 to 4. The Wilcoxon-Mann-Whitney-Test (z= -0,306, p-value= 0,760) leads us to concluded that the energy efficient group and the not energy efficient group cannot be distinguished in the category level of willing to know more about energy efficiency.

5.2.8 8G-Correlations between categories

Once the data of the seven categories was analyzed it is pertinent to know if there exists any relation between the categories. By using the Spearman's rank correlation coefficient or Spearman's rho, some correlations between the categories were found. A clearest explanation is given with diagram 5- 2.

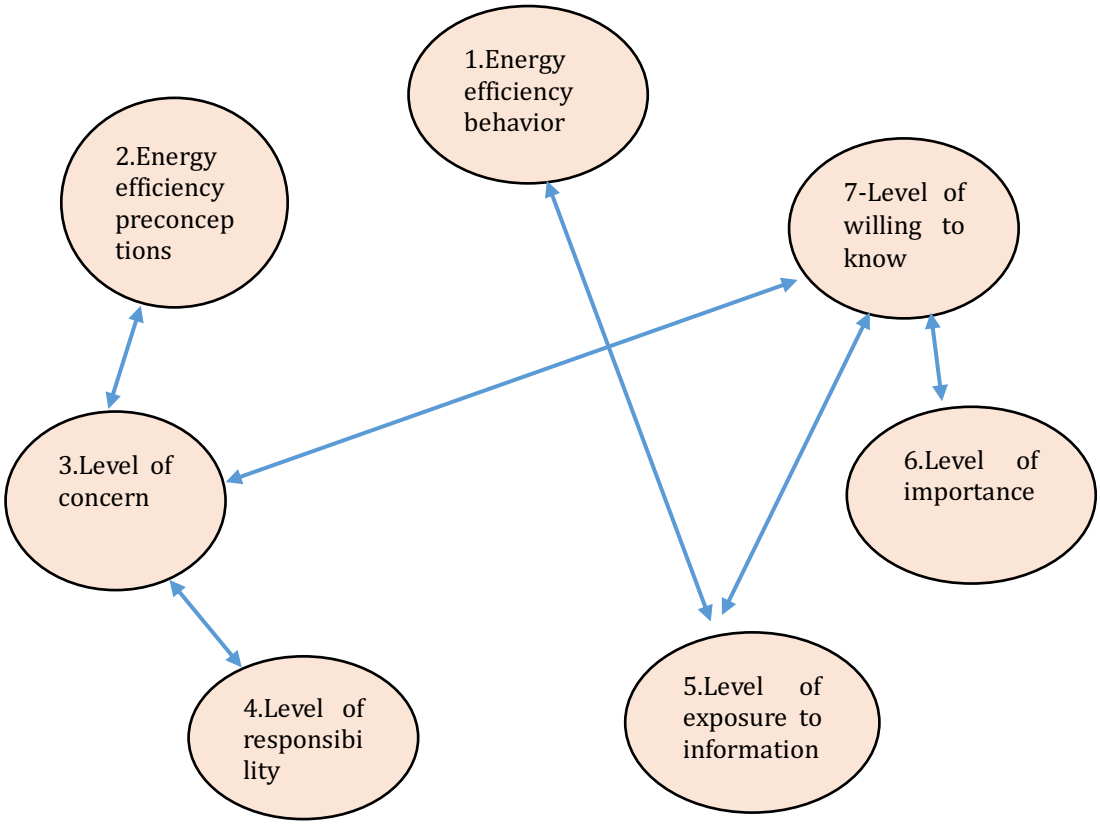
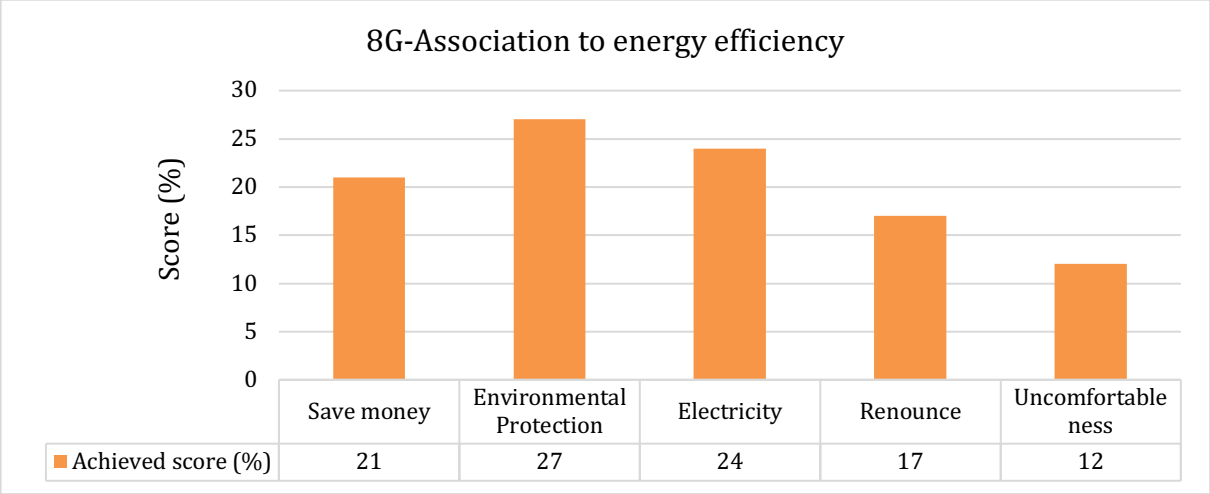


Diagram 5- 2 8G-Correlations between the categories

5.2.9 8G-Association to energy efficiency

In order to make an association to the topic energy efficiency, the participants were given five options (Save money, Environmental protection, electricity, renounce and

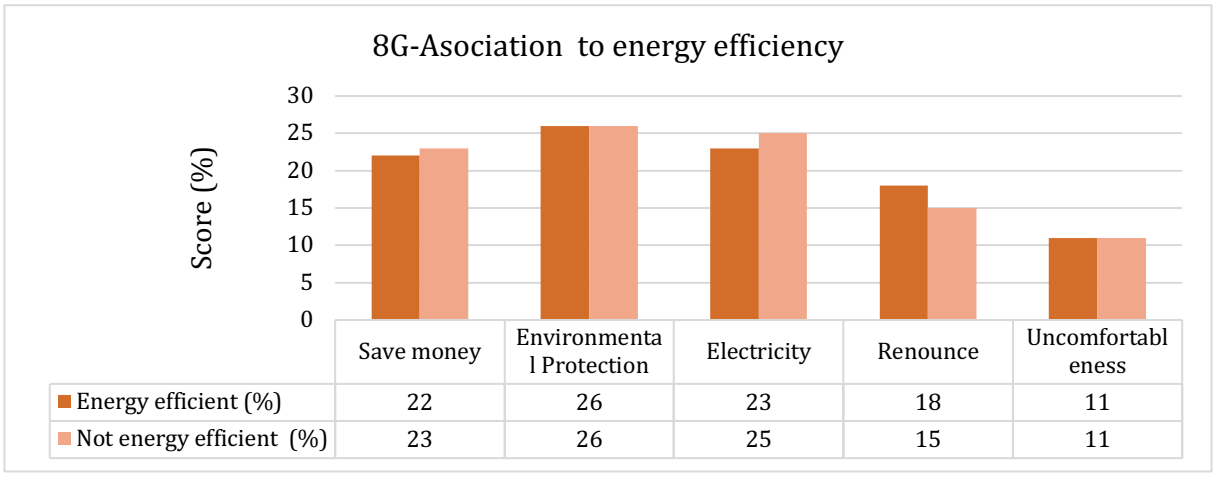
uncomfortableness). They were asked to make a ranking of the most associated word to energy efficiency, 1 being the highest and 5 the lowest. Graphic 5-37 deals with the rankings made by 129 year eight secondary school children from Germany.



Graphic 5- 37 8G-Association to energy efficiency

The graph shows that the most associated word to energy efficiency for the year eight secondary school children from Germany was environmental protection, in second place in the ranking is electricity. With a difference of 3% save money is in the third position in the ranking. They rank renounces and uncomfortableness as the last two words.

In order to find out if the energy efficient group and the not energy efficient group differ in ranking the five words, graph 5-38 was made with 38 valid answers from the energy efficient group and 33 valid answers from the not energy efficient group.



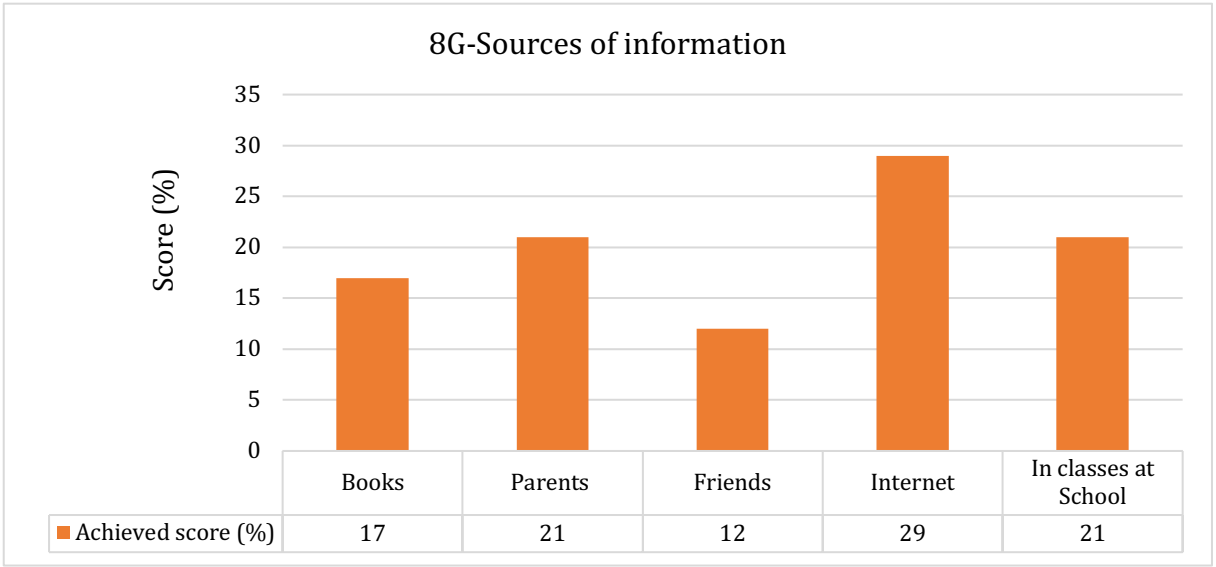
Graphic 5- 38 8G-The most associated word to energy efficiency, by group

The graph shows that both groups made the same ranking as the one coming from the entire group, but they differ in the percentage of achievement in 3 of the 5 words. Even though the results of the Wilcoxon–Mann–Whitney Test (save, z= -0,338, *p*-value= 0,735, Environmental protection z= -0,006, *p*-value= 0,995, Electricity, z= -0,823, *p*-value= 0,41, renounce, z= -1,4, *p*-value= 0,161, Uncomfortableness z= -0,302, *p*-value= 0,763), leads us to concluded that both groups are not distinguished by ranking the most associated word to energy efficiency. For this reason, in future comparisons the rankings made by the entire group will be used.

5.2.10 8G-Sources of information

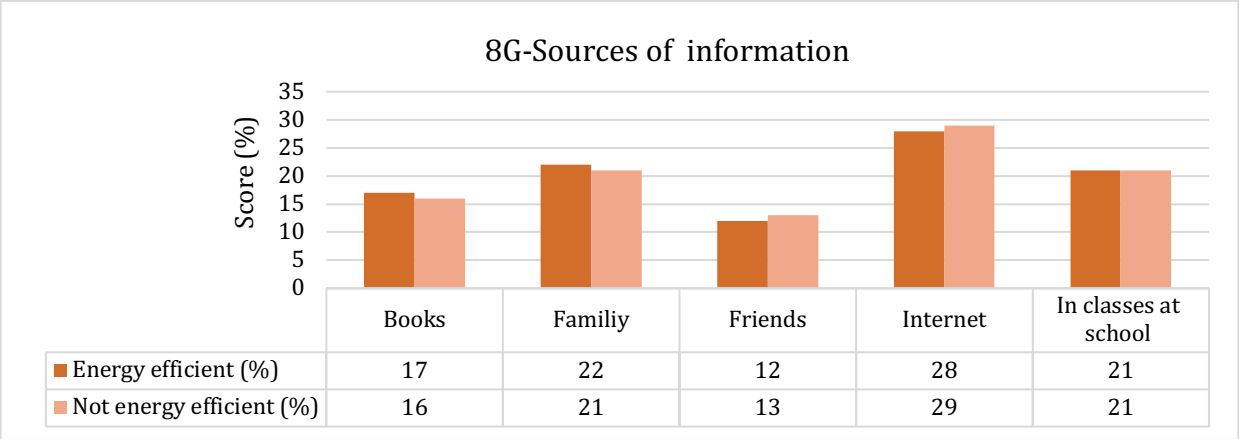
This association question is trying to find out where the information about environmental topics that the children might get is coming from. Which is the most used source of information by the year eight secondary school children from Germany? To answers the question, five sources of information were given to the respondents: books, family, friends, internet and at classes at school. They had to rank each word as their most and least used source of information.

Graphic 5-39 shows the ranking of the most and least used source of information made by 124 secondary school children from Germany who were attending the year eight when the survey was targeted.



Graphic 5- 39 8G-Sources of information

The most used source of information for this 124 children was internet, while parents and school are in joint second place in the ranking. They have given books as the third most used source of information and in last place in the ranking is friends. Now it is then important to know if the energy efficient group and the not energy efficient group obtain information about environmental problems from the same sources. Graphic 5-40 deals with the results of 39 participants from the energy efficient group and 29 participants from the not energy efficient group.

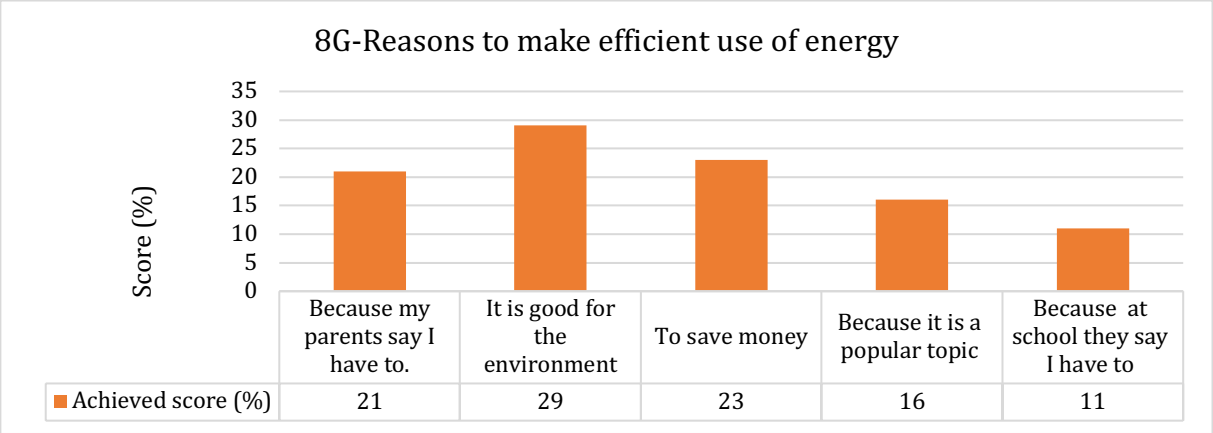


Graphic 5- 40 8G- Sources of information, by group

As it can be seen on the graph, both group slightly differ by ranking the most used source of information. Even though the results of the Wilcoxon–Mann–Whitney Test (Books, z= -0,729, *p*-value= 0,466, Family z= -0,351, *p*-value= 0,725, Friends, z= - 0,985, *p*-value= 0,325, Internet z= -0,328, *p*-value= 0,743, In classes at School z= -0,16, *p*-value= 0,873) leads us to concluded that both groups are not distinguished by ranking the most used source of information. For this reason, in future conclusions the rankings made by the entire group will be used.

5.2.11 8G-Reasons to make efficient use of energy

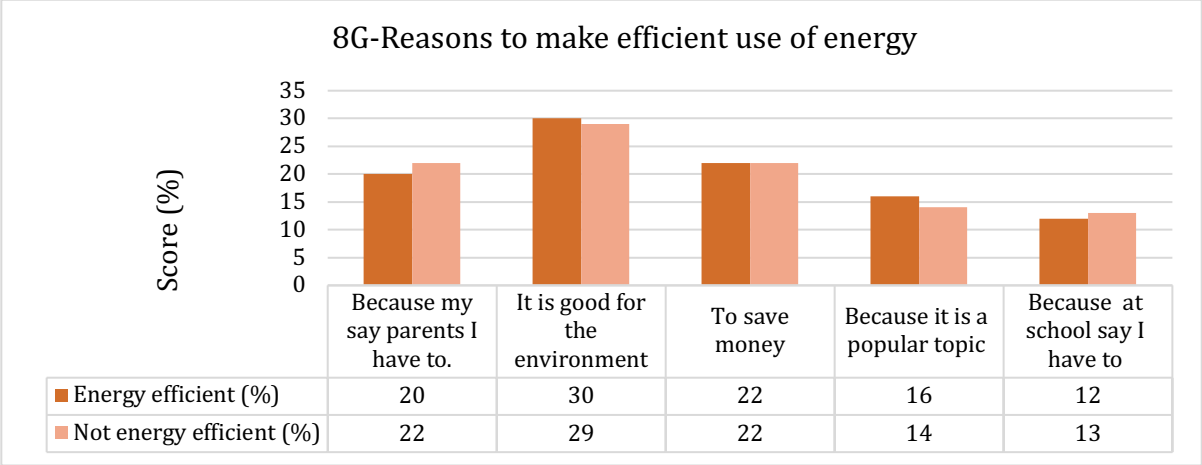
The children were asked to rank which reasons they could have to use energy efficiently. To make the ranking five reasons were given to them. Graphic 5-41 shows the rankings made by 137 children attending year eight in Germany when the study was targeted.



Graphic 5- 41 8G-Reasons to make efficient use of energy

The graph shows that the principal reason that this group of children have to make efficient use of energy is because it is good for the environment. The second reason for them is to save money. Because their parents say so is in third place in the ranking. Because it is a popular topic is above because at school say they have to. Now it is important to explore if the energy efficient group and the not energy efficient have the same reasons to use energy efficiently.

Graphic 5-42 was made from the analysis of 39 participants from the energy efficient group and 34 participants from the not energy efficient group. Graphic 5-42 shows that both groups made almost the same ranking, but they differ in achievement in four of the five reasons.



Graphic 5- 42 8G-Reasons to make efficient use of energy, by group

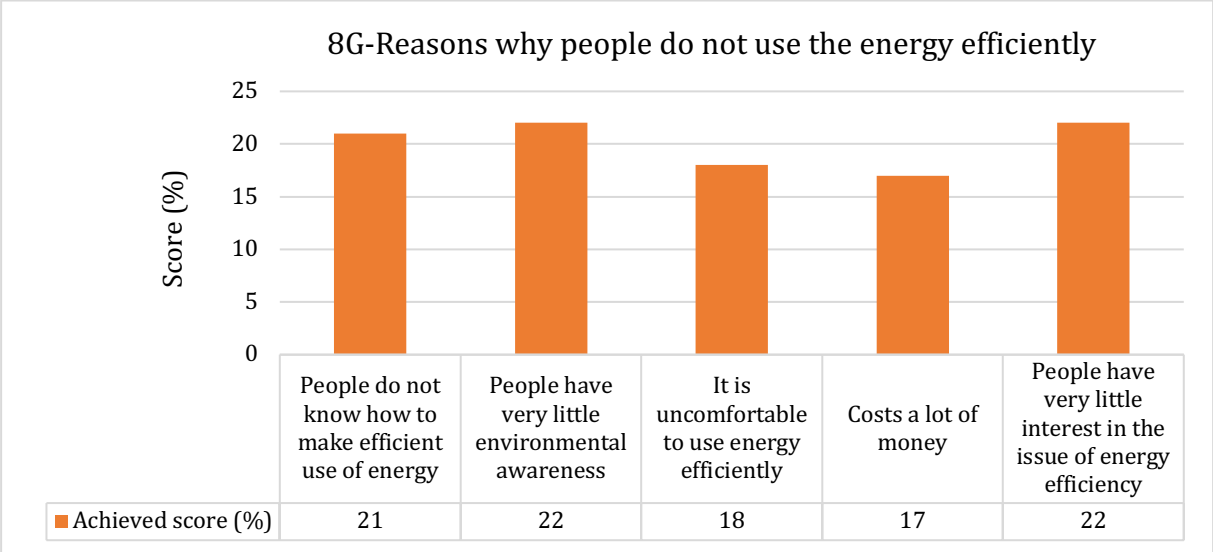
By comparing both groups, Using the Wilcoxon–Mann–Whitney Test, the results (Because my parents say you have to do it, z= -1,12, *p*-value= 0,263, It is good for the environment. z= -0,446, *p*-value= 0,656, To save money, z= -0,286, *p*-value= 0,775, Because it is a popular topic z= -1,211, *p*-value= 0,226, Because at school they say that you have to do it z= -0,103, *p*-value=

0,918) lead us to concluded that the groups do not differ by ranking the reason to make an efficient use of energy. From now on and in future conclusions the rankings made by the entire group will be used.

5.2.12 8G-Reasons why people do not make efficient use of energy

In the survey the respondents were asked to rank the reasons they think people could have to not make efficient use of energy. As with the other association question in this part, to the respondents were given five reasons to rank.

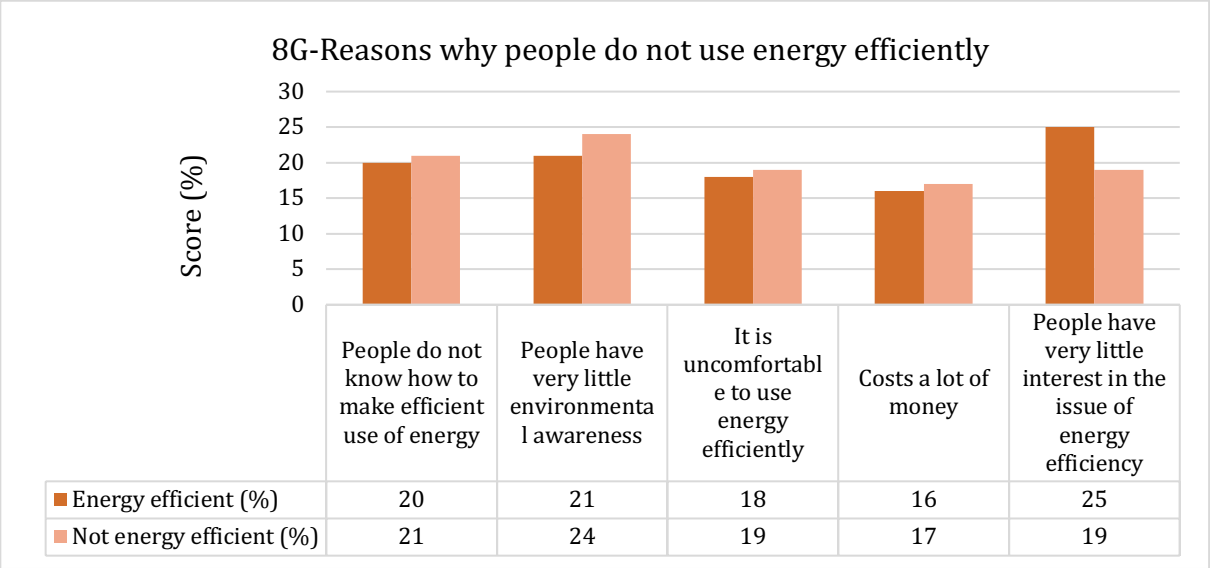
Graph 5-43 deals with the results of 107 valid answers. The graph shows that this groups of children think that the main reason why people do not use energy efficiently is because of people's poor environmental awareness and because of people's lack of interest in the topic. They have ranked these two reasons with exactly the same percentage. As the second more important reason, they think it is because people do not know how to do it.



Graphic 5- 43 8G-Why people do not use energy efficiently

In third place in the ranking is because of the uncomfortableness of using energy efficiently. The last reason in the rankings made by this group of children is because it costs a lot of money.

Now it is then time to know if the energy efficient group and the not energy efficient group differ by ranking these five reasons. Graphic 5-44 deals with the results of 32 valid answers from the energy efficient group and 25 valid answers from the not energy efficient group.



Graphic 5- 44 8G-Reasons why people do not use energy efficiently, by group

The graph shows that both groups slightly differ by ranking the reasons why people do not use energy efficiently.

Due to the results of the Wilcoxon–Mann–Whitney Test (People do not know how to make efficient use of energy, z= -0,645, *p*-value= 0,519, People have very little environmental awareness. z= -1,565, *p*-value= 0,118, It is uncomfortable to use energy efficiently, z= -0,008, *p*-value= 0,993, costs a lot of money z= -0,042, *p*-value= 0,967, People have very little interest in the topic of energy efficiency z= -2,02, *p*-value= 0,043), it is considered that there are not significant differences between the group in four of the five reasons why people do not use energy efficiently. The groups differ by ranking the option, people have very little interest in the topic of energy efficiency. The energy efficient group scored higher by ranking this last reason.

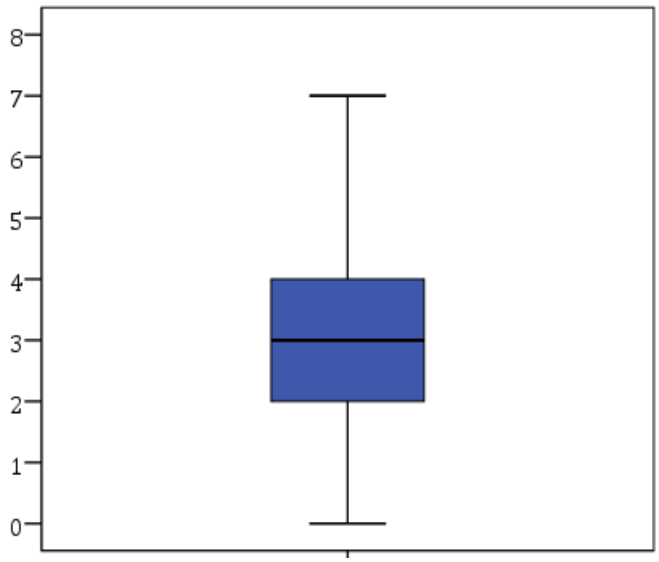
5.3 Year Eleven secondary school children Honduras

In this section the results of a Likert-scale survey are described. The survey was targeted at 174 school children who were in year eleven in Honduras when the study was carried out. As in previous sections, the results will be given in seven categories and four association questions. Each category was made by adding up the score achieved in each question that belongs to the category. The first category to be explained is energy efficiency behavior.

5.3.1 11H-Energy efficiency behavior

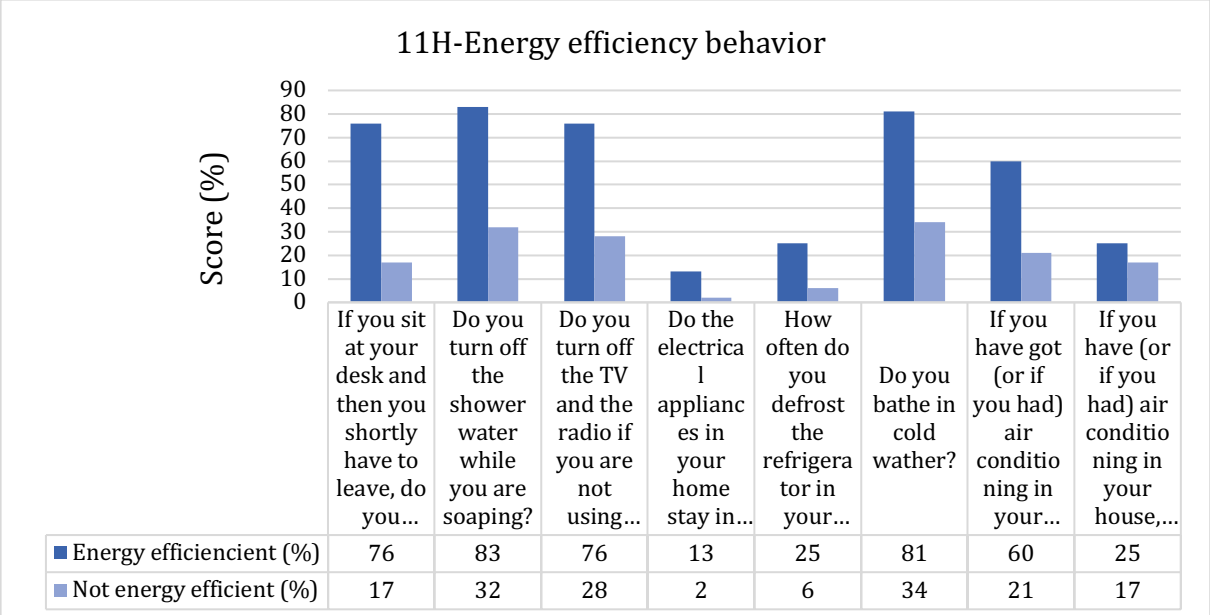
In this category the results of eight questions answered by 139 children attending year eleven in Honduras were put together. Graph 5-45 shows the results of energy efficiency behavior for this group.

The data on Graph 5-45 spreads from 0 to 7 on the energy efficiency behavior scale, suggesting that the group is heterogeneous in energy efficiency behavior. The 50% in the middle of the distribution range from 2 to 4, showing a high level of agreement with each other. 50% of the group scored 3 or less on the scale. The graph also shows that at least some of the participants might never use energy efficiently. The dataset seems to be skewed down throughout the entire scale, but a sample skewness of 0,307 leads us to conclude that the dataset is moderately symmetrical on a range from 0 to 7.



Graphic 5- 45 11H-Energy efficiency behavior

In order to explore possible differences across the group, from the data of the category energy efficiency behavior the group was divided into two subgroups. By making a median split it was possible to separate the 139 children into the energy efficient and the not energy efficient. As a result, the energy efficient group has 63 participants and the not energy efficient group has 47 participants. 29 of the participants were exactly on the median, because of this they do not belong to either of the two groups. Graph 5-46 shows question achievement in the category energy efficient behavior by each of the two subgroups: the energy efficient and the not energy efficient.



Graphic 5- 46 11H-Energy efficiency behavior by group

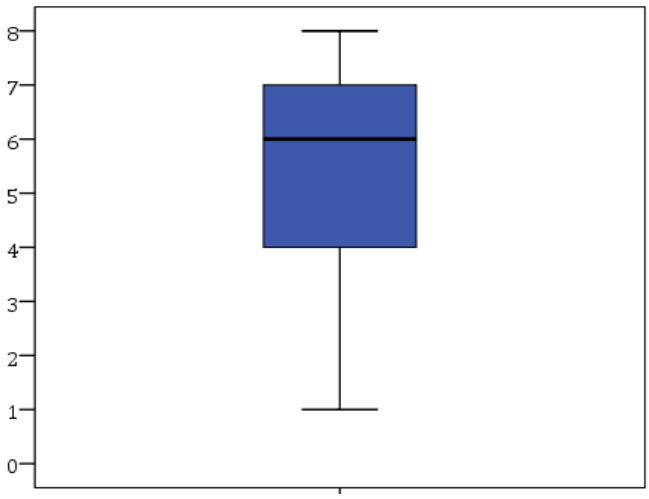
The graph shows that the groups are distinguished in each of the eight questions that belong in the category energy efficiency behavior. Both groups got the highest achievement by answering the question related to the use of warm water. Both groups got the lowest achievement by answering the question: Do the electrical appliances in your home stay in standby mode when they are not in use? Both groups differ the most by answering the question related to the efficient use of a lighting at home; with this question the energy efficient group obtained a question score of 76% and the not energy efficient group scored 17%.

By turning the TV and the radio off when they are not in use, the difference in achievement between the groups is also considerable, the energy efficient group achieved almost 50% higher than the not energy efficient group. When they were asked: If you've got (or if you had) air conditioning in your home do you prefer to wear lighter clothes instead of turning up the air conditioning? the energy efficient group achieved more than 40% higher than the not energy efficient. By using the Wilcoxon-Mann-Whitney-Test we can conclude that the difference between the groups is significant in each of the eight questions of the category, the energy efficient group achieved higher in each question than the not energy efficient group.

5.3.2 11H-Preconceptions about energy efficiency

In this category the results of four level of agreement questions in the questionnaire were put together. The results analyzed in this category show 161 valid answers from school children in year eleven in Honduras when the study was carried out. By answering the four questions the participant had the chance to achieve a score of between 0 and 8 points. Graph 5-47 shows the data distribution of the category preconceptions about energy efficiency.

The data distributions on Graph 5-47 spreads across the entire scale, suggesting varied opinions across the group, and we can say that the group is heterogeneous in the category preconceptions about energy efficiency. The graph shows that many students have similar views on certain parts of the scale. In the upper 50% students' views are more similar, they appear to have a high level of agreement with each other regarding preconceptions about energy efficiency. We can consider this 50% as the high performers of the group, they range from 6 to 8 on the scale. A sample skewness of -0,537 leads us to conclude that the data distribution is moderately skewed up in a range from 1 to 8.

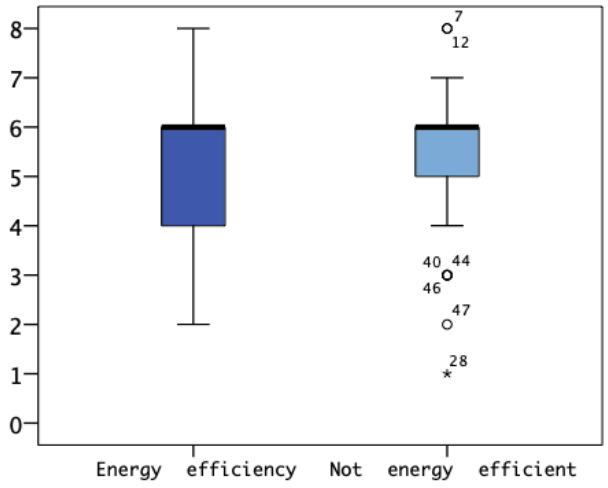


Graphic 5- 47 11H-Preconceptions about energy efficiency

In order to find out whether an area of difference exists between the energy efficient and the not energy efficient 62 valid answers from the energy efficient group and 45 valid answers from the not energy efficient group were analyzed.

Graph 5-48 deals with the results of this analysis. Graph 5-48 shows different patterns for both groups. By comparing the data dispersion of both groups, the interquartile range and the overall range are different for both groups; the overall range as well as the interquartile range of the not energy efficient group is greater, Comparing the data location, both medians are at the same level; 50% of both groups scored 6 or more.

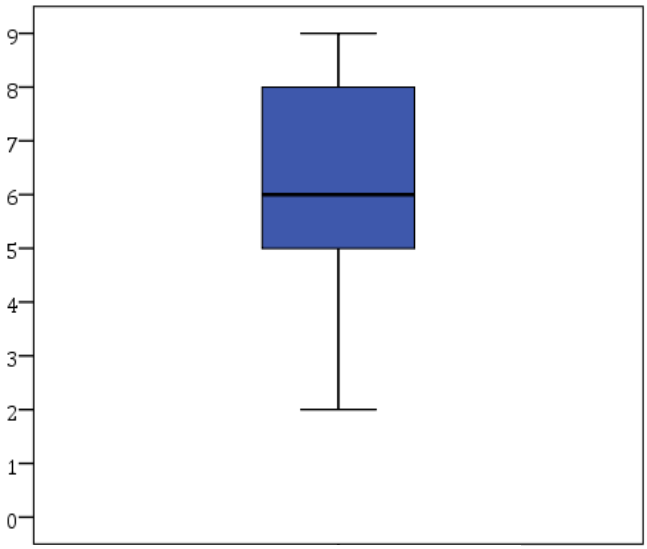
Both batches of data are skewed up; a skewed sample of -0,522 for the energy efficient group and -0,893 for the not energy efficient group allows us to conclude that the data distribution of both groups are moderately symmetrical, in a range from 2 to 8 for energy efficient and from 1 to 8 for the not energy efficient. The data of the not energy efficient has outliers that might require a closer look in the future. Although both groups differ in data dispersion, using the Wilcoxon-Mann-Whitney-Test (z= -0,215 p-value= 0,830) leads us to conclude that the energy efficient group and the not energy efficient group cannot be distinguished in the category preconceptions about energy efficiency.



Graphic 5- 48 11H-Preconceptions about energy efficiency, by group

5.3.3 11H-Level of concern

In this category the results of three level of agreement questions answered by 162 school children in year eleven in Honduras are described. By answering the three questions of the category the respondent had the chance to achieve a score of between 0 and 9 points. Graph 5-49 deals with the results.



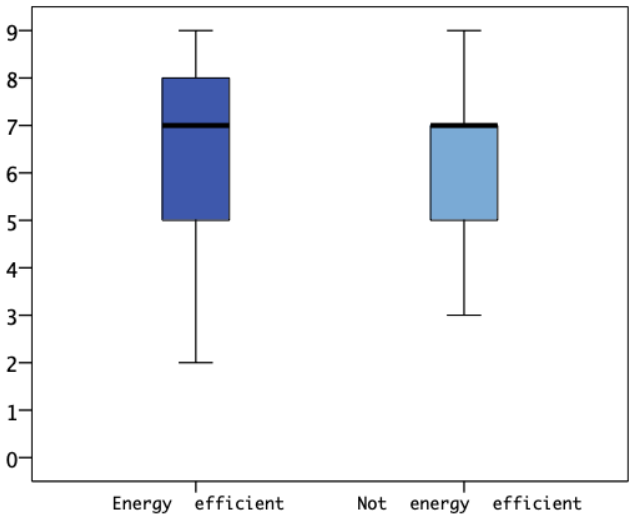
Graphic 5- 49 11H-Level of concern

The graph shows a dataset spreading from 2 to 9 on the scale, this suggests a varied level of concern across the group; the group is heterogeneous in their level of concern. At least some of the participants have the highest level of concern and there are some of them whose scored 2 on a scale of 9 on the level of concern.

50% of the group scored 6 or more and 75% of the group scored 5 or more. A

sample skewness of -0,196 leads us to conclude that the data is approximately symmetrical in a range from 2 to 9. The category was also analyzed by subgroups, that is, in order to find any significant difference between the groups, a comparison between the energy efficient group and the not energy efficient group in the category level of concern was made.

On Graph 5-50 both data distributions are shown. By comparing the data dispersion of both groups, it can be seen that both groups differ in the interquartile range and in the overall range. From the location of the data for both groups, the median of both groups scored 7 or more. By comparing the skewness of both batches of data it seems to be skewed up, but nether skewness is particularly marked. The sample skewness of -0,264 for the energy efficient group in a range from 2 to 9 and a sample skewness of -0,416 in a range from 3 to 9 leads us to conclude that both sets of data are moderately symmetrical. Although the data dispersion for both groups seems to be different, by using the Wilcoxon-Mann-Whitney-Test (z= -0,712 p-value= 0,476) it was found that the groups cannot be distinguished in the category level of concern about environmental problems and the efficient use of energy.



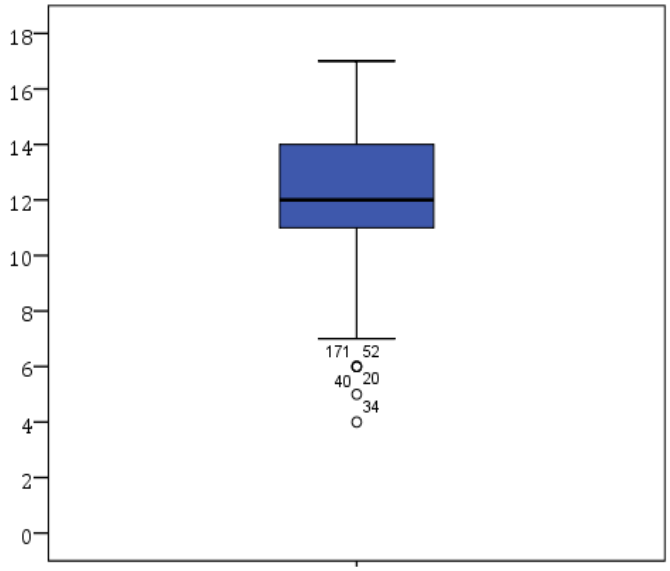
Graphic 5- 50 11H-Level of concern, by group

5.3.4 11H-Level of responsibility

In this category the results of six level of agreement questions are described. By answering the six questions the respondents had the chance to achieved a score from 0 to 18 points. For this category 153 valid answers were analyzed. Graph 5-51 deals with the results of this category.

The data distribution on Graph 5-51 spreads from 4 to 17, suggesting very varied views across the group. That is, the group is heterogeneous in the category level of responsibility.

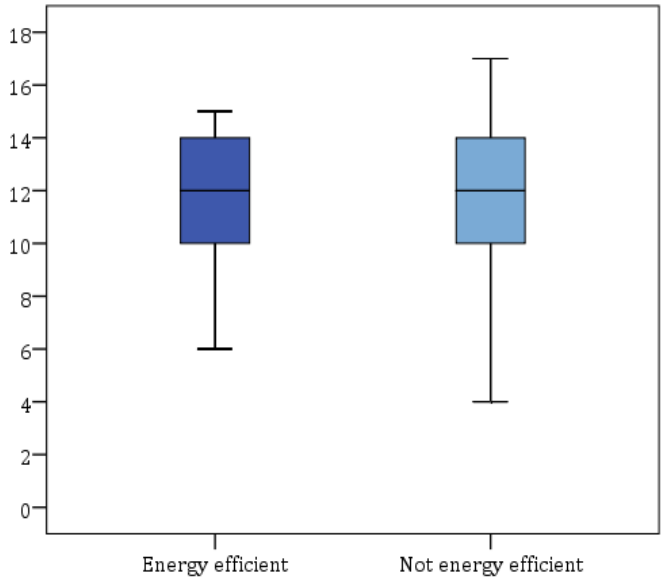
50% of the group scored 12 or higher. The dataset has some outliers which might require further study in future conclusions.



Graphic 5- 51 11H-Level of responsibility

A sample skewness of -0,563 allows us to conclude that the dataset is moderately skewed up, ranging from 4 to 17 on the level of responsibility scale. In order to find an area of difference between the energy efficient group and the not energy efficient group in relation to responsibility in environmental protection and the efficient use of energy 59 valid answers from the energy efficient group and 46 valid answers from the not energy efficient group were analyzed.

As can be seen on Graph 5-52, although the interquartile range seems to be similar on some parts of the scale, the overall range of the energy efficient group is smaller. By comparing data location, both medians are on the same level; 50% of both groups scored 12 or higher. Both datasets seem to be skewed up, but neither skewness is highly marked. From a sample skewness of -0532 for the energy efficient group, taking into account a range from 6 to 15, and a skewness of -0,492 for the not energy efficient group, ranging from 4 to 17 on the scale, we can conclude that the dataset of the energy efficient group is moderately skewed up, while the dataset of the not energy efficient group can be described as approximately symmetrical. Although the data distribution for both groups have some differences, from the results of the Wilcoxon-Mann-

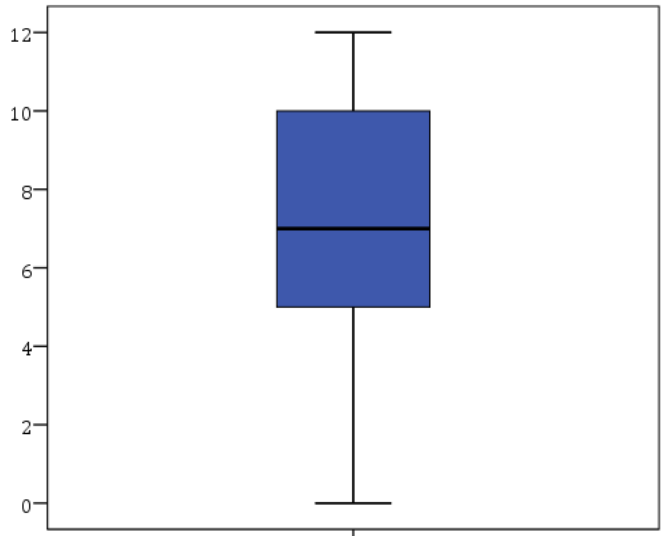


Graphic 5- 52 11H-Level of responsibility, by group

Whitney-Test (z= -0,212 p-value= 0,832) we can conclude that the energy efficient group and the not energy efficient group of the year eleven secondary school children from Honduras cannot be distinguished in the category level of responsibility about environmental problems and the efficient use of energy.

5.3.5 11H-Level of exposure to information

In this category the results of three frequency questions were collated. By answering the questions, the respondents had the chance to achieve a score of between 0 and 12 points. Graph 5-53 deals with the results of 157 school children who in year eleven in Honduras when the study was carried out.

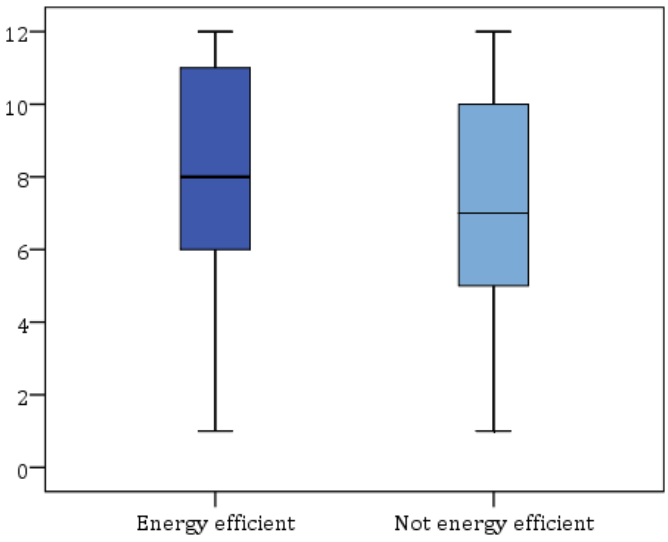


Graphic 5- 53 11H-Level of exposure to information

The graph shows a distribution spreading across the entire scale, this suggests that the students vary greatly in their level of exposure to information. 50% of the group range from 0 to 7 on the scale and the other 50% range from 7 to 12. From a sample skewness of -0,077 we can conclude that the dataset is approximately symmetrical, ranging across the entire scale.

To find out if both the energy efficient group and the not energy efficient group differ in their level of exposure to information 63 valid answers from the energy efficient group and 46 valid answers from the not energy efficient group were analyzed.

Graph 5-54 deals with the results of this analysis. The dataset of both groups spread from 1 to 12, showing very varied opinions across both groups. The interquartile range for both groups seems to be similar; the overall range is the same for both groups.



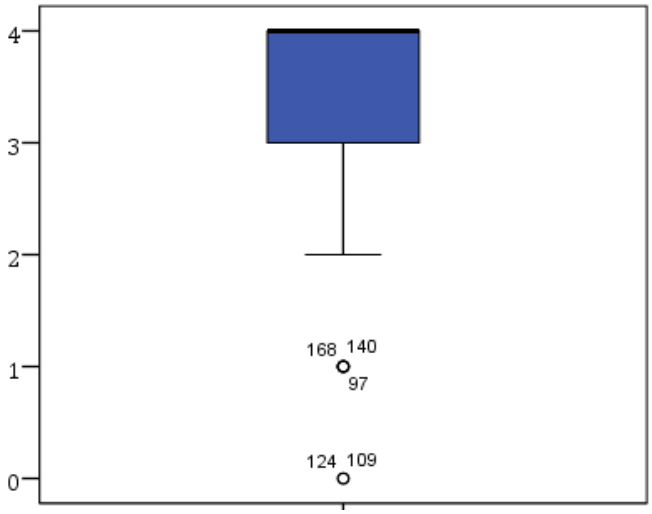
Graphic 5- 54 11H-Level pf exposure to information, by group

The median for the energy efficient group is greater by one point, and the dataset of the energy efficient group seems to be skewed up, but neither skewness is particular marked. A sample skewness of -0,306 for the energy efficient group and 0,15 for the not energy efficient group leads us to conclude that the dataset of both groups are approximately symmetrical.

Although the data distribution for both groups differs on some parts of the scale, from the results of the Wilcoxon-Mann-Whitney-Test (z= -1,556 p-value= 0,120) we can conclude that the energy efficient group and the not energy efficient group of year eleven secondary school children from Honduras cannot be distinguished in the category level of exposure to information about environmental problems and the efficient use of energy.

5.3.6 11H-Level of importance of "energy saving"

In this category the results of one association question are described. The question had five possible answers where the respondents had the chance to answer how important the topic "energy saving" is for them; by answering the question they could get a score from 0 to 4.



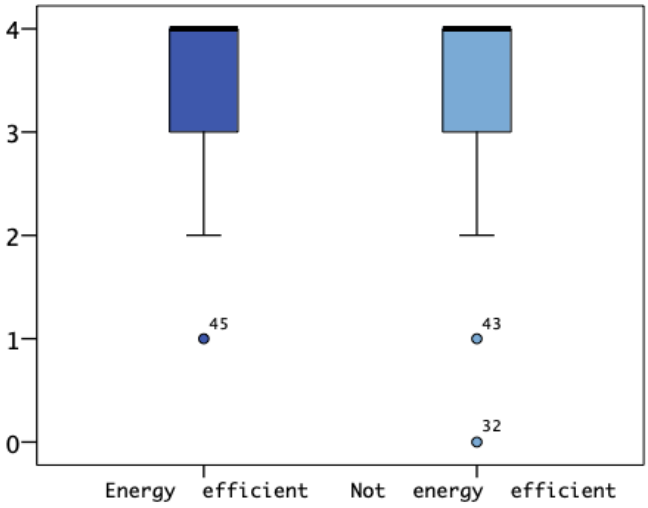
Graphic 5- 55 11H- Level of importance of "energy saving"

Graph 5-55 shows the results of 163 valid answers coming from the secondary school children. The data distribution on Graph 5-55 spreads from 0 to 4, taking into account the outliers, the opinions in this group about the importance of "energy

saving" are very varied; for some respondents the topic is extremely important while for other respondents the topic is not important at all. On some parts of the scale the students' views are more similar. 50% of the group scored 4 or less, a sample skewness of -1,623 leads us to conclude that the dataset in the category level of importance of energy saving is highly skewed.

To find an area of difference between the energy efficient group and the not energy efficient group regarding the importance of the topic "energy saving" 60 valid answers for the energy efficient group and 46 valid answer for the not energy efficient group were analyzed.

Graph 5-56 illustrates the results of this analysis. The graph shows two very similar distributions, both batches of data have an equal interquartile range and a similar overall range.

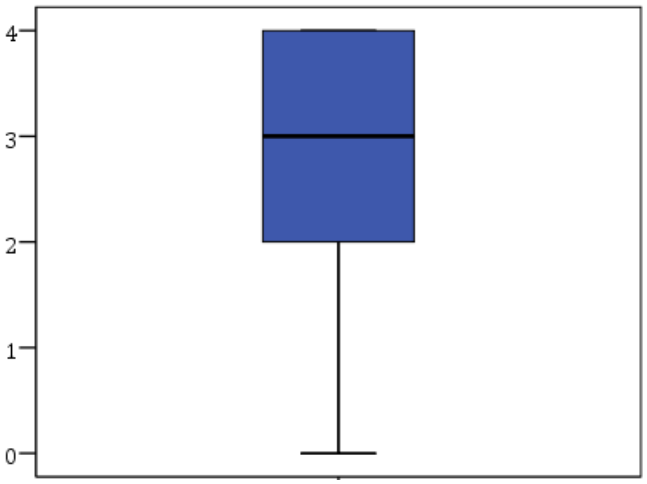


Graphic 5- 56 11H-Level of importance of "energy saving" by group

Both medians are at the same level, 50% of both groups scored 4 or less, and both datasets have outliers which could require further investigation in future conclusions. From the results of the Wilcoxon-Mann-Whitney-Test (z= -0,945 p-value= 0,345) we can say that the energy efficient group and the not energy efficient group of the year eleven secondary school children from Honduras cannot be distinguished in the category level of importance of energy saving.

5.3.7 11H-Level of willing to know more about energy efficiency

In this category the results of one question are described. The question had five possible answers with which it was possible to find out whether the respondents were willing to know more about energy efficiency. By answering the question, the responded had the chance to achieve a score from 0 to 4.

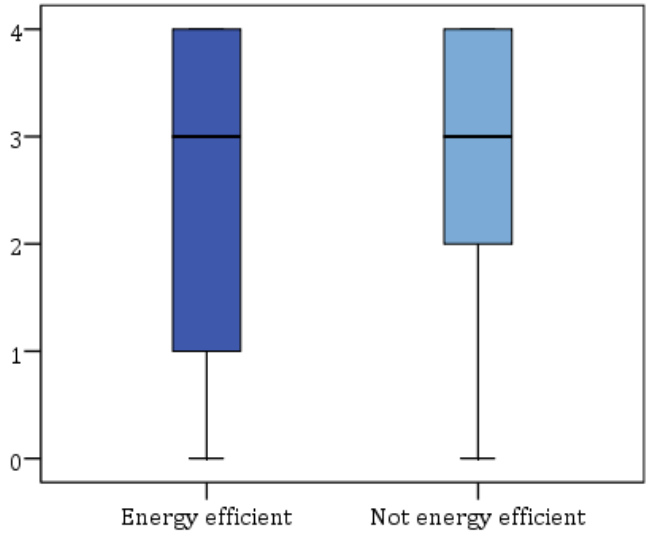


Graphic 5- 57 11H-Level of willing to know more about energy efficiency

Graph 5-57 deals with the results of 169 valid answers coming from the year eleven secondary school children in Honduras. The graph shows a data distribution that spreads across the entire scale. This suggests very varied opinions across the group. The group seems to be completely heterogeneous in willing to know more about energy efficiency, some want to know much more about the topic while others do not want to know anything more. The median is located at 3 on the scale. A sample skewness of -0,680 leads us to conclude that the dataset in the category willing to know more about energy efficiency is moderate skewed up, ranging from 0 to 4 on the scale.

In this category the results by subgroups were analyzed; 62 valid answers from the energy efficient groups and 47 valid answers from the not energy efficient group.

Graph 5-58 shows the data distribution of both groups. By comparing the data dispersion of both groups we found that although they slightly differ in the interquartile range, the overall range of both groups is the same; both datasets seem to be heterogeneous in the category willing to know more about energy efficiency. A sample skewness of -0,676 for the energy efficient group and -0,706 for the not energy efficient group, leads us to conclude that both datasets are moderately skewed up. Although the pattern distribution for both groups appears to differ on certain parts of the



Graphic 5- 58 11H-Level of willing to know more about energy efficiency

scale, by using the Wilcoxon-Mann-Whitney-Test (z= -0,051 p-value= 0,959) no significant difference was found between the groups.

From this results we can conclude that the energy efficient group and the not energy efficient group of year eleven secondary school children from Honduras cannot be distinguished in the category willing to know more about energy efficiency. Beside the results by category it is important to find out whether there is any relation between the categories.

5.3.8 11H-Relations between categories

By using the Spearman's rank correlation coefficient or Spearman's rho, were found different relations between the categories. For the year eleven secondary school children from Honduras the following correlation between the categories were found:

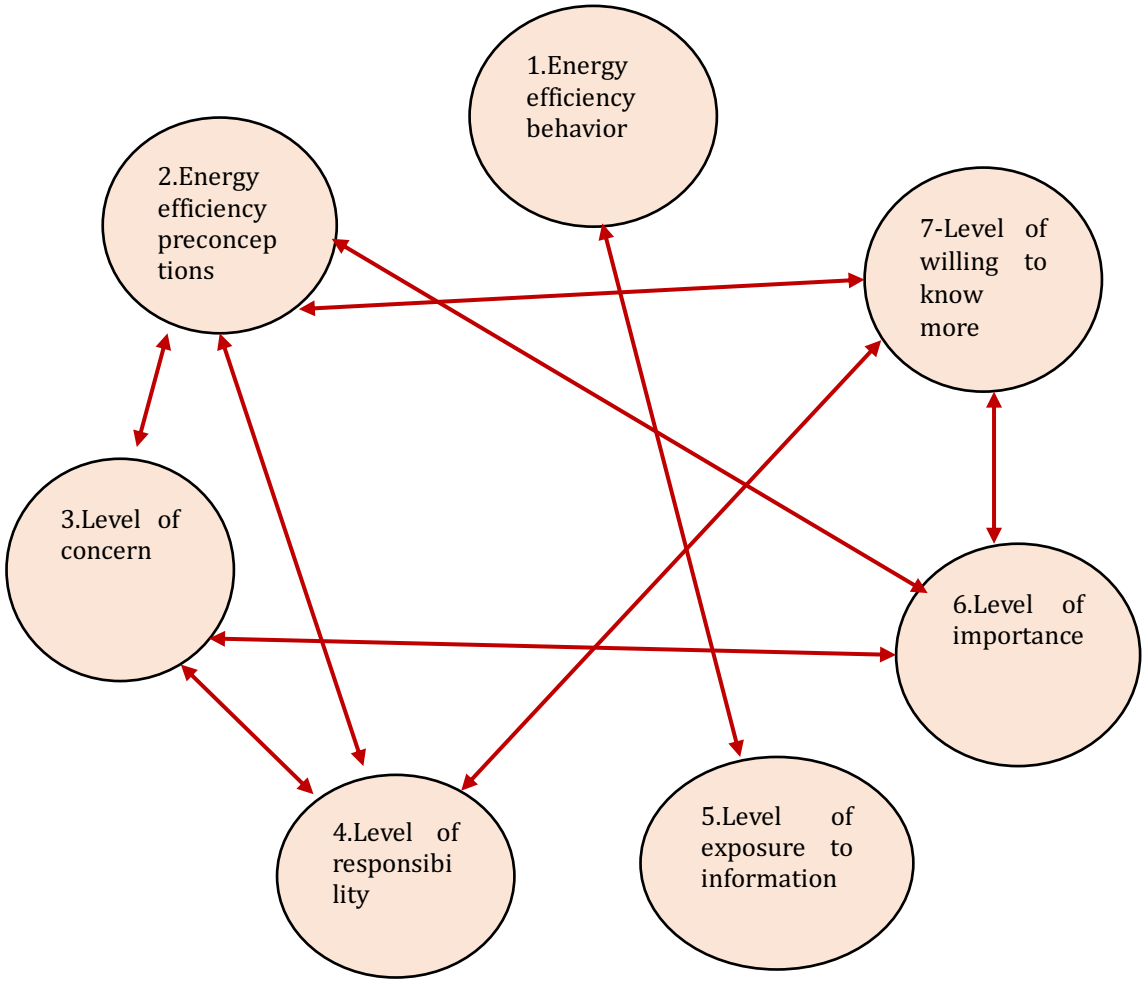
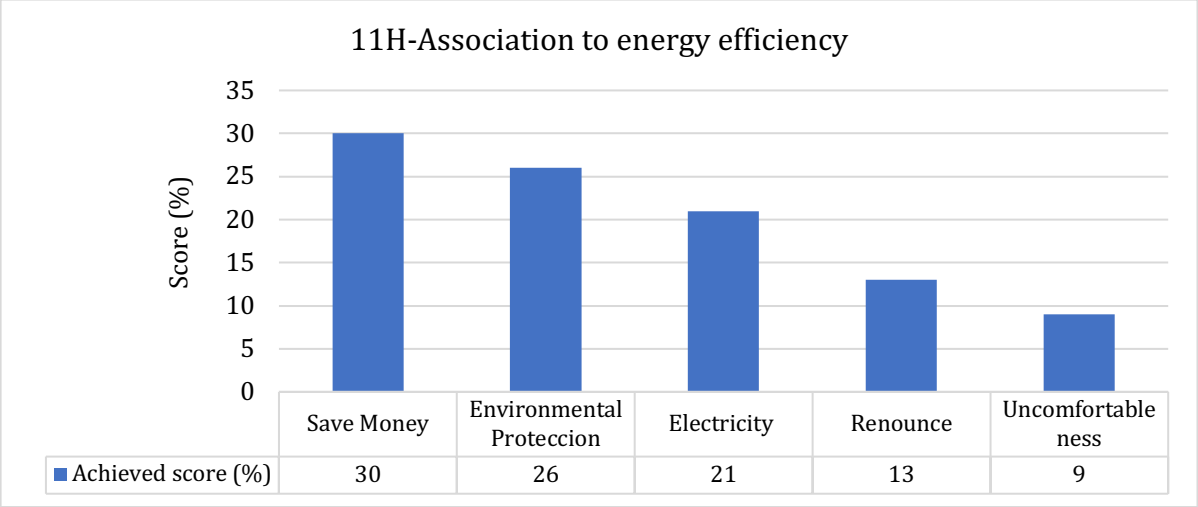


Diagram 5- 3 11-H Correlations between categories

5.3.9 11H- Associations with energy efficiency

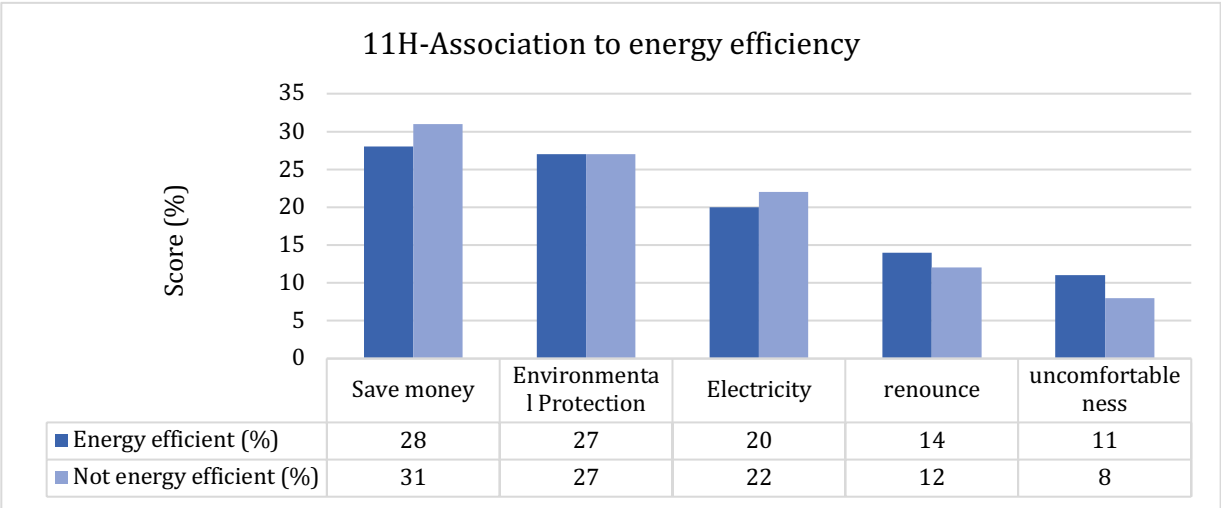
The following association question asked the respondents which for them is the term most and the least associated with energy efficiency. In order to find this association, the respondents were given five options. The respondents had to give a ranking with these five options from the term most associated with energy efficiency to the term least associated with energy efficiency.

The task was to give to each given option a level of importance from 1 to 5. For example, when for a respondent the option “save money” is the term most associated with energy efficiency, he/she should have marked the option as number 1. When the option “electricity” is the second most associated term with energy efficient, he/she should have marked this option as number two and so on until giving to each option a different number from one to five. To analyze the data a score was given to each answer. An option which was marked as number one was given 5 score points because it is the most important option for the respondents, so it gets the highest score. An option marked as number 2 was given 4 score points, the option marked as number 3 was given tree score points and so on until the option marked as number 5 got 1 score point. The last option means the term is the least associated with energy efficiency, in this regard this option gets the lowest score. In this order from each respondent we have five options scoring from 1 to 5. To get the group's ranking we added up the score given by each group member to each option. Once we added the scores, the option with the total highest score occupied the first place in the ranking and the option with the lowest total score occupied the last place in the ranking. On Graph 5-59 are shown the results.



Graphic 5- 59 11H-Association to energy efficiency

The graph shows that the term most associated with energy efficiency for this group of children is "save money", following by "environmental protection", the third term in the ranking is "electricity" and the terms least associated with energy efficiency for them are "renounce" and "uncomfortableness". In order to see whether any area of difference appears by associating energy efficiency with the five mentioned list of terms the results of 42 valid answers from the energy efficient group and 27 valid answers from the not energy efficient group were analyzed. Graph 5-60 deals with the results.



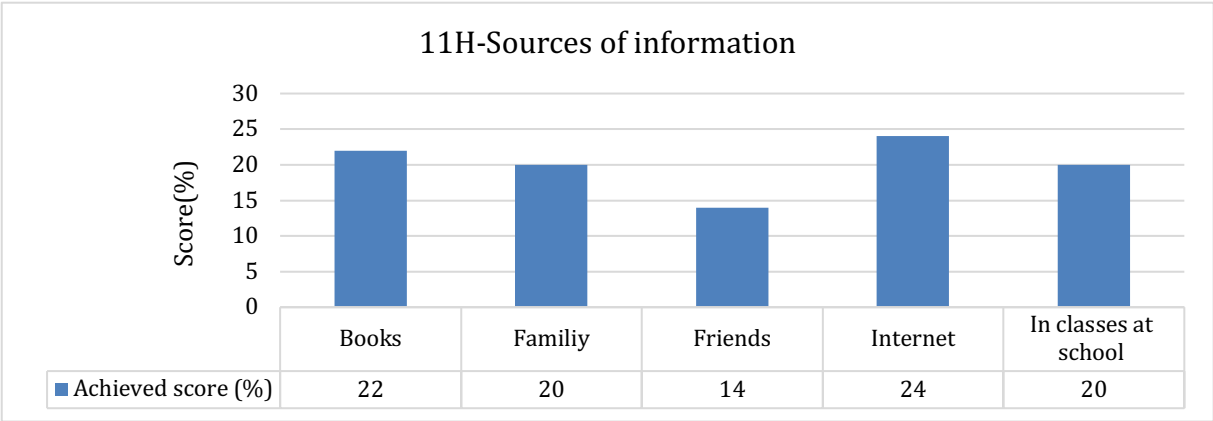
Graphic 5- 60 11H-Association to energy efficiency, by group

Graph 5-60 shows that both groups give the same ranking, however they differ in the percentage of achievement corresponding to each option. Even though the results of the Wilcoxon–Mann–Whitney-Test ("save money" z= -1,457, *p*-value= 0,145; "environmental

protection" z= -0,961, *p*-value= 0,337; "electricity" z= -1,629, *p*-value= 0,103; "renounce" z= -1,186, *p*-value= 0,236; "uncomfortableness" z= -0,969, *p*-value= 0,333) leads us to conclude that both groups are not distinguished by ranking the word most associated with energy efficiency.

5.3.10 11H-Sources of Information

This association question aimed to find out which is the most used source of information by year eleven secondary school children from Honduras. To this end the respondents were given five sources of information with which they should give a ranking with the most and the least used source of information for them. Graph 5-61 shows the ranking given by 96 students.

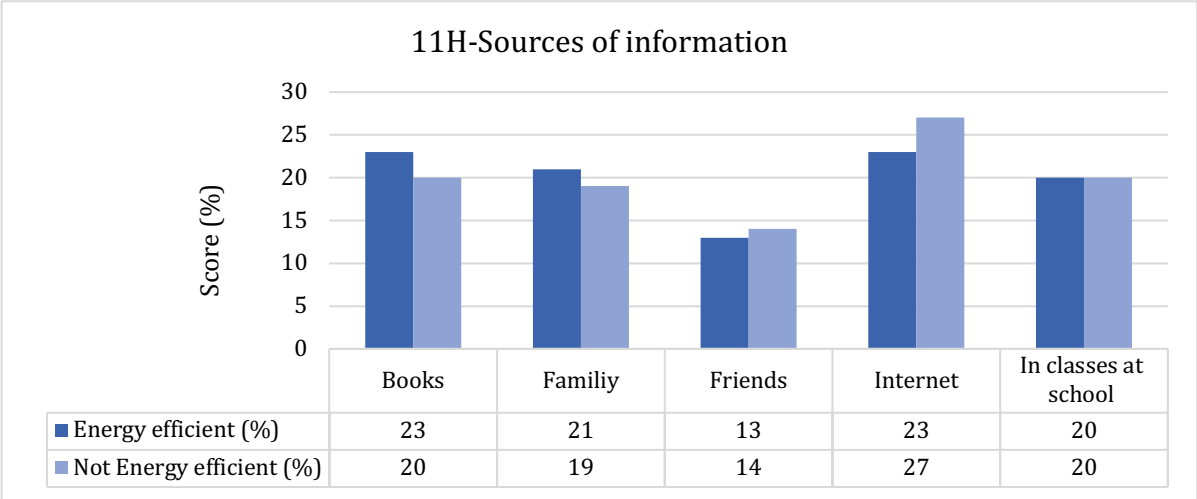


Graphic 5- 61 11H-Sources of information

They named the "internet" as their first source of information about environmental problems and the efficient use of energy, "books" are in second place in the ranking, followed by "family" in the third place. "In classes at school" takes the fourth position in the ranking as a source of information. "Friends" with 14% of achievement is located in the last position in the ranking.

In order to find out whether the energy efficient group and the not energy efficient group differ in the most and the least used source of information, 33 valid answers from the energy efficient group and 26 valid answers from the not energy efficient group were analyzed.

On Graph 5-62 the rankings given by both groups is shown.



Graphic 5- 62 11H-Sources of information, by group

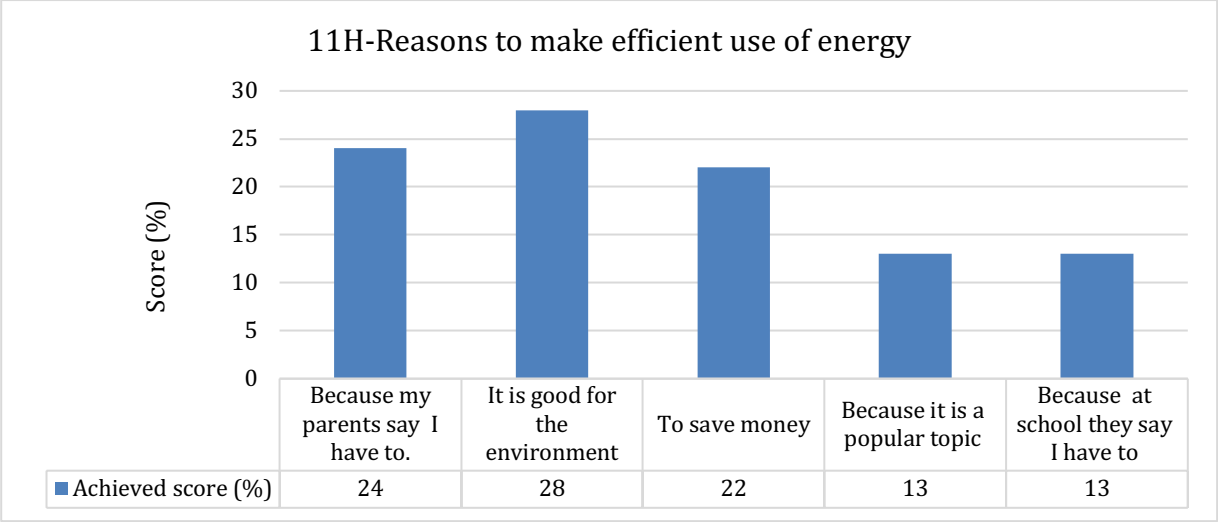
The graph shows that both groups give similar rankings for the most and the least used source of information. They slightly differ by ranking the "internet", "books" and "in classes at school", but the results of the Wilcoxon–Mann–Whitney-Test ("books" z= -1,166, *p*-value= 0,244; "family" z= -0,751, *p*-value= 0,452; "friends" z= -0,657, *p*-value= 0,511: "internet" z= -1,665, *p*-value= 0,096; "in classes at school" z= -0,181, *p*-value= 0,856) leads us to conclude that both groups are not distinguished by ranking the most used source of information.

In this way we can consider that the ranking given by both groups is the same as the one from the entire group, so in future comparisons the ranking given by the entire group will be used.

5.3.11 11H-Reasons to make efficient use of energy

This association question aimed to find out which are the principal reasons that the respondents could have to make efficient use of energy. To this end the respondents were given five reasons: because my parents say I have to, it is good for the environment, to save money, because it is a popular topic and because at school they say I have to do it.

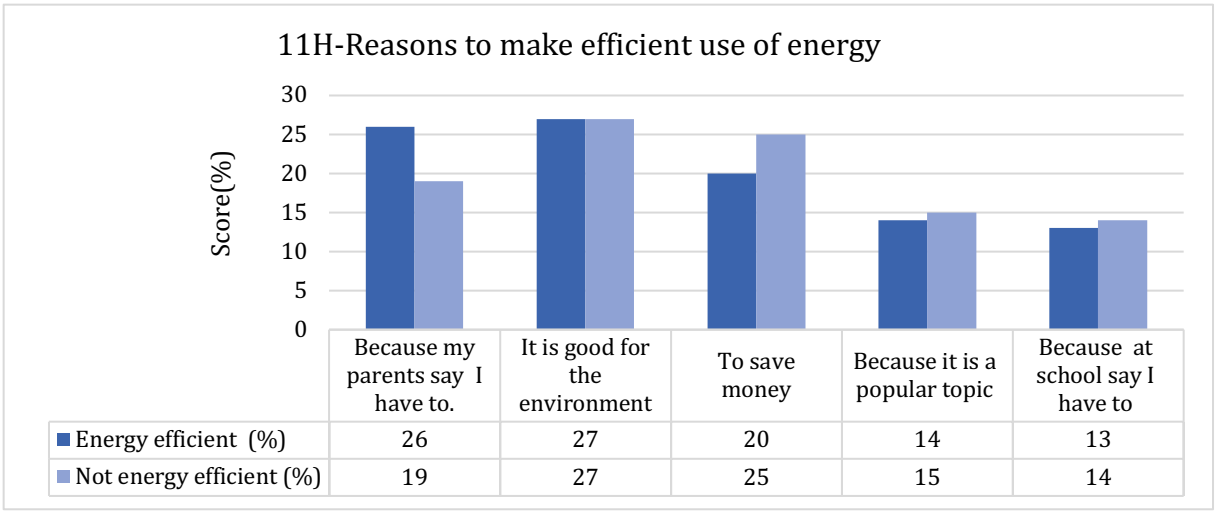
They should rank the most important and the least important reasons. Graph 5-63 shown the ranking given by 100 year eleven secondary school children from Honduras.



Graphic 5- 63 11H-Reasons to make efficient use of energy

It can be seen on the graph that the main reason to make efficient use of energy for this group of children is because it is good for the environment, in second place in the ranking they chose because my parents say I have to and the third reasons for them is to save money. Because it is a popular topic and because at school they say I have to do it are both located in last place in the ranking.

In order to find out whether the energy efficient group and the not energy efficient group differ in ranking the reasons to make efficient use of energy 36 valid answers from the energy



Graphic 5- 64 11H-Reasons to make efficient use of energy, by group

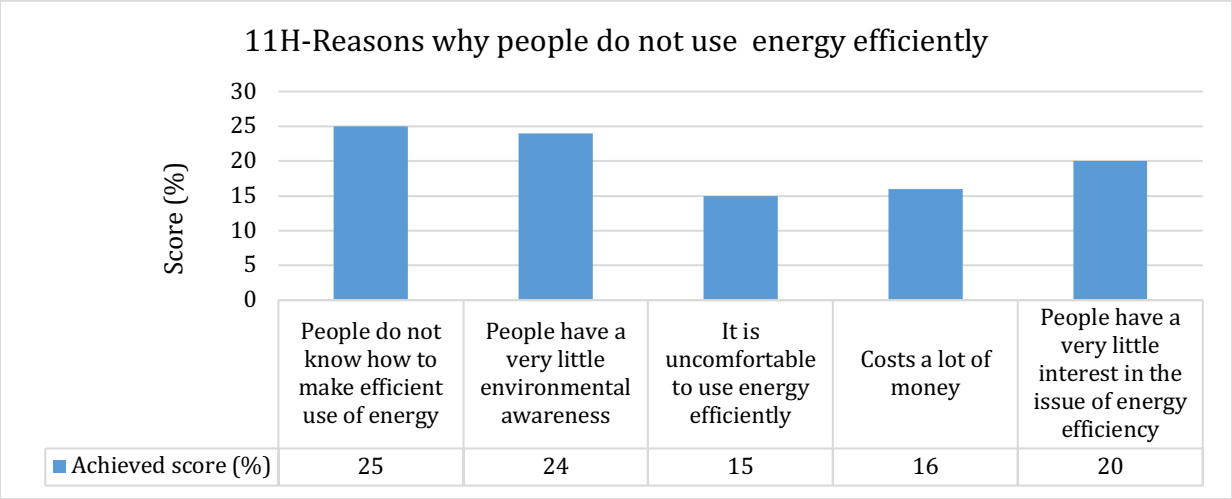
efficient group and 21 valid answers from the not energy efficient group were analyzed. Graph 5-64 deals with the results of this analysis.

The graph shows that both groups ranked three of the five reasons at the same position, they differ by ranking to save money as a reason to make efficient use of energy and because their parents say they have to

Even though the results of the Wilcoxon–Mann–Whitney-Test ("Because my parents say you have to do it" z= -2,783, *p*-value= 0,005; "It is good for the environment" z= -0,125, *p*-value= 0,9; "To save money" z= -2,195, *p*-value= 0,028; "Because it is a popular topic" z= -0,564, *p*-value= 0,573; "Because at school they say I have to do it" z= -0,404, *p*-value= 0,686) leads us to conclude that, both groups differ in ranking the first and the third position. It seems that because the parents say they have to do it and to save money are more important reason to use energy efficiently for the energy efficient group. In ranking the other three reasons both groups cannot be distinguished.

5.3.12 11H-Reasons why people do not use energy efficiently

The last association question was aimed at finding out the students' opinions regarding the reasons why people do not use energy efficiently. In this association question five reasons why people do not make efficient use of energy were given to the students. The task was to rank the following five reasons: people do not know how to make efficient use of energy,



Graphic 5- 65 11H-Reasons why people do not use energy efficiently

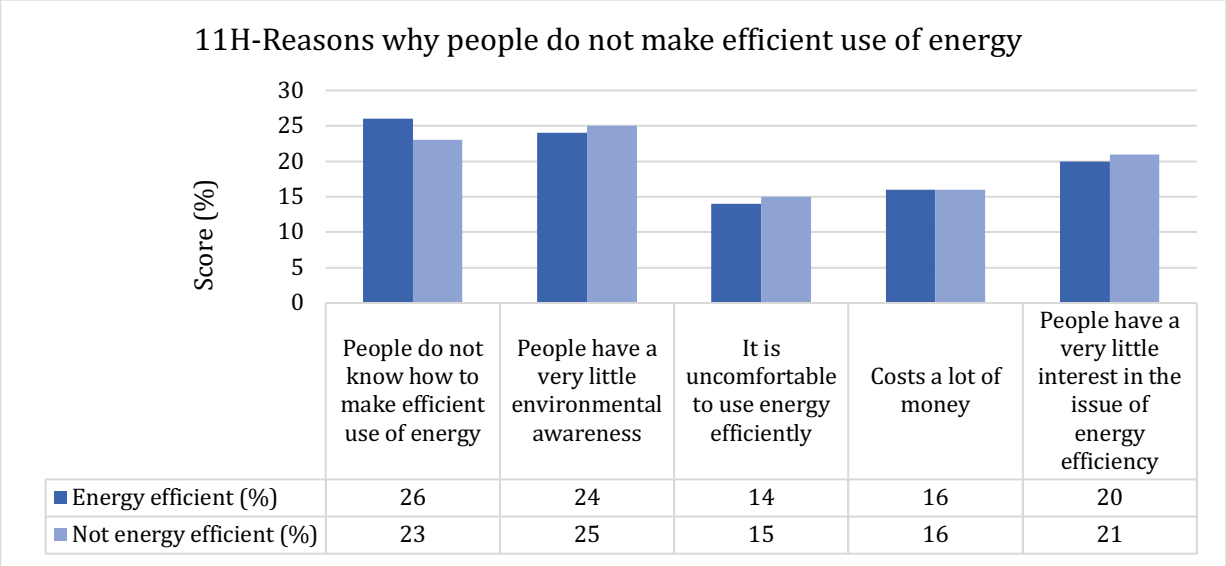
people have very little environmental awareness, it is uncomfortable to use energy efficiently, costs a lot of money and people have very little interest in the issue of energy efficiency.

On Graph 5-65 are shown the rankings given by 88 year eleven secondary school children from Honduras.

The graph shows that for this group of children the principal reason why people do not make efficient use of energy is because people do not know how to make it, secondly they think it is because of people's poor environmental awareness. In third place in the ranking is people's lack of interest in the topic. The reasons in the last two positions are because it costs a lot of money and because it is uncomfortable to use energy efficiently, respectively.

To find out whether the energy efficient group and the not energy efficient group gave the same rankings for the reasons why people do not make efficient use of energy 38 valid answers from the energy efficient group and 21 valid answers from the not energy efficient group were analyzed.

Graph 5-66 deals with the results.



Graphic 5- 66 11H- Reasons why people do not make efficient use of energy, by group

The graph shows that both groups have ranked in the same position 3 of the 5 reasons. Due to the results of the Wilcoxon–Mann–Whitney-Test (People do not know how to make efficient use of energy z= -1,24, *p*-value= 0,215; People have very little environmental awareness z= -

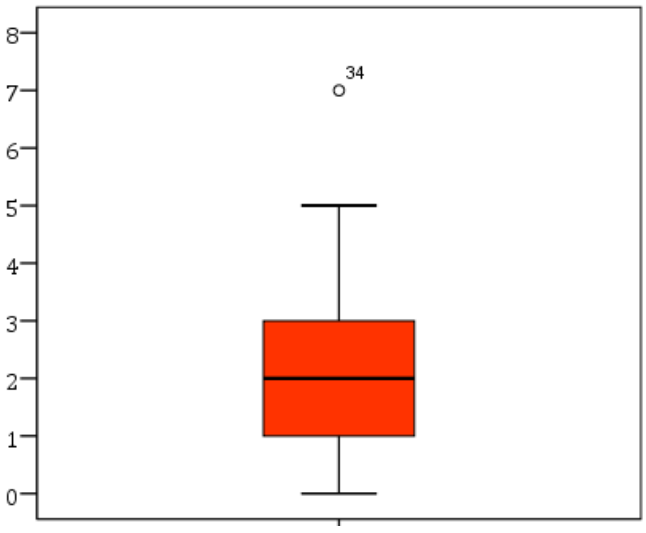
0,628, *p*-value= 0,53; It is uncomfortable to use energy efficiently z= -0,65, *p*-value= 0,516; costs a lot of money z= -0,041, *p*-value= 0,967; People have very little interest in the topic of energy efficiency z= -0,269, *p*-value= 0,788), it is considered that there are no significant differences between the groups regarding the reasons why people do not use energy efficiently. In future comparisons we are going to use the ranking given by the entire group.

5.4 Year Eleven secondary school children Germany

In this section the results of a survey are described that was aimed at 152 secondary school children in year eleven in Germany when the survey was carried out. The results are presented in seven categories and four association questions. Each category as well as each association question have a different number of valid answers. In the description the valid answers belonging to each category will be named. As in the previous sections, the first category to be described is energy efficiency behavior.

5.4.1 11G-Energy efficiency behavior

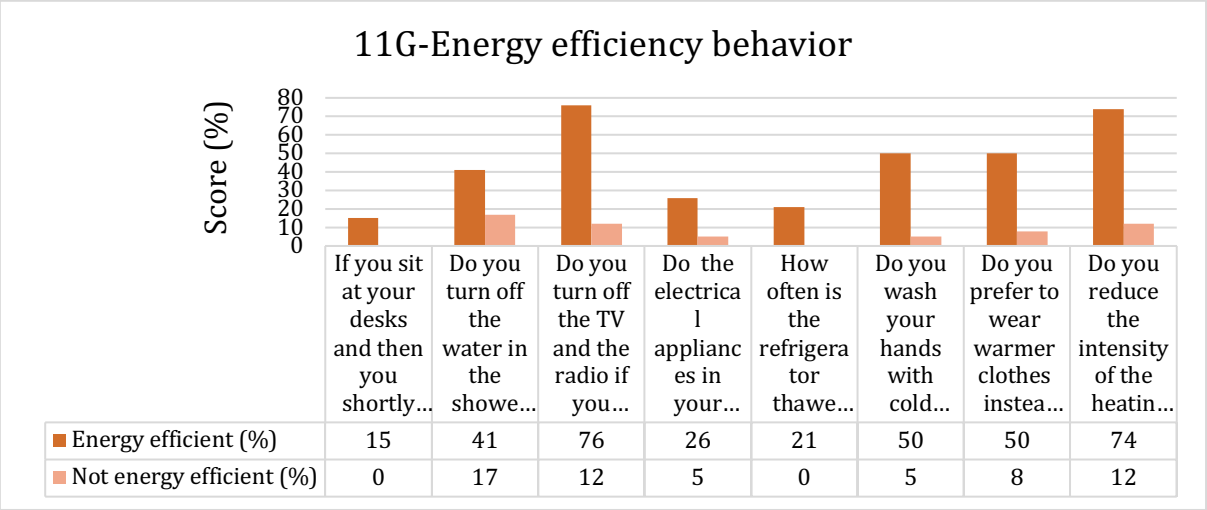
In this category the results of eight questions are described; each question describes behavior in using energy efficiently. By answering all the eight questions the respondents had the chance to achieved a score from 1 to 8 points. Graph 5-67 shows the results of 121 valid answers.



Graphic 5- 67 11G-Energy efficiency behavior

The graph shows data distribution spreading from 0 to 7 on the scale, suggesting heterogeneity in the category. 50% of the group scored 2 or less, while 75% of the group scored 3 or less on the scale. A skewness of 0,787, leads us to conclude that the dataset is moderately skewed down. On the upper side of the scale there is an outlier which could require a further inquiry in future conclusions.

The 121 valid answers of this category were divided into two groups: the energy efficient and the not energy efficient. The energy efficient group are the ones who are above the median, the not energy efficient are the ones who are below the median. To this end a median split was made which has given as a result three groups: 59 participants in the not energy efficient group, 34 participants in the energy efficient group and 28 participants who were exactly at the median. Discounting the group representing the participants exactly at the median, Graph 5-68 shows whether both other groups, the not energy efficient and the energy efficient, differ in question achievement in the category energy efficiency behavior.

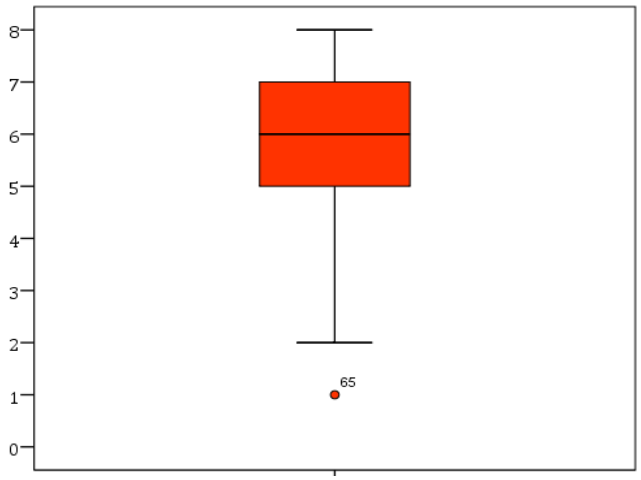


Graphic 5- 68 11G- Energy efficiency behavior, by group

The graph shows that the achievement of both groups differ in each of the eight questions. Both groups differ the most on question achievement regarding the use of electrical appliances like radios and TVs and by reducing the intensity of the heating at night. From now on for each category and each association question the results of the 152 secondary school children as well as the results of the 59 participants the not energy efficient group and the 34 participants in the energy efficient group will be described.

5.4.2 11G-Preconceptions about energy efficiency

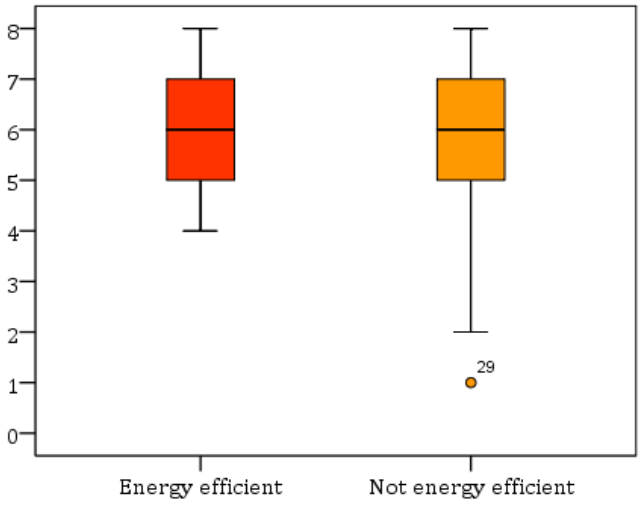
This category has 4 level of agreement questions. By answering each question, the respondents had the chance to achieve a score of between 0 and 8 points. Graph 5-69 deals with the results for this category.



Graphic 5- 69 11G-Preconception about energy efficiency

The graph shows a dataset spreading from 1 to 8 on the scale, suggesting very varied views across the group and the median is located at 6 on the scale. 50% of the group scored 6 or higher and 75% of the group scored 5 or higher. A skewness of -0,692 allows us to conclude that the dataset is moderately skewed up, ranging from 1 to 8 on the scale. The dataset for this category has 1 outlier which could require further analysis in future conclusions. In order to find any area of difference between the energy efficient group and the not energy efficient group, 29 valid answers from the energy efficient group and 50 valid answers from the not energy efficient group were analyzed. Graph 5-70 deals with these results.

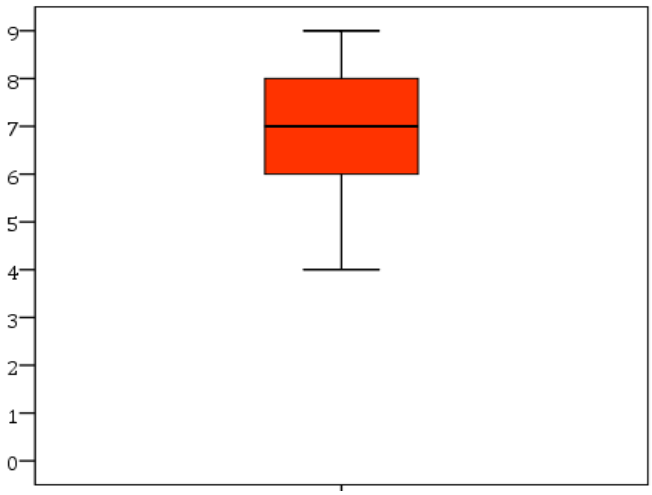
By comparing the data dispersion, the interquartile ranges are reasonably similar for both groups, though the overall range is greater for the not energy efficient group. By comparing the data location, both medians are at the same level, 50% of both groups scored 6 or more and 75% of both groups scored 5 or more. A skewness of -0,207 for the energy efficient group and -0,607 for the not energy efficient group leads us to conclude that the dataset of the energy efficient group is approximately symmetrical, while the batch of data for the not energy efficient group is moderately skewed up. Although both data distributions appear to have some differences, by comparing both datasets using the Wilcoxon-Mann-Whitney-Test the results (z= -0,895 p-value= 0,371), leads us to conclude that the groups cannot be distinguished in the category preconceptions about energy efficiency.



Graphic 5- 70 11G-Preconception about energy efficient, by group

5.4.3 11G-Level of concern.

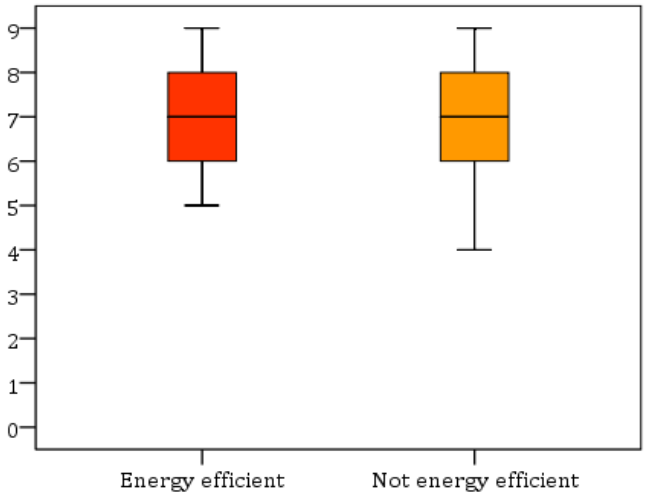
In the category level of concern the results of three level of agreement question were collated. By answering the three questions the participants had the chance to achieve a score of between 0 and 9 points. In the analysis of this category the results of 125 valid answers were taken into account. Graph 5-71 shows the results.



Graphic 5- 71 11G-Level of concern

The dataset spreads from 4 to 9 on the scale, showing different views across the group. 50% of the group scored 7 or higher and 75% of the group scored 6 or higher. From a skewness of -0,44 we can describe the dataset as approximately symmetrical, ranging from 4 to 9 on the scale.

In order to find any area of difference between the energy efficient group and the not energy efficient group 28 valid answers from the energy efficient group and 51 valid answer from the not energy efficient group were analyzed.



Graphic 5- 72 11G-Level of concern, by group

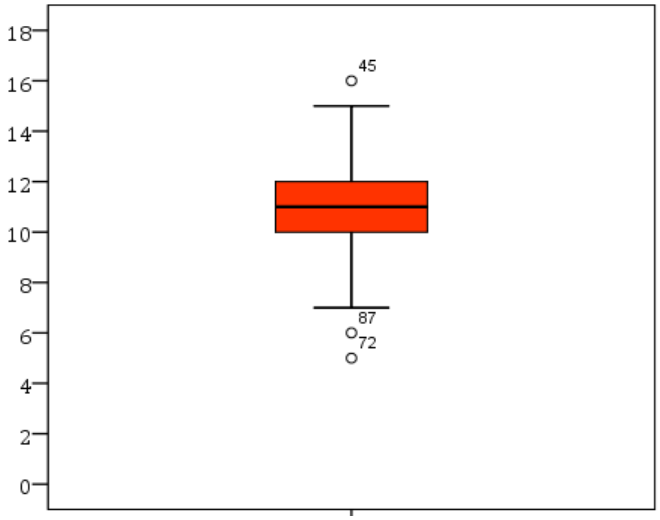
On Graph 5-72 the results of this analysis are shown. The graph shows two similar patterns for both groups. By comparing the dispersion, the interquartile range seems to be reasonably similar for both groups, while the overall range is greater for the not energy efficient group. By comparing the data location, 50% of both groups scored 7 or higher and 75% of both groups scored 6 or higher. Both batches of data appear to be up skewed but neither skewness is particularly marked. A skewness of -0,711 for the energy efficient group and

0,080 for the not energy efficient group allows us to conclude that the dataset of the energy efficient group is more skewed up in the range from 5 to 9.

By comparing the dataset using the Wilcoxon-Mann-Whitney-Test, the results of the test (z= -0,259 p-value= 0,796) leads us to conclude that the groups cannot be distinguished in the category level of concern.

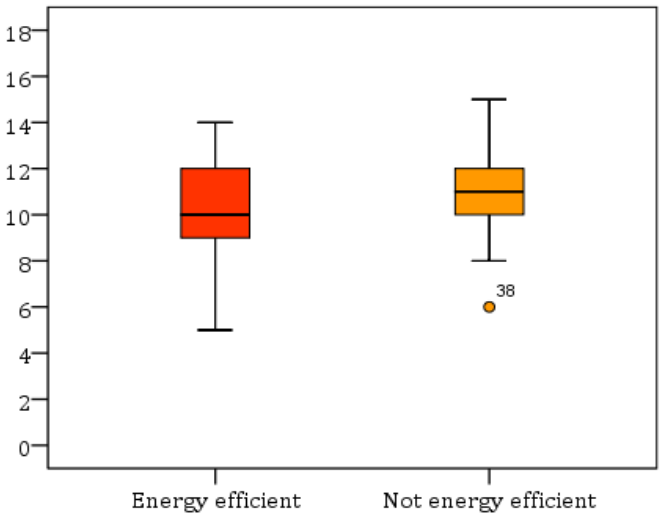
5.4.4 11G-Level of Responsibility

The category level of responsibility was created by putting together the results of 6 level of agreement questions. By answering all the 6 questions the respondents had the chance to achieve a score of between 0 and 18 points. In the category 125 valid answers coming from year eleven secondary school children from Germany were analyzed.



Graphic 5- 73 11G-Level of responsibility

On Graph 5-73 are shown the results of this analysis. The data distribution on Graph 5-73 spreads from 5 to 16 on the scale, suggesting very varied opinions amongst the group. 50% of the group scored 11 or more on the scale and 75% of the group scored 10 or more on the scale. The dataset has outliers at the beginning and at the end of the scale, which might require further analysis in future conclusions. A skewness of 0,092 allows us to conclude that the dataset is approximately symmetrical, ranging from 5 to 16 on the scale. In order to see whether both the energy efficient and the not energy efficient groups differ in the category level of responsibility, 28 valid answers from the energy efficient group and 51 valid answers from the not energy efficient group were analyzed. On Graph 5-74 are shown the results of this analysis.

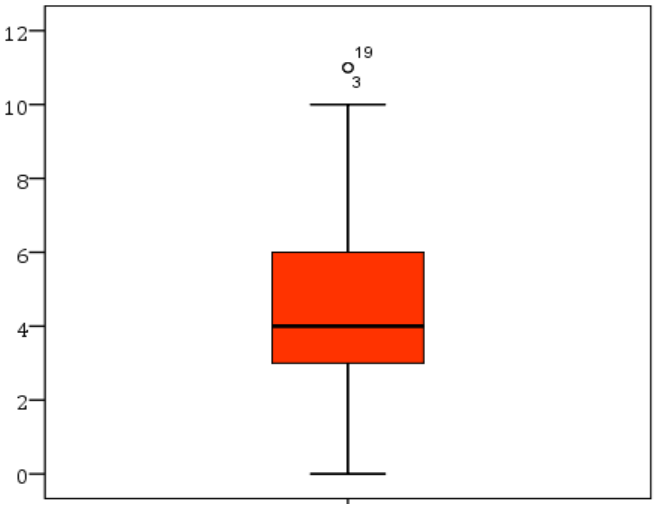


Graphic 5- 74 11G-Level of responsibility, by group

As can be seen on the graph, the dataset differs on the interquartile range and on the overall range. By comparing the data location, the median of the not energy efficient group is greater by one point; the dataset of the not energy efficient group also has an outlier, which might require special attention in future conclusions. By comparing the skewness of both batches of data, a skewness of 0-,351 for the energy efficient group and 0,070 for the not energy efficient group leads us to conclude that both groups have approximately symmetrical data distributions. By comparing the data distribution using the Wilcoxon-Mann-Whitney-Test, the results (z= -0,715 p-value= 0,475) leads us to conclude that the groups cannot be distinguished in the category level of responsibility.

5.4.5 11G-Level of exposure to information

To find out whether the respondents are exposed to information about environmental problems and the efficient use of energy three frequency questions added to this category. By answering the three questions the respondents had the chance to score between 0 and 12 points. In this category 141 valid answers were analyzed. The results of this analysis are shown on Graph 5-75.



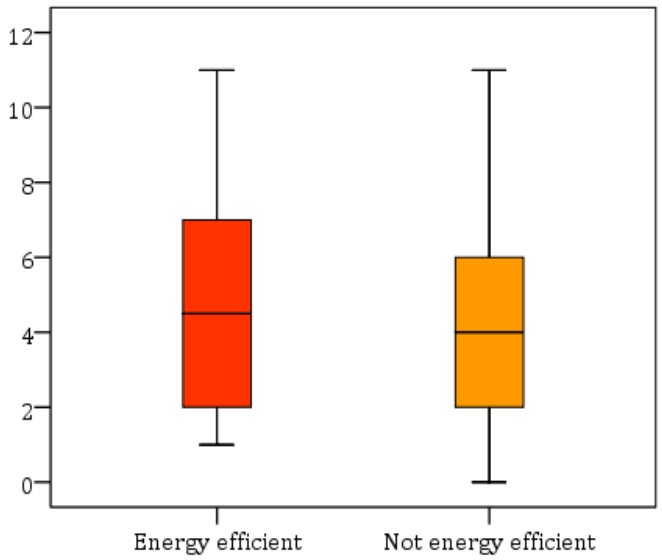
Graphic 5- 75 11G-Level of exposure to information

It can be seen on the graph that the data distribution spreads from 0 to 12 on the scale, suggesting that the group is heterogeneous in the level of exposure to information. 50% of the group scored 4 or less and 75% of the group scored 6 or less. There are 2 outliers which might require further analysis in future conclusions. A skewness of 0,424 allows us to describe

the data distribution in the category level of exposure to information as approximately symmetrical, ranging across the entire scale.

In order to find out whether the energy efficient group and the not energy efficient group can be distinguished in the category level of exposure to information, 34 valid answers from the energy efficient group and 57 valid answers from the not energy efficient group were analyzed. Graph 5-76 deals with the results. The graph shows a similar pattern.

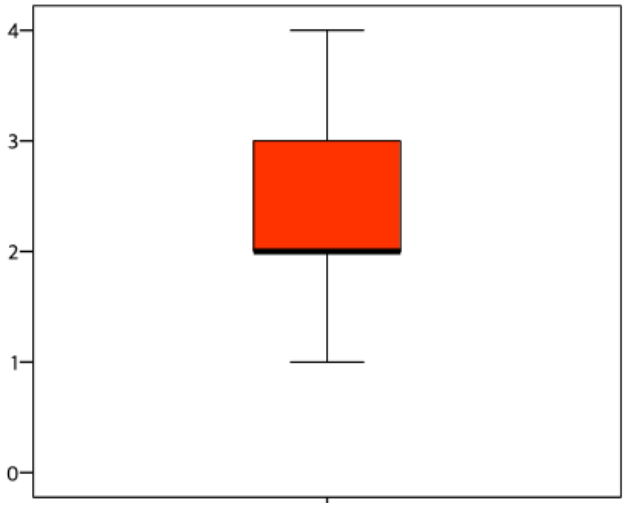
By comparing the data distribution, the interquartile range is similar for both groups while the overall range is also similar for both batches of data. By comparing the data location, the median of the energy efficient group is slightly higher. Although both groups appear to differ on some parts of the scale, the results of the Wilcoxon-Mann-Whitney-Test (z= -0,744 p-value= 0,457) leads us to conclude that both the energy efficient group and the not energy efficient cannot be distinguished in the category level of exposure to information.



Graphic 5- 76 11G-Level of exposure to information, by group

5.4.6 11G-Level of importance of "energy saving"

This category has one simple question where the respondents were asked whether the topic "energy saving" was important to them. To answers the question five possible answers were given to the respondents; each possible answer means a level of importance from not important at all to extremely important. By answering the question, they had the chance to achieve a score of between 0 and 4 points. Into this category 143 valid answers were analyzed. Graph 5-77 shows the results.

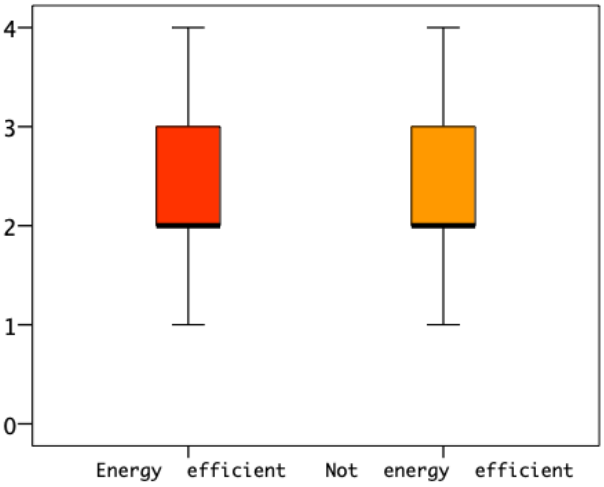


Graphic 5- 77 11-G Level of importance of "energy saving"

The graph shows a dataset spreading from 1 to 4 on the scale. It suggests that the group is heterogeneous in the level of importance of energy saving. 75% of the group scored 2 or higher on the scale.

From a skewness of 0,469 we can conclude that the dataset in this category is approximately symmetrical.

In order to find out whether the energy efficient group and the not energy efficient group could be distinguished in the category level of exposure to information, 32 valid answers from the energy efficient group and 56 valid answers from the not energy efficient group were analyzed. Graph 5-78 deals with the results.



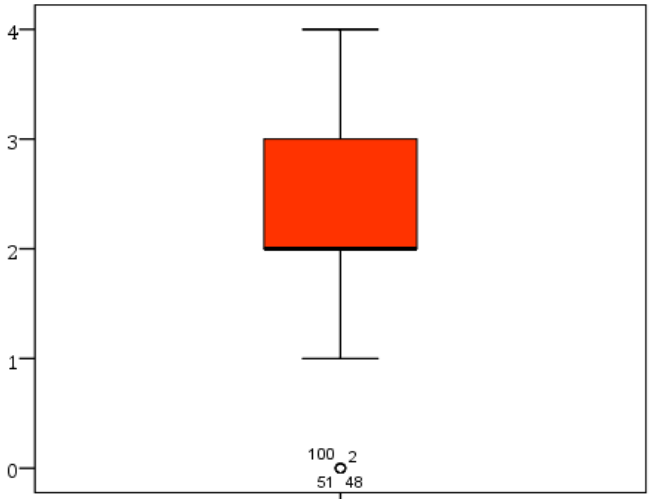
Graphic 5- 78 11G-Level of importance of "energy saving" by group

The graph shows similar data distribution. By comparing the data dispersion, the interquartile range of both group is similar as well as the overall range. By comparing the data location 75% of both groups scored 2 or more. A skewness of 0,469 for the energy efficient group and 0,230 for the not energy efficient group leads us to conclude that both batches of data are approximately symmetrical.

By comparing both data distributions using the Wilcoxon-Mann-Whitney-Test for two independent samples, the test's results (z= -2,491, p-value= 0,013) leads us to conclude that both groups can be distinguished in the category level of importance on the topic "energy saving". A full analysis of the data distribution leads us to conclude that the topic energy saving is more important for the energy efficient group.

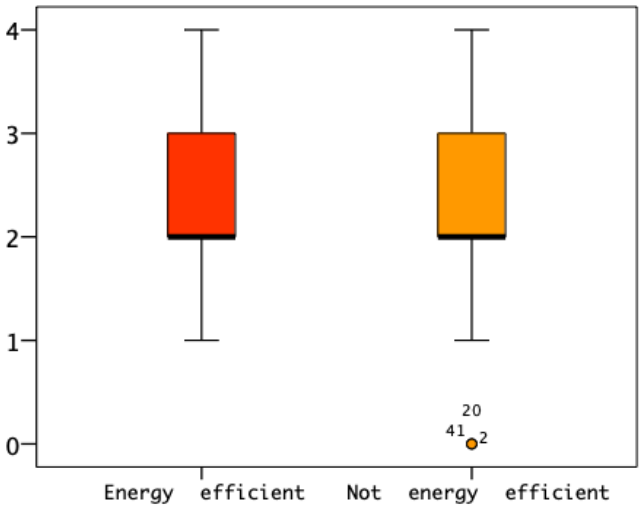
5.4.7 11G-Level of willing to know more to know more about energy efficiency

To find out whether the respondents want to know more about energy efficiency in this category one single choice question was included. The students were able to choose between five possible answers. On Graph 5-79 the results of 140 valid answers are shown.



Graphic 5- 79 11G-Level of willing to know more about energy efficiency.

As it can be seen on the graph, the data distribution spreads across the entire scale, suggesting heterogeneity in the category. 50% of the group scored 2 or more on the scale. The data has also had 4 outliers to be analyzed in future conclusions. From a skewness of -0,276 we can conclude that the data distribution in the category is approximately symmetrical. In order to find out whether the energy efficient group and the not energy efficient group can be distinguished in the category want to know more about energy efficiency 31 valid answers from the energy efficient group and 56 valid answers from the not energy efficient group were analyzed.



Graphic 5- 80 11G-Level of willing to know more about energy efficiency, by group

Graph 5-80 shows the data distribution for the results.

In the data dispersion both groups are reasonably similar in the interquartile range as well as in the overall range. In the data location, both batches of data are similar too; 75% of both groups scored 2 or higher. A skewness of 0,427 for the energy efficient group and -0,332 for the not energy efficient group illustrates that both batches of data are approximately symmetrical. Finally, the results of the Wilcoxon-Mann-Whitney-Test (z= -1,893, p-value=

0,058) leads us to conclude that both groups cannot be distinguished in wanting to know more about energy efficiency.

5.4.8 11G-Correlations between the categories

From the results of the survey targeted at 152 year eleven secondary school children in Germany found the following correlations between the groups.

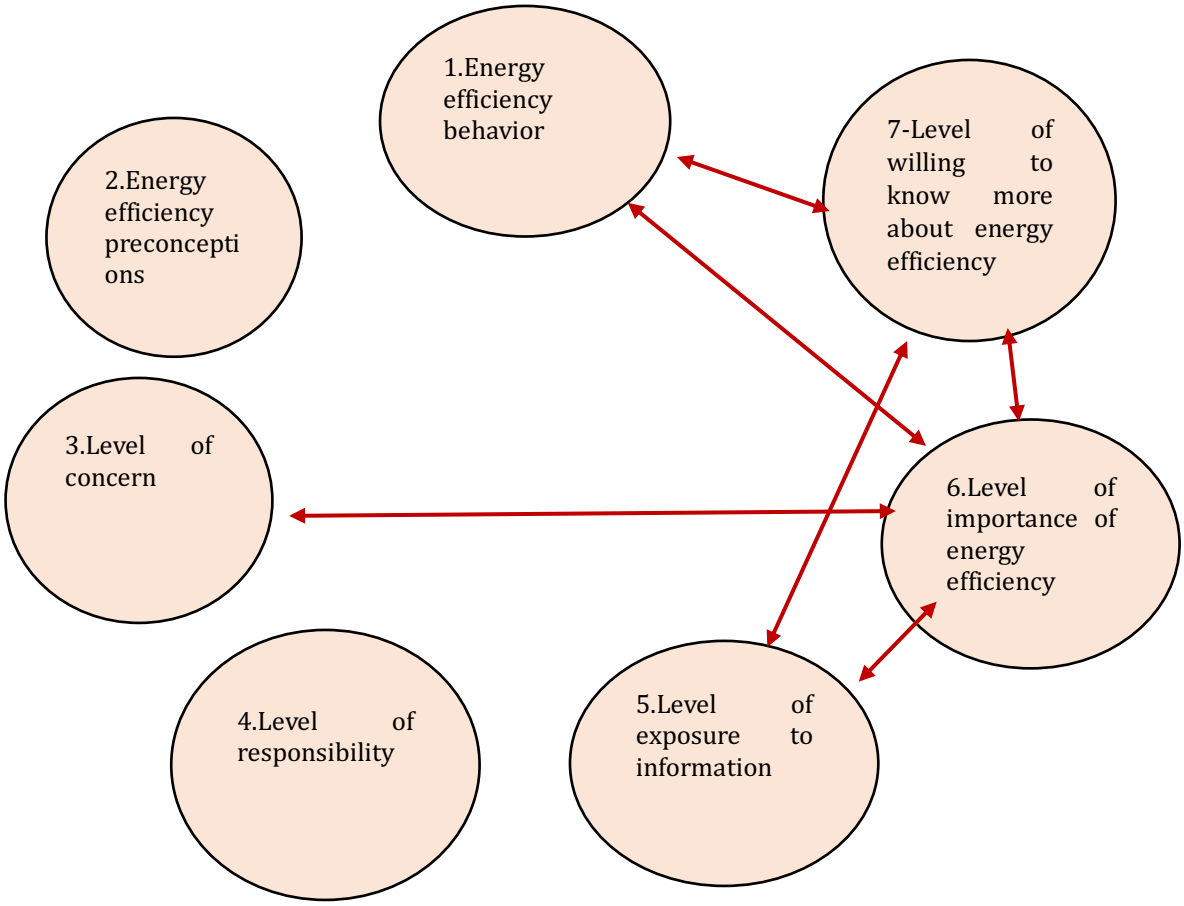
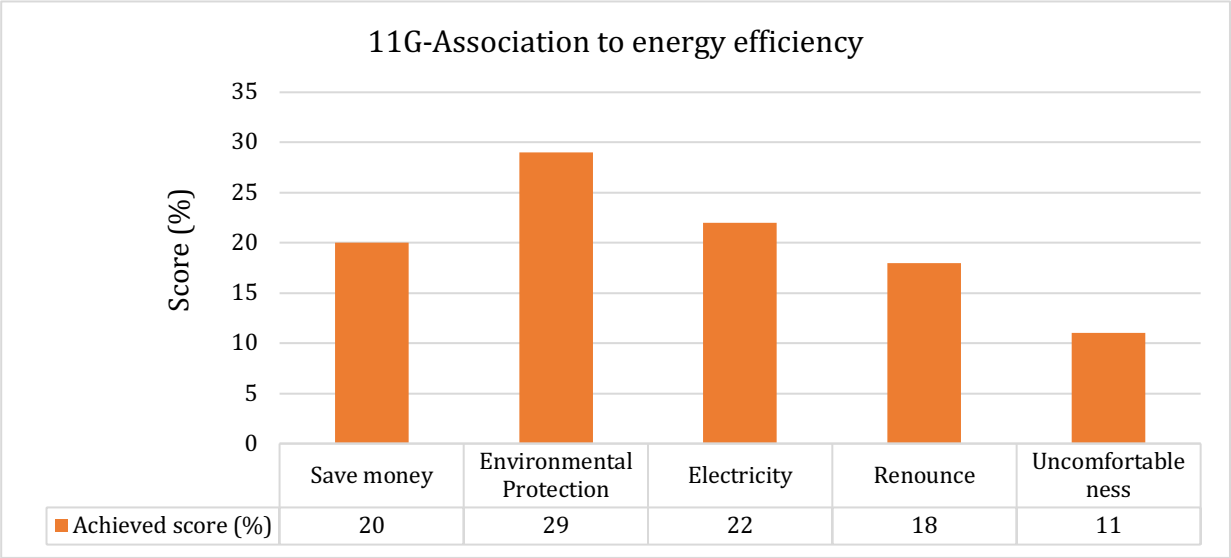


Diagram 5- 4 11-G Correlations between categories

5.4.9 11G-Associations to energy efficiency

In this section the association that the respondents made regarding energy efficiency are described. In the question five options were given to the students, the target was to give a ranking with these five options, in first place being the term most associated with energy efficiency and in fifth place the term least associated with energy efficiency. On Graph 5-81

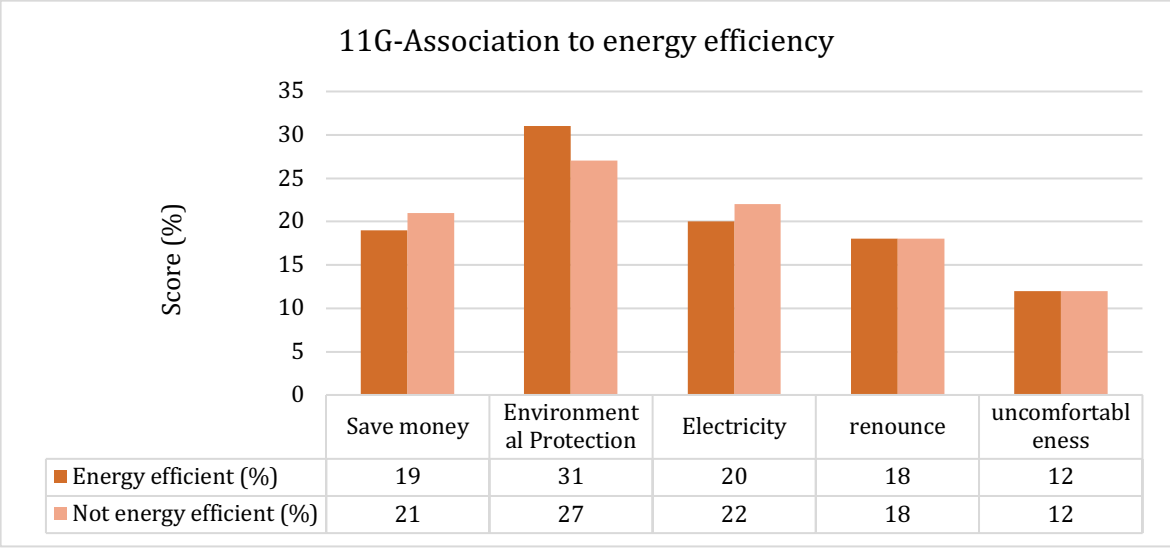
are shown the results of 119 valid answers coming from the year eleven secondary school children from Germany.



Graphic 5- 81 11G-Associationen to energy efficiency

It can be seen on the graph that the term most associated with energy efficiency for this group was environmental protection, followed by electricity, while in third place in the ranking is save money. Renounce and uncomfortableness are located in the last places of the ranking.

To find whether the energy efficient group and the not energy efficient group make the same associations with energy efficiency 27 valid answers from the energy efficient group and 47 valid answers from the not energy efficient group were analyzed. On Graph 5-82 are shown the rankings given by the two groups.



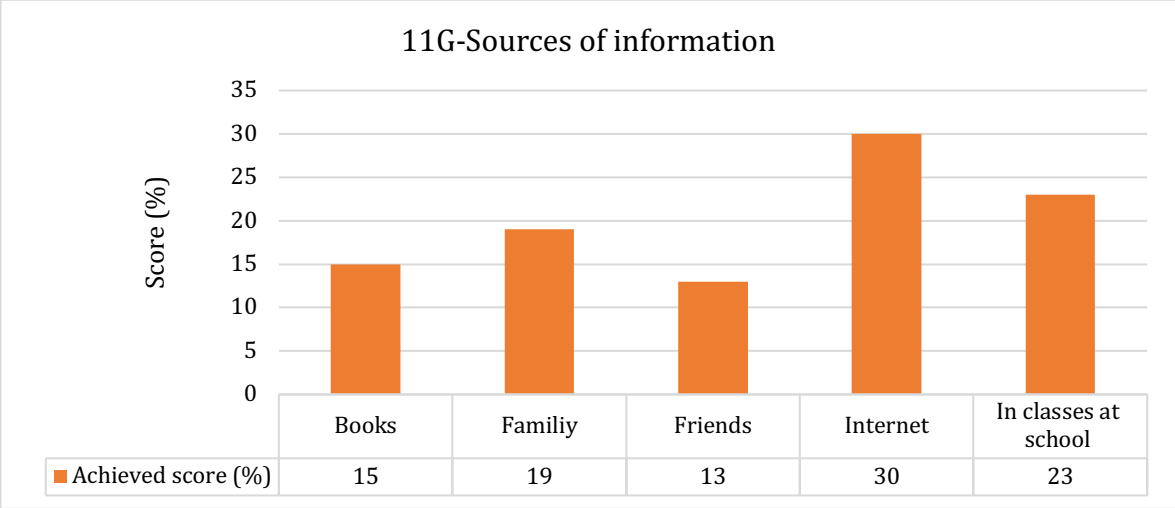
Graphic 5- 82 11G- Association to energy efficiency, by group

Both groups have given the same rankings; the term most associated with energy efficiency for both groups was environmental protection and the term least associated in the ranking of both groups is uncomfortableness.

By comparing both groups with each other, the results of the Wilcoxon–Mann–Whitney-Test ("save money" z= -0,719, *p*-value= 0,472; "environmental protection" z= -2,019, *p*-value= 0,044; "electricity" z= -0,987, *p*-value= 0,324; "renounce" z= -0,322, *p*-value= 0,457; "uncomfortableness" z= -0,074, *p*-value= 0,941) leads us to conclude that both groups are not distinguished by ranking environmental protection. From the graph we can conclude that the energy efficient group made a stronger association of environmental protection with energy efficiency. The groups do not differ by ranking save money, electricity, renounce and uncomfortableness.

5.4.10 Sources of Information

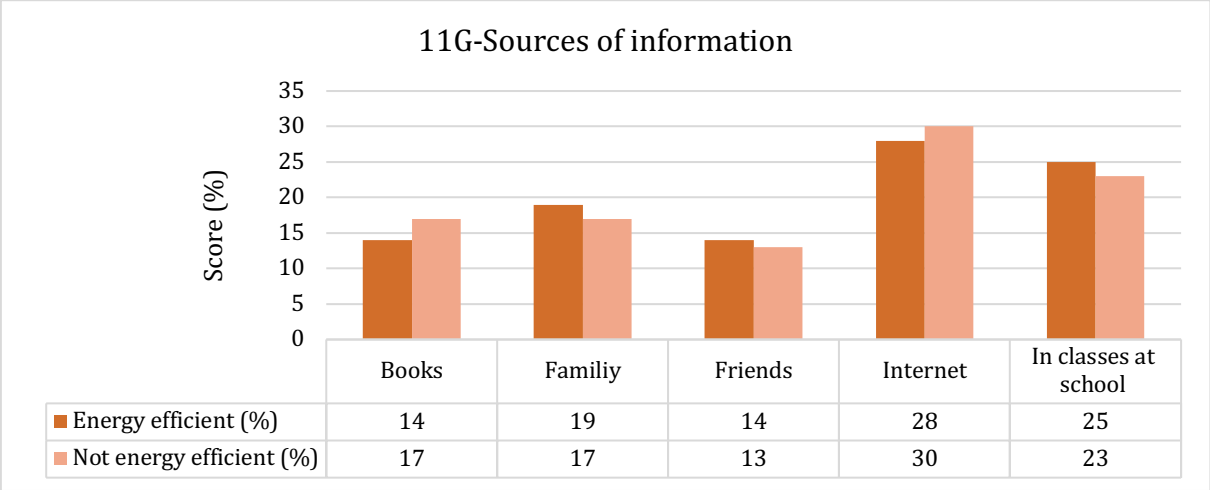
This association question aimed to discover the most and the least used sources of information by the group of respondents. On Graph 5-83 shown the rankings given by 105 year eleven secondary school children from Germany.



Graphic 5- 83 11G-Sources of information

It can be seen on the graph that the most used source of information by this group was the internet, followed by in classes at school; as the third source of information they used family and the least used sources of information are books and friends. In order to find out whether the energy efficient group and the not energy efficient group differ in ranking their sources

of information, 22 valid answers from the energy efficient group and 46 valid answers from the not energy efficient group were analyzed. Graph 5-84 deals with the results.



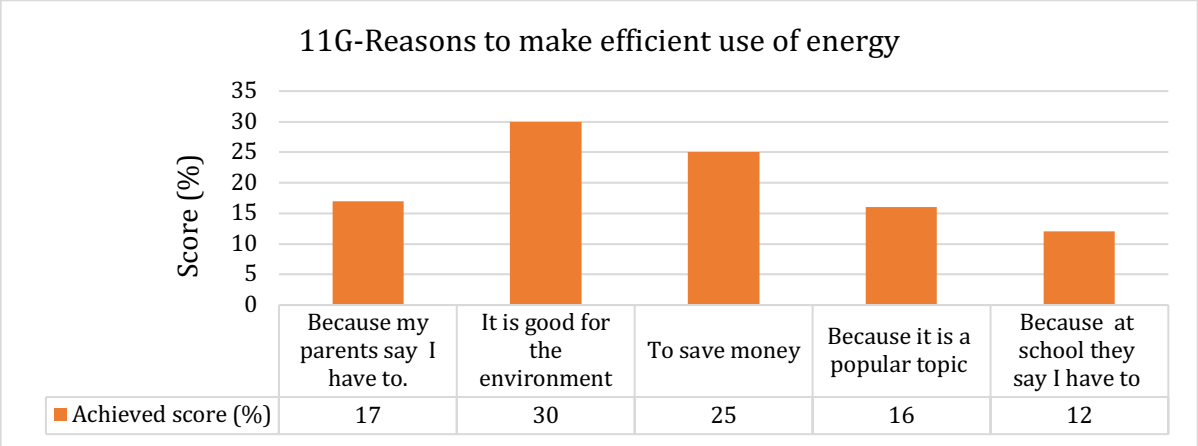
	Books	Familiy	Friends	Internet	In classes at school
Energy efficient (%)	14	19	14	28	25
Not energy efficient (%)	17	17	13	30	23

Graphic 5- 84 11G-Sources of information, by group

The graph shows that both groups gave similar rankings. By comparing both groups with each other by using the Wilcoxon–Mann–Whitney-Test ("books" z= -2,052, *p*-value= 0,04; "family" z= -1,035, *p*-value= 0,301; "friends" z= -1,447, *p*-value= 0,148; "internet" z= -1,302, *p*-value= 0,193; "in classes at school" z= -0,92, *p*-value= 0,357) we have found that the energy efficient group use books as a source of information more often than the not energy efficient group. By ranking family, friends, internet and in classes at school both groups do not differ.

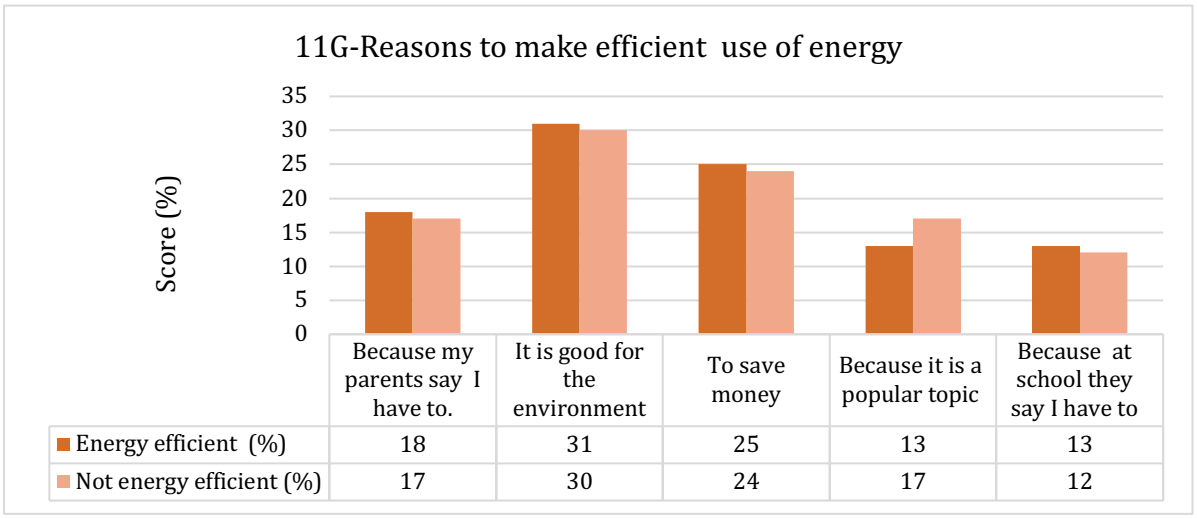
5.4.11 11G-Reasons to make efficient use of energy

In order to find out which are the main reasons that the group of students have in making efficient use of energy, they were asked in this question to rank a given list of reasons from 1 to 5; 1 being the principal reason and 5 the least important reason for them to make efficient use of energy. On Graph 5-85 are shown the results of 117 valid answers.



Graphic 5- 85 11G-Reasons to make efficient use of energy

It can be seen on the graph that the year eleven secondary school children from Germany would be willing to make efficient use of energy principally because it is good for the environment, following in the ranking the second reason they have is to save money. In third place in the ranking is because their parents say they have to. The last two reasons for them were because is a popular topic and because at school say they have to. In order to find an area of difference between the energy efficient group and the not energy efficient group 25 valid answers from the energy efficient group and 49 valid answers from the not energy efficient group were analyzed. Graph 5-86 deals with the results.



Graphic 5- 86 11G-Reasons to make efficient use of energy , group

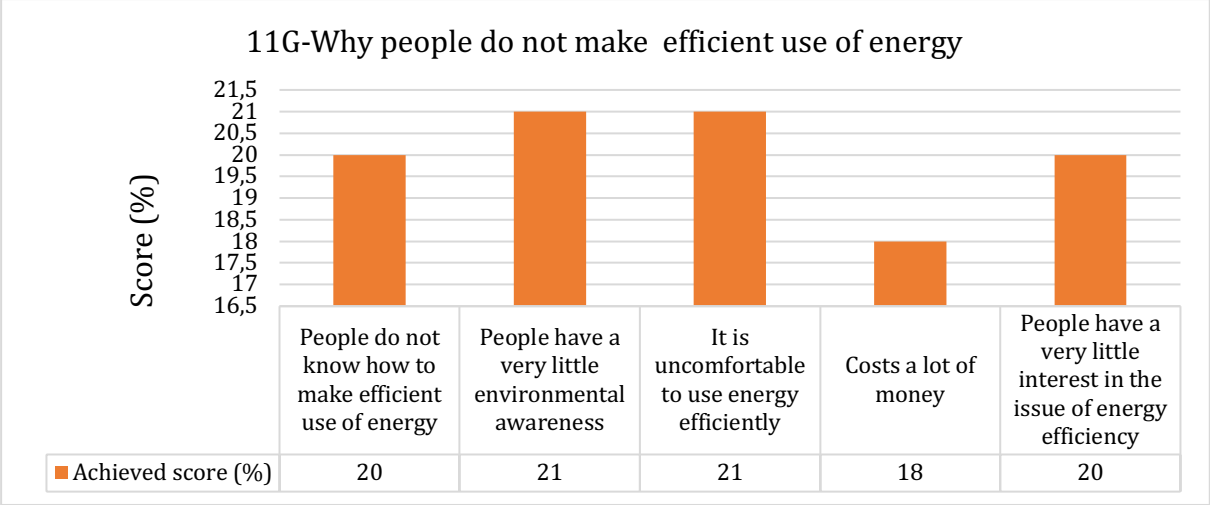
From Graph 5-86 we can say that both groups have gaven the same rankings. The results of the Wilcoxon–Mann–Whitney-Test ("because my parents say you have to do it" z= -0,909, *p*-value= 0,363; "it is good for the environment" z= -0,208, *p*-value= 0,835; "to save money" z=

-0,283, *p*-value= 0,777; “because it is a popular topic” z= -2,842, *p*-value= 0,004; “because at school they say that you have to do it” z= -0,863, *p*-value= 0,388) leads us to conclude that both groups are distinguished by ranking because it is a popular topic as a reason to make efficient use of energy. We can conclude from the graph that this reason is more important for the not energy efficient group. By ranking the other four reason to make efficient use of energy both groups were found not to be distinguished

5.4.12 11G-Reasons why people do not make efficient use of energy

To find out the students' opinions regarding the reasons people could have to not make efficient use of energy five possible reasons were given to the students. The task was to give a ranking of these five reasons, 1 being the most important reason and 5 the least important reason.

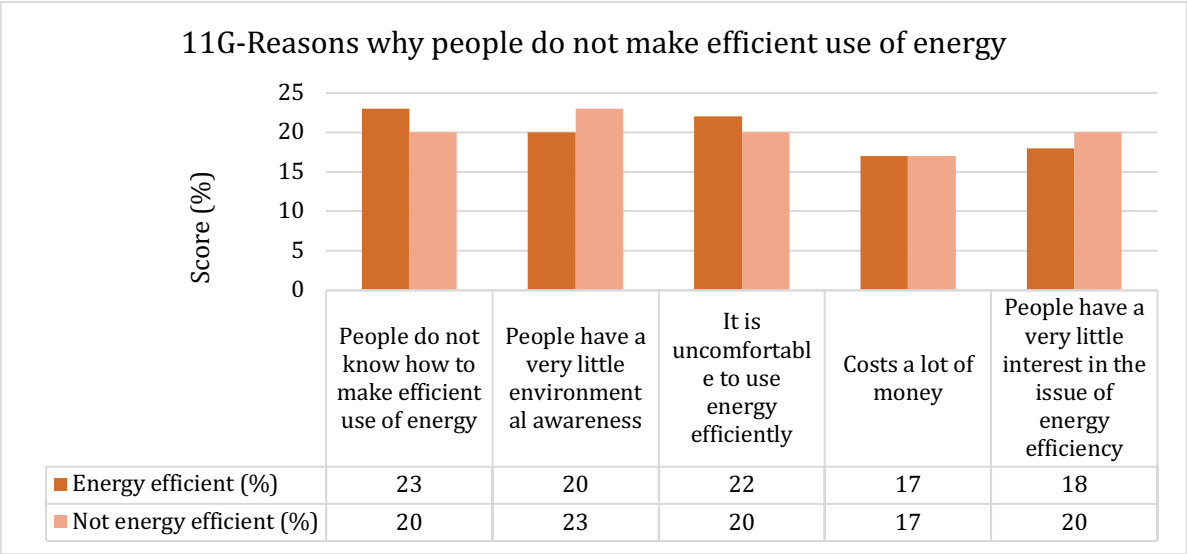
Graph 5-87 deals with the results of 99 valid answers.



Graphic 5- 87 11G- Why people do not make efficient use of energy

As can be seen on the graph, according to the year eleven secondary school children from Germany people do not make efficient use of energy because they have very little environmental awareness and because it is uncomfortable to use energy efficiently. In second place in the ranking are two reasons: people do not know how to do it and people's lack of interest in energy efficiency. The last position in the ranking is because it costs a lot of money.

This association question was also analyzed by use of subgroups. By analyzing 22 valid answers from the energy efficient group and 41 valid answers from the not energy efficient group we were able to determine the rankings given by both groups. The results are shown on Graph 5-88. They differ the most in the amount of points achieved for each term.



Graphic 5- 88 11G- Reason why people do not make efficient use of energy

By comparing both groups with each other using the Wilcoxon–Mann–Whitney-Test ("people do not know how to make efficient use of energy" z= -0,907, *p*-value= 0,364; "people have very little environmental awareness" z= -1,056, *p*-value= 0,291; "it is uncomfortable to use energy efficiently" z= -0,965, *p*-value= 0,335; "it costs a lot of money" z= -0,163, *p*-value= 0,871; "people have very little interest in the topic of energy efficiency" z= -0,854, *p*-value= 0,393), the results leads us to conclude that there are no significant differences between the group regarding the reasons why people do not use energy efficiently. In future comparisons we are going to use the rankings given by the entire group.

5.5 University students Honduras

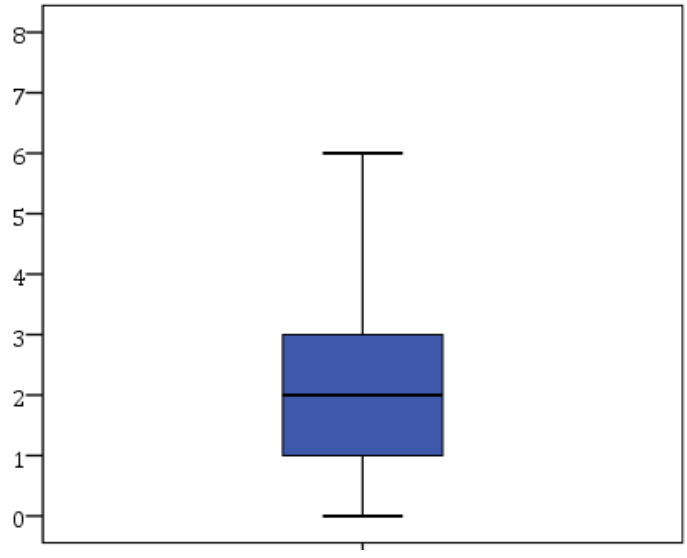
In this section the results of a survey are described that was targeted at 109 university students in Honduras who were enrolled in the first semester of natural sciences at the Universidad Pedagógica Nacional Francisco Morazán. Due to the fact that student numbers in one city were too small for the investigation aims, the survey was targeted at two campuses: in San Pedro Sula and in Tegucigalpa. The results are described, as in the previous section, by

categories and association questions. The university students' results have two more categories than the secondary school children; one of these two categories was named as "waste of energy" and has two frequency questions; the second category was named as "commitment as a future teacher" and has one frequency question. In the association question some of the options differ from the options given to the secondary school children, this is because of their level of education, and the reasons are fully explained in section 3.3.

The university students will be identified as UNI-H for the university students from Honduras and as UNI-G for the university students from Germany.

5.5.1 UNI-H Energy efficiency behavior

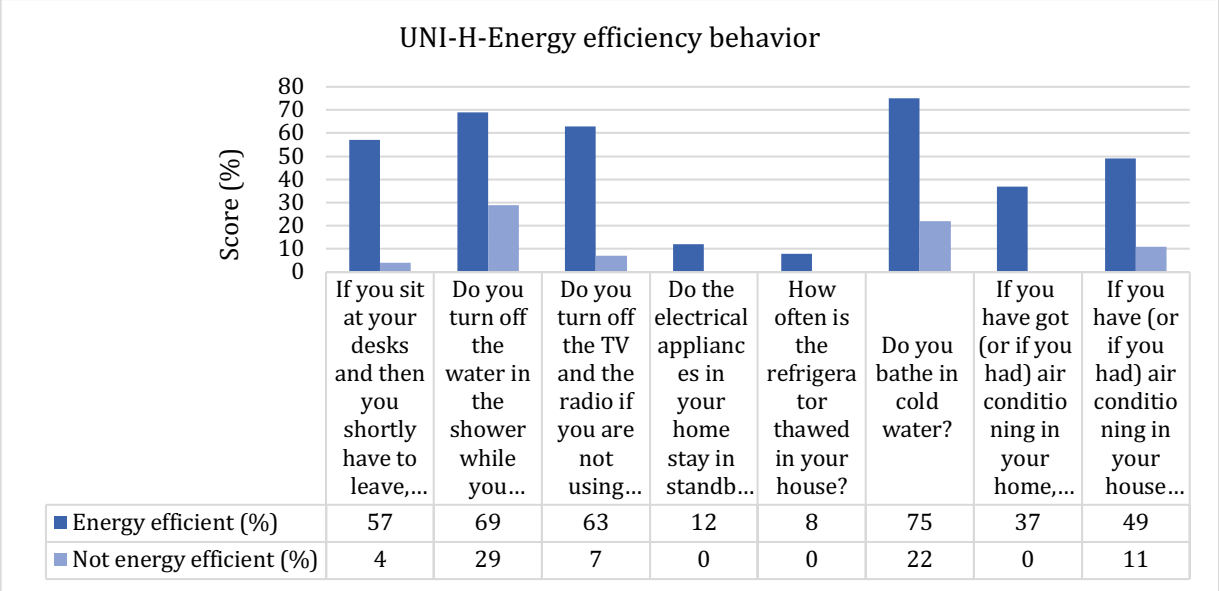
The category energy efficiency behavior for the university students has 8 frequency questions, and as for the secondary school children, by answering the 8 question the participant had the chance to achieve a score of between 0 and 8 points. The survey was targeted at 109 students of which 103 have given valid answers in this category.



Graphic 5- 89 UNI-H Energy efficiency behavior

Graph 5-89 shows the results of the category energy efficiency behavior of 106 university students from Honduras. The dataset spreads from 0 to 6 on the scale, suggesting varied energy efficiency behavior across the group; the median is located at 2 on an 8-point scale, 50% of the students scored 2 or less and 75% of the group is on or under 3 on the 8-point scale. From a skewness of 0,356 we can describe the data distribution as approximately symmetrical, ranging from 0 to 6 on the scale.

As in the previous section, by making a median split of the results of the category energy efficiency behavior, the Honduran university students group was dived into two subgroups: the energy efficient and the not energy efficient. The energy efficient group has 51 participants, the not energy efficient group has 28 participants and 24 students were exactly in the median. In this manner the 24 respondents who are exactly in the median do not to either of the two groups. On Graph 5-90 the question achievement in the category energy efficiency behavior by the two groups, the energy efficient and the not energy efficient, is shown below.



	If you sit at your desks and then you shortly have to leave,...	Do you turn off the water in the shower while you...	Do you turn off the TV and the radio if you are not using...	Do the electrical applianc es in your home stay in standb...	How often is the refrigera tor thawed in your house?	Do you bathe in cold water?	If you have got (or if you had) air conditio ning in your home,...	If you have (or if you had) air conditio ning in your house...
Energy efficient (%)	57	69	63	12	8	75	37	49
Not energy efficient (%)	4	29	7	0	0	22	0	11

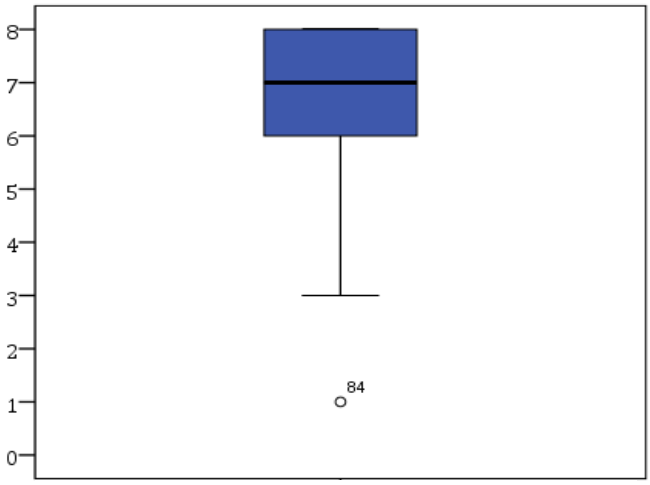
Graphic 5- 90 UNI-H Question achievement in the category energy efficiency behavior, by group

As can be seen on Graph 5-90 the energy efficient group score higher in each question of the category energy efficiency behavior. That is, the energy efficient group and the not energy efficient group can be distinguished in each of the eight questions of the category.

From now on the results will be described by group, i.e. the results of the entire university students group and by the subgroups, the energy efficient and not energy efficient.

5.5.2 UNI-H Preconceptions about energy efficiency

In the category preconception about energy efficiency the results of four level of agreement questions were put together. By answering the four questions the respondents had the chance to achieved a score of between 0 and 8 points.

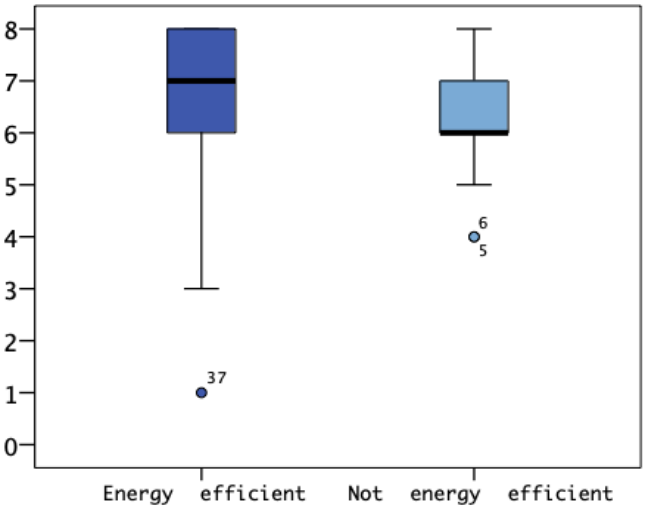


Graphic 5- 91 UNI-H Preconceptions about energy efficiency

On Graph 5-91 the results of 104 valid answers are shown. The dataset on Graph 5-91 spreads from 1 to 8 on the scale, showing very varied views across the group. The students in the upper quartile seem to have a very high level of agreement with each other on efficiency. The median is located at 7 on an 8-point scale, 75% of the groups scored 6 or more.

From a skewness of -1,287 we can describe the data distribution as highly skewed up, ranging from 1 to 8 on the scale. The results of this category by subgroup are shown on Graph 5-92.

The graph shows the results of 57 valid answers from the energy efficient group and 27 valid answers from the not energy efficient group. The graph shows two different distributions. By comparing the data dispersion, both groups differ on the interquartile range as well as on the overall range. By comparing the data location, the median for the energy efficient group is greater by one point.



Graphic 5- 92 UNI-H Preconceptions about energy efficiency, by group

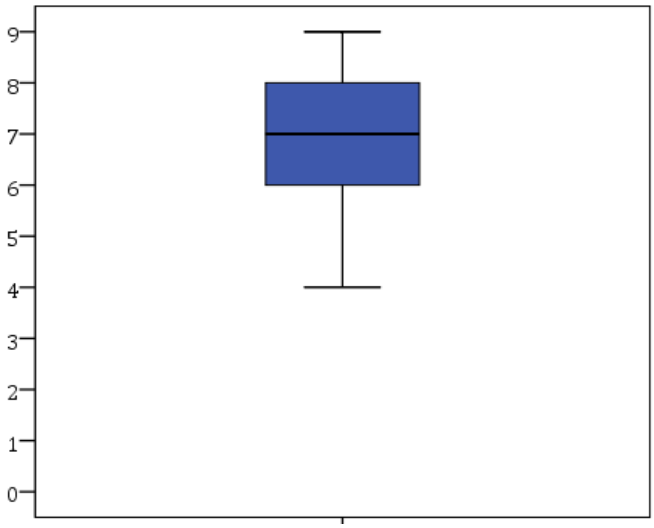
By comparing the skewness of both batches of data, a skewness of -1,632 for the energy efficient group and -0,595 for the not energy efficient group, we can describe the data distribution of the energy efficient group as highly skewed up and the data distribution of the not energy efficient group as moderately skewed up. By comparing both batches of data using the Wilcoxon-Mann-Whitney-Test, the results, (Z = -1,315, p-value = 0,189), lead us to conclude that the energy

efficient group and the not energy efficient group do not differ in the category preconceptions about energy efficiency.

5.5.3 UNI-H Level of concern

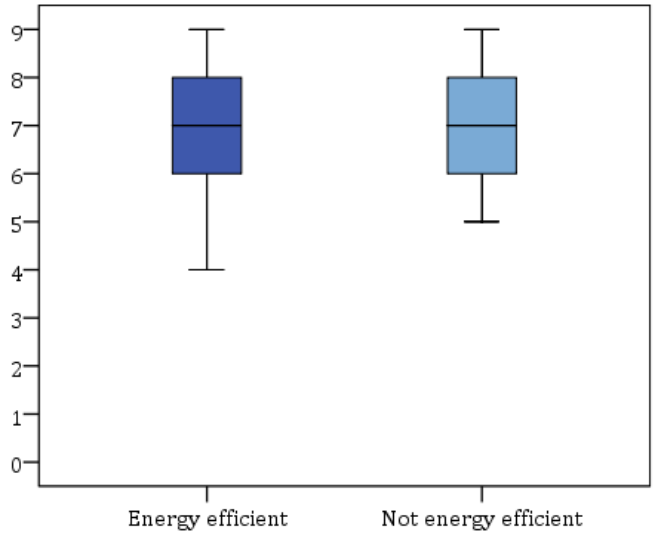
The category level of concern has three level of agreement questions, and were intended to find out whether the participants are worried about energy efficient use and environmental problems. By answering the three questions the participants had the chance to achieve a score of between 0 and 9 points. The three questions were answered by 105 university students from Honduras.

Graph 5-93 shows the results. As can be seen on the graph, the dataset ranges from 4 to 9 on a 9-point scale, suggesting very varied views across the group. The median of the data is located at 7, 50% of the group scored 7 or more and 75% of the group scored 6 or more. With a skewness of -0,357 the data can be described as approximately symmetrical in a range from 4 to 9 on the scale. In order to find an area of difference between the energy efficient group and the not energy efficient group 50 valid answers from the energy efficient group and 27 valid answers from the not energy efficient group were analyzed. Graph 5-94 shows the results.



Graphic 5- 93 UNI-H Level of concern

By comparing the data distribution, the two batches of data seem to be similar in the interquartile range as well as in the overall range. By comparing the data location, the median of both groups is at the same level, 7 on a 9-point scale. 50% of both groups scored 7 or more and 75% of both groups scored 6 or more.



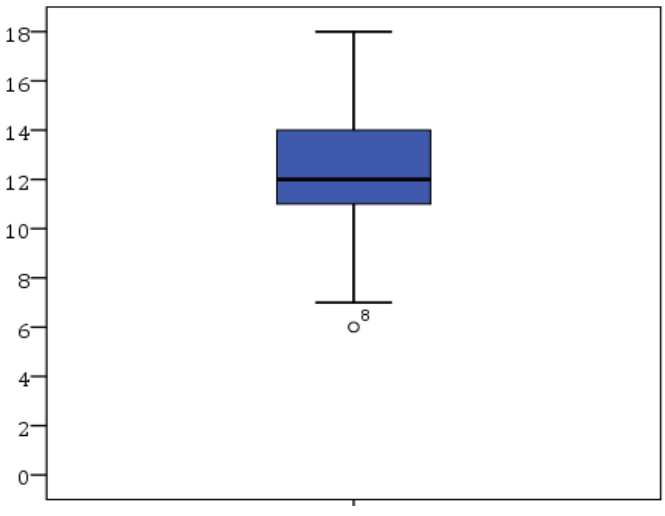
Graphic 5- 94 UNI-H Level of concern, by group

From a skewness of -0,283 and -0,243 we can describe both data distributions as approximately symmetrical in a range from 4 to 9 for the energy efficient group and from 0 to 5 for the not energy efficient group.

By comparing both batches of data using the Wilcoxon-Mann-Whitney-Test, the results (Z = -0,3621, p-value = 0,717) lead us to conclude that the energy efficient group and the not energy efficient group cannot be distinguished in the category level of concern.

5.5.4 UNI-H Level of responsibility

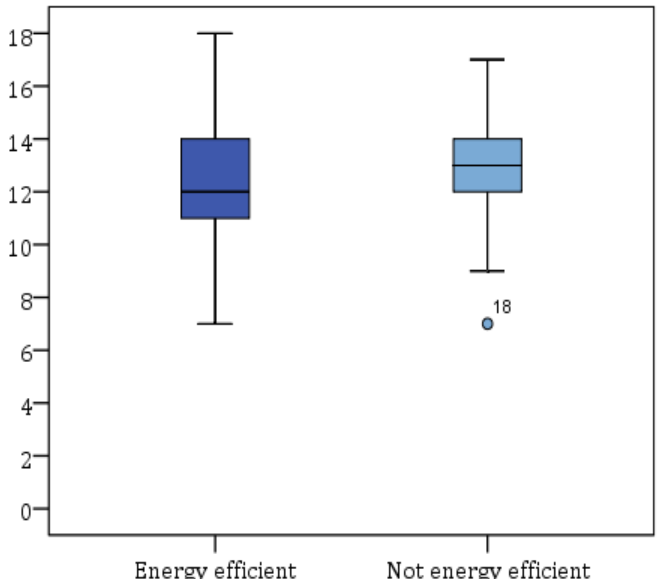
In the category level of responsibility, the results of 6 level of agreement questions were put together. By answering all 6 questions that belong in the category the participant had the chance to achieve a score of between 0 and 18 points.



Graphic 5- 95 UNI-H Level of responsibility

On Graph 5-95 the results of 100 valid answers are shown. As can be seen on the graph, the dataset spreads from 6 to 18 on the 18-point scale from this the group can be considered heterogeneous in the category level of responsibility. The median is located at 12 points, 50% of the group scored 12 or more and 75% of the group scored 11 or more. A skewness of -0,046 leads us to described the data distribution as approximately symmetrical in a range from 6 to 18 on the scale. The graph shows an outlier that could require special attention in future conclusions. In order to find any areas of difference between the energy efficient group and the not energy efficient group

regarding the level of responsibility 49 valid answers from the energy efficient group and 25 valid answers from the not energy efficient group were analyzed. The results are shown on Graph 5-96.



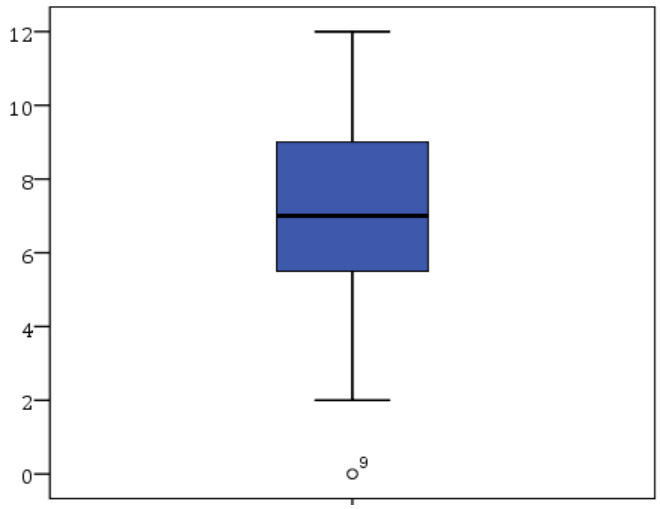
Graphic 5- 96 UNI-H Level of responsibility, by group

By comparing the data dispersion of both groups, both seem to slightly differ in the interquartile range as well as in the overall range. The data location of both groups is different. The median of the energy efficient group is located one point under the median of the energy efficient group, that is, 50% of the not energy efficient group scored 13 or more on the scale. A skewness of -0,470 for the energy efficient group and -0,499 for the not energy efficient group leads us to describe both batches of data as approximately symmetrical. By comparing both batches of data using the Wilcoxon-Mann-Whitney-Test, the results (Z =-0,964 p = 0,335) lead us to conclude that the energy efficient group and the not energy efficient group cannot be distinguished in the category level of responsibility.

5.5.5 UNI-H Level of exposure to information

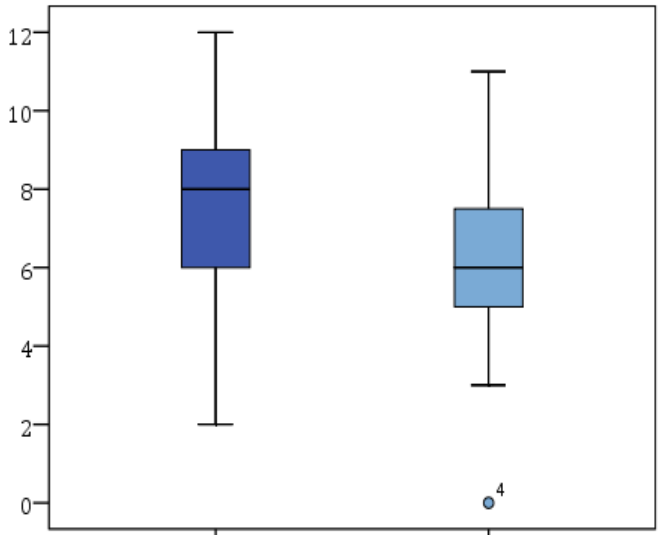
On having a level of expose to information, three frequency questions were put in the category. Each question had five possible answers: always, very often, sometimes, rarely and never. By answering the question each possible answer gets one score point. By answering the three question of the category the respondent had the chance to score between 0 and 12 points. After analyzing 100 valid answers the results of this category are shown on Graph 5-97.

The graph shows a dataset spreading across the entire scale, suggesting a very varied level of exposure to information across the group. The median is located at 7 points, 50% of the group scored 7 or more and 75% of the group scored 5 or more. From a skewness of -0,291 we can describe the data as approximately symmetrical, ranging across the entire scale. The data of the category level of exposure to information was also analyzed by use of sub-groups; from the energy efficient group 49 valid answers were analyzed and from the not energy efficient group 25 valid answers were analyzed. The results are show on Graph 5-98.



Graphic 5- 97 UNI-H Level of exposure to information

By comparing the data dispersion on Graph 5-98, it seems both groups differ in the interquartile range as well as in the overall range. By comparing the data location, the median for the not energy efficient group is greater by one point. 75% of the not energy efficient group scored in or above the median of the energy efficient group.



Graphic 5- 98 UNI-H Level of exposure to information, by group

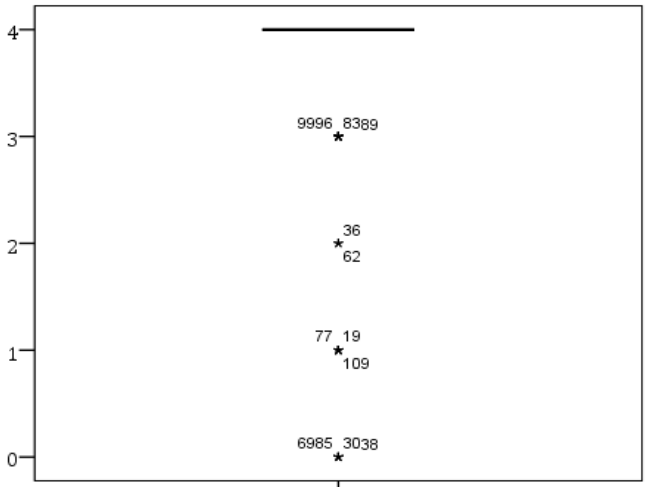
From a skewedness of -0,162 for the energy efficient group and -0,338 for the not energy efficient group we can describe both data distributions as approximately symmetrical, ranging from 7 to 18 for the energy efficient group and from 7 to 17 for the not energy efficient group. By comparing both batches of data using the Wilcoxon-Mann-Whitney-Test, the results (z= -1.748 *p*-value= 0,080) leads us to conclude that both groups are not

distinguished in the category level of exposure to information.

5.5.6 UNI-H Level of importance of the topic "energy saving"

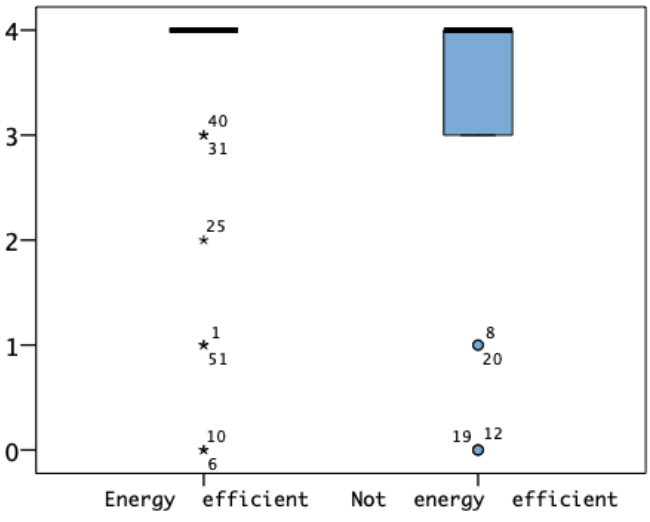
The category has only one question: How important is energy saving for you? To answer the question, the respondents had to choose between five possible answers. The answers were given on a scale of importance of 0 to 4.

On Graph 5-99 the results of 102 valid answers are shown. As can be seen on the graph the data distribution for this category spreads across the entire scale, however it can clearly be seen that more than 90% of the data is accumulated at the end of the scale. The median is located at the top of the scale; over 90% of the group scored in the median. The dataset also has some outliers that could require special attention in future conclusions. The data of the category was also analyzed by use of subgroups, that is, the energy efficient and the not energy efficient.



Graphic 5- 99 UNI-H Level of importance of energy efficiency

The results are shown on Graph 5-100. On the graph two different pattern are shown, by comparing the data dispersion of both groups they seem to differ in the interquartile range as well as in the overall range. The median of both is at the same level; a skewness of -2,134 for the energy efficient group and -1,865 for the not energy efficient group leads us to describe both batches of data as highly skewed up.

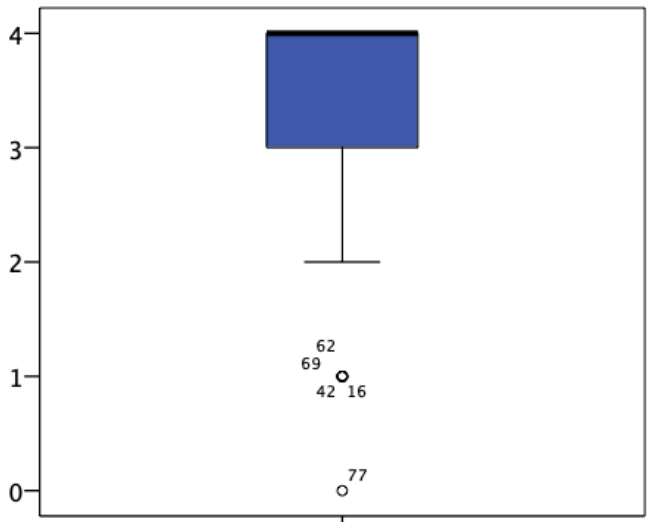


Graphic 5- 100 UNI-H Level of importance of energy efficiency, by group

By comparing the data distribution, the Wilcoxon–Mann–Whitney-Test (z= -2,231, *p*-value= 0,026) leads us to conclude that both groups are distinguished in the category level of importance of energy saving. Although both medians are at the same level, by analyzing the data it can be concluded that the energy efficient group got a higher score in the category Level of importance of the topic energy saving.

5.5.7 Level of willing to know more about energy efficiency

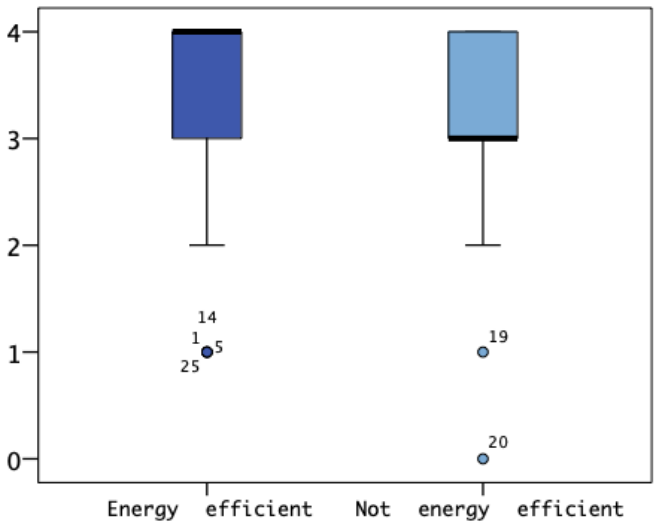
The category has one question: Do you want to learn more about energy efficiency? To answer the question, the respondents had to choose an answer from five possible ones: yes, very much more; yes, much more; a little bit more; less more; no. By answering, yes, very much more the participant gets four score points and so on with the other possible answers. By answering that they do not want to know more about the topic they get zero score points. So the scale in willing to know more about the topic goes from zero to four score points.



Graphic 5- 101 UNI-H Level of willing to know more about energy efficiency

The data analysis from 106 valid answers are presented on Graph 5-101. As shown on the graph, the dataset spreads from 0 to 4 on the scale, suggesting very varied views across the group. the median is located at the end of the scale, the 50% who scored right in the median seem to have a high level of agreement which each other. The dataset has also some outliers which could require a further analysis in future conclusions. The data distribution by subgroup are shown on Graph 5-102.

By comparing both batches of data, they seem to be similar by comparing the data dispersion, the data locations as well as by the skewness. Both batches of data seem to have a lack of



Graphic 5- 102 UNI-H- Level of willing to know more about energy efficiency

symmetry, a skewness of -2,023 for the energy efficient group and -1,797 for the not energy efficient group allows us to describe both batches of data as highly skewed up.

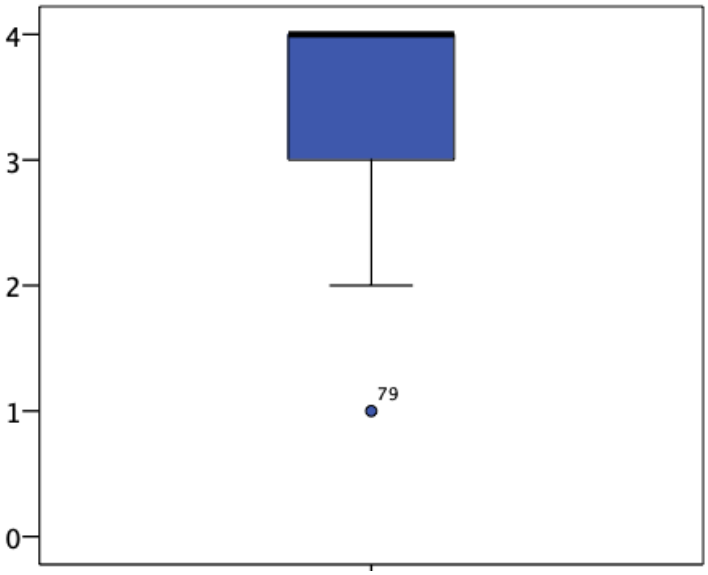
Although both batches of data seem to be similar, the results of the Wilcoxon–Mann–Whitney-Test (z= -2,313, *p*-value= 0,021) leads us to conclude that both groups can be distinguished in the category want to know more about energy efficiency. By making a more exhaustive analysis of the data we can concluded that the energy efficient group is willing to know more about energy efficiency.

5.5.8 UNI-H Level of engagement as a future teacher

The category level of engagement aimed to find out the respondent's level of commitment as a future teacher regarding the implementation of new programs related to the efficient use of energy. The category has only one frequency scale question with five possible answers and to each answer was given a range of points. The question was as follows: "Would you commit as a teacher to perform pedagogical activities at your home and in your work center with the aim of encouraging the efficient use of energy?" By marking the answer "always" they get 4 score points, "very often" 3 score points, "sometimes" 2 score points, "rarely" 1 score point and "never" gets 0 score point. The category ranges from 0 to 4 points, 4 being a high level of commitment and 0 the lowest level of commitment.

It was a frequency scale and not a level of agreement scale because the objective was to assess the level of commitment, not the level of agreement. With a level of agreement question in this category we could only know if they would do or would not perform pedagogical activities with the aim of encouraging the efficient use of energy. Due to the fact that the concept level of commitment belongs to such an affective domain as a feeling, it is possible to

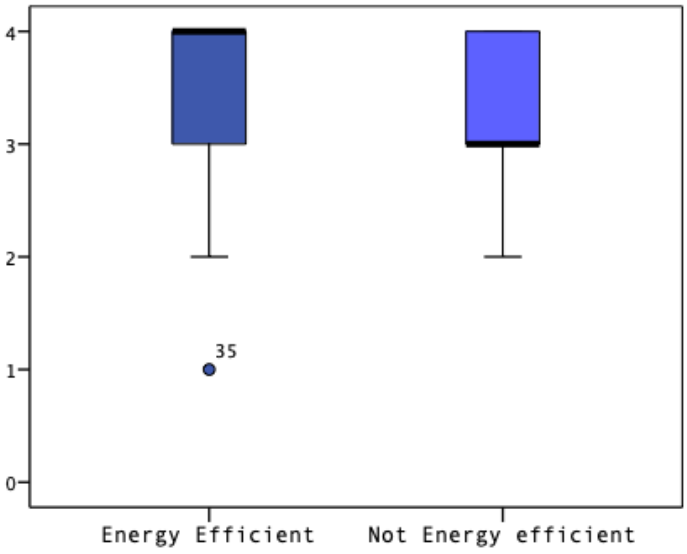
assess this feeling with the Likert scale. The answer "always" would mean the participant is willing to take any chance to perform pedagogical activities with the aim of encouraging the efficient use of energy.



Graphic 5- 103 UNI-H Level of engagement as a future teacher

On Graph 5-103 the results of the category level of engagement as a future teacher are shown. As can be seen on the graph, the dataset in this category spreads from 1 to 4, showing varied views across the group. 50% of the group scored at the highest level of the scale, while around 75% scored in a range from 2 to 3.A skewness of -1,021 allows us to describe the data a highly skewed up on a scale from 1 to 4. The data analysis by group are shown on Graph 5-104.

Graph 5-104 shows two similar patterns by comparing the data dispersion, both groups seem to be similar in the interquartile as well as in the overall range.



Graphic 5- 104 UNI-H Level of engagement as a future teacher

By comparing the data location, the median of the not energy efficient group is greater by one point, A skewness of 1,086 for the energy efficient group and 0,526 for the not energy efficient group, which leads us to conclude that the dataset of the energy efficient group is more skewed down, ranging from 1 to 4 on the scale.

The Wilcoxon–Mann–Whitney-Test (z= -405, p-value= 0,686) leads us to conclude that the groups are not distinguish with respect to their level of engagement as future teacher.

5.5.9 UNI-H Correlations between the categories

From the results of the survey targeted at 109 university students in Honduras who were enrolled in the first semester of natural sciences at the Universidad Pedagógica Nacional Francisco Morazán when the study was carried out, the following correlations between the groups were found.

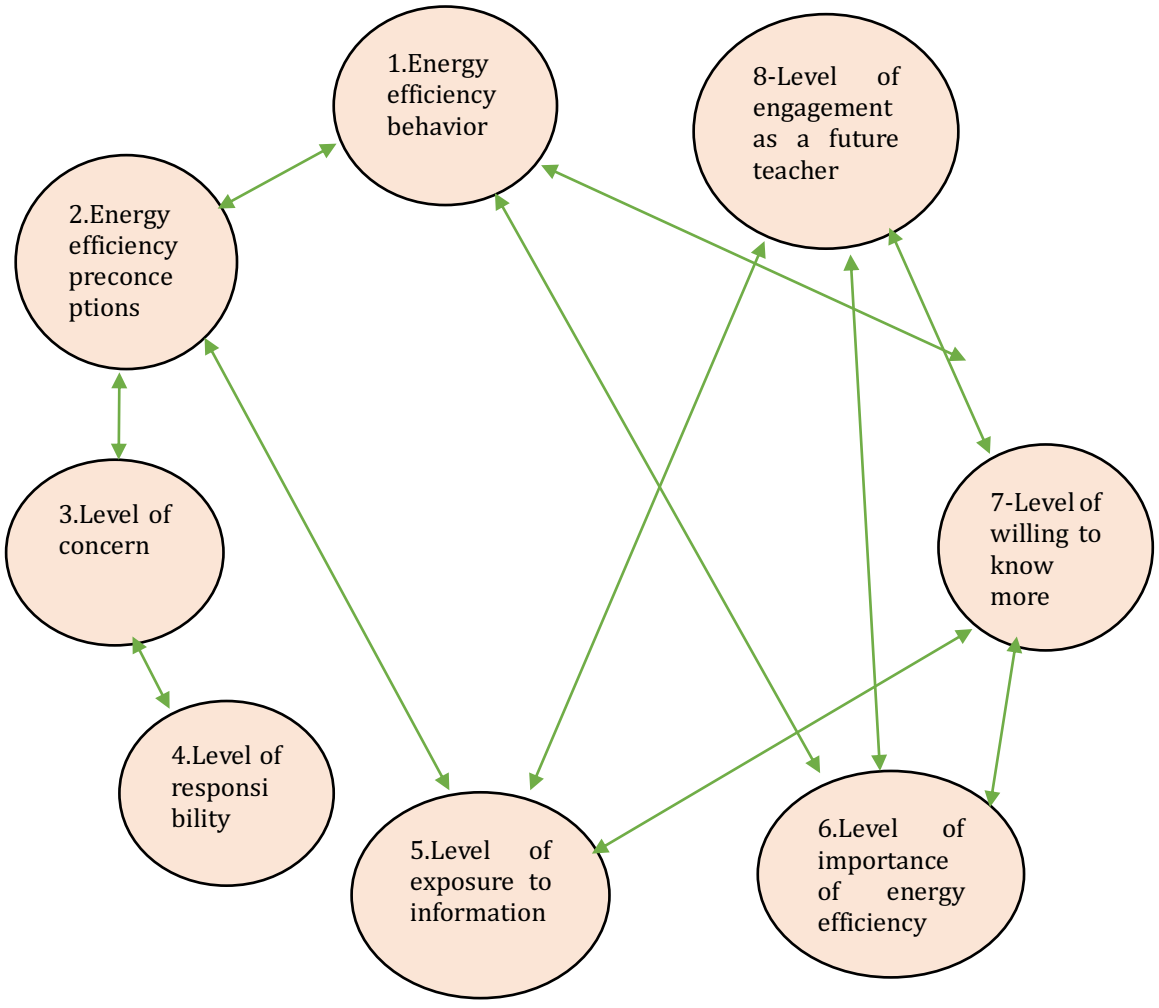
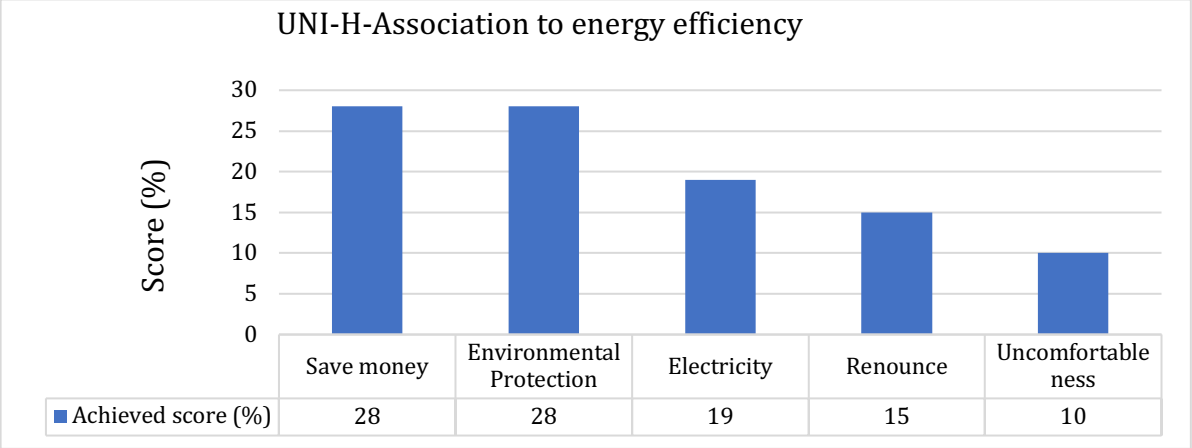


Diagram 5- 5 UNI-H Correlations between categories

5.5.10 UNI-H Associations with energy efficiency

In order to make an association with the topic energy efficiency, the participants were given five options (save money, environmental protection, electricity, renounce and

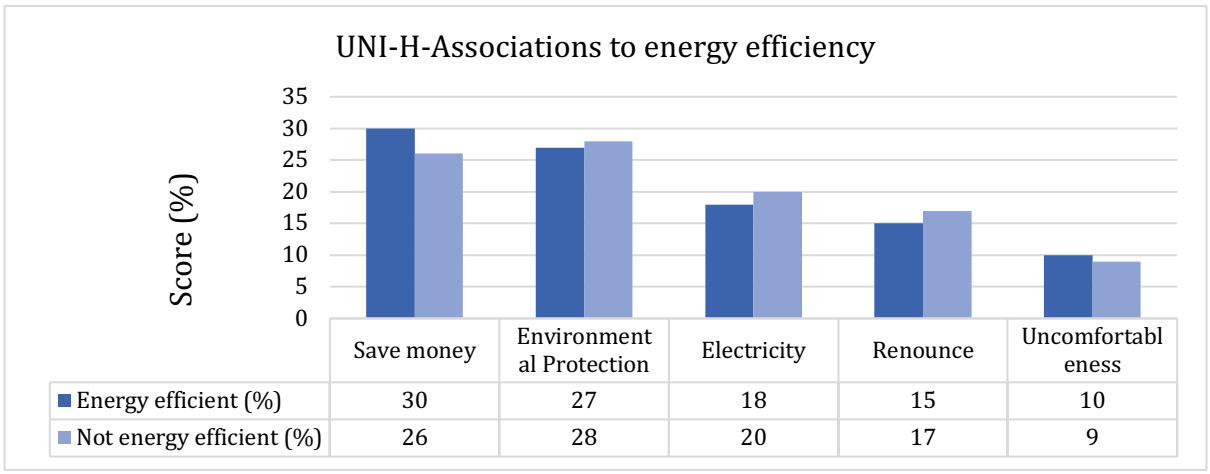
uncomfortableness). They were asked to rank the words most associated with energy efficiency, 1 being the highest and 5 the lowest. Graph 5-105 deals with the rankings given by 109 university students from Honduras. Graph 5-105 deals with the results.



Graphic 5- 105 UNI-H Association to energy efficiency

As can be seen on the graph, the term most associated with energy efficiency for this group of students was save money and environmental protection, both at the same level. Electricity is in third place, in fourth position is renounce and the least term in the ranking is uncomfortableness.

On Graph 5-106 the results by subgroup are shown. The Wilcoxon–Mann–Whitney-Test was used to find out whether both groups differ by associating the given term to energy efficiency.



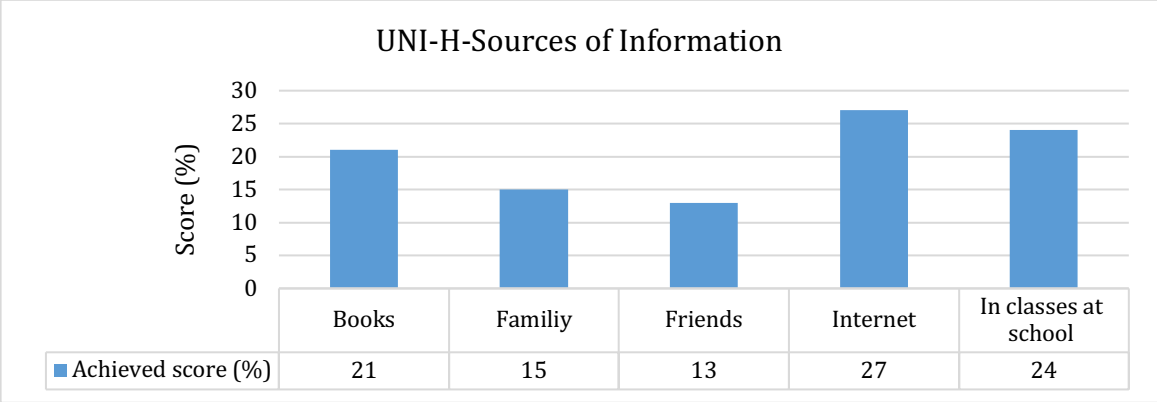
Graphic 5- 106 UNI-H Association to energy efficient by group

The tests results are the follows: save z= -2,189, *p*-value= 0,029; Environmental protection z= -0,75, *p*-value= 0,453; Electricity z= -0,59, *p*-value= 0,555; renounce z= -1,398, *p*-value=

0,162; Uncomfortableness z= -1,059, *p*-value= 0,29. From the tests results we can conclude that both groups can be distinguished by the term save money. From the graph we can clearly see that the energy efficient group made a stronger association with energy efficiency the term save money. By the other four terms on the ranking according to the test results, both groups are indistinguishable.

5.5.11 UNI-H Sources of Information

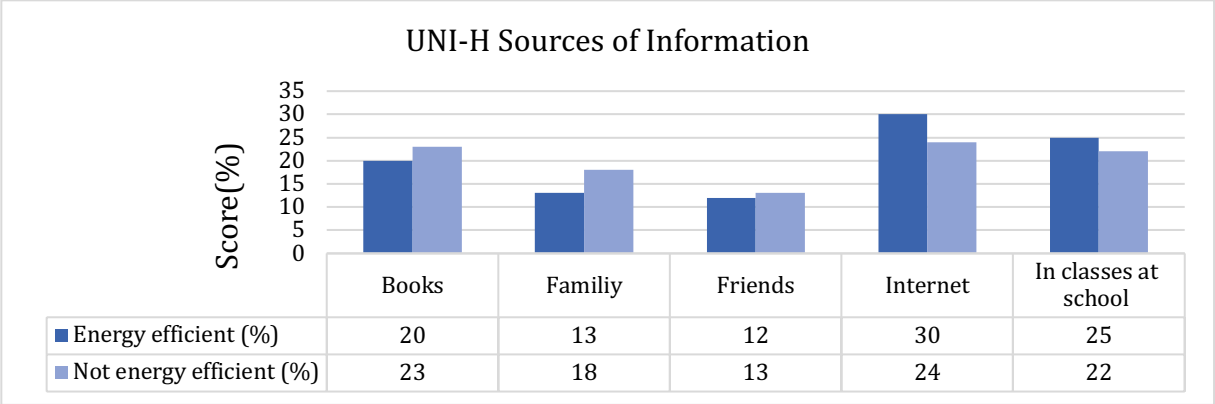
This association question aims to find out where the information about environmental topics that the respondents might have is coming from. Which is the most used source of information by the year eight secondary school children from Germany? To answer the question, five sources of information were given to the respondents: books, family, friends, internet and in classes at school. They had to rank each option as their most and least used source of information.



Graphic 5- 107 UNI-H Sources of Information

Graph 5-107 shows the ranking of the most and least used source of information made by 109 university students from Honduras.

The respondents have given as their most used source of information as internet, following by in classes at school, the third source of information is books. The least used sources of information are family and friends in joint last place. The results by subgroup are given on Graph 5-108

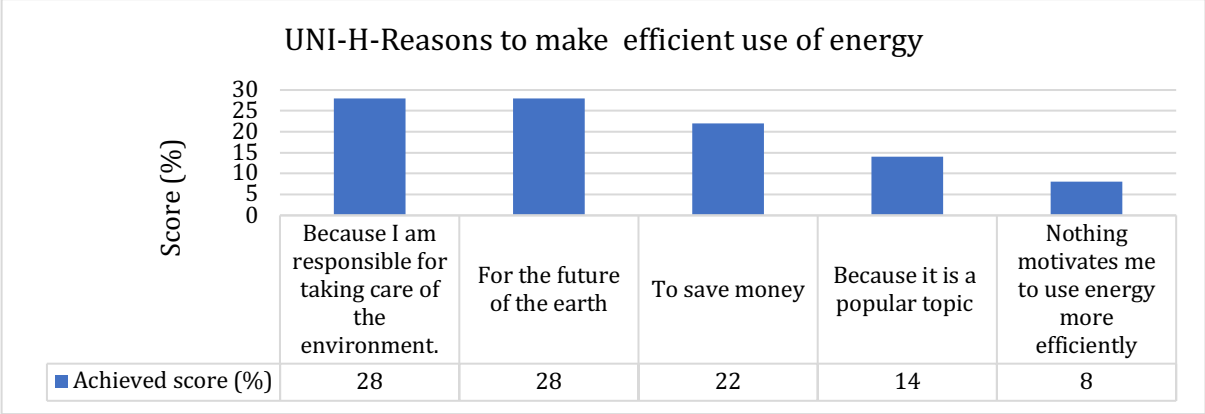


Graphic 5- 108 UNI-H Sources of Information, by group

The Wilcoxon–Mann–Whitney-Test was used to find out whether both groups differ by ranking their sources of information. The test results are as follows: Books z= -1,031, *p*-value= 0,303; Family z= -1,926, *p*-value= 0,054; Friends z= -0,195, *p*-value= 0,846; Internet z= -2,012, *p*-value= 0,044; In classes at School z=-0,931, *p*-value= 0,352. Both groups can be distinguished by ranking internet and family as a source of information. For the energy efficient group internet is the most used source of information, by ranking the other terms as sources of information a statistically significant difference between the groups was not found.

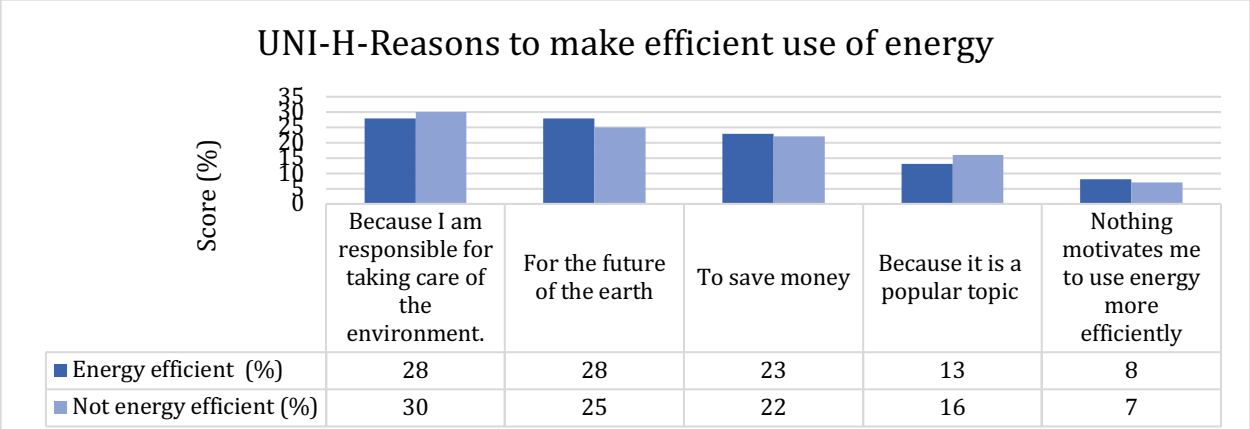
5.5.12 UNI-H Reasons to make efficient use of energy

The respondents were asked to rank which reasons they could have to use energy efficiently. To give the ranking five reasons were provided to them.



Graphic 5- 109 UNI-H Reasons to make efficient use of energy

Graph 5-109 shows the rankings by 63 university students from Honduras. As the graphs shows, the most important reason that this group of students have to make efficient use of energy is because they feel responsible for taking care of the environment as well as for the future of the earth. In second position is to save money. The least important reasons for this group of Honduran students were because it is a popular topic and Nothing motivates me to use energy more efficiently. The ranking given by group is shown on Graph 5-110.

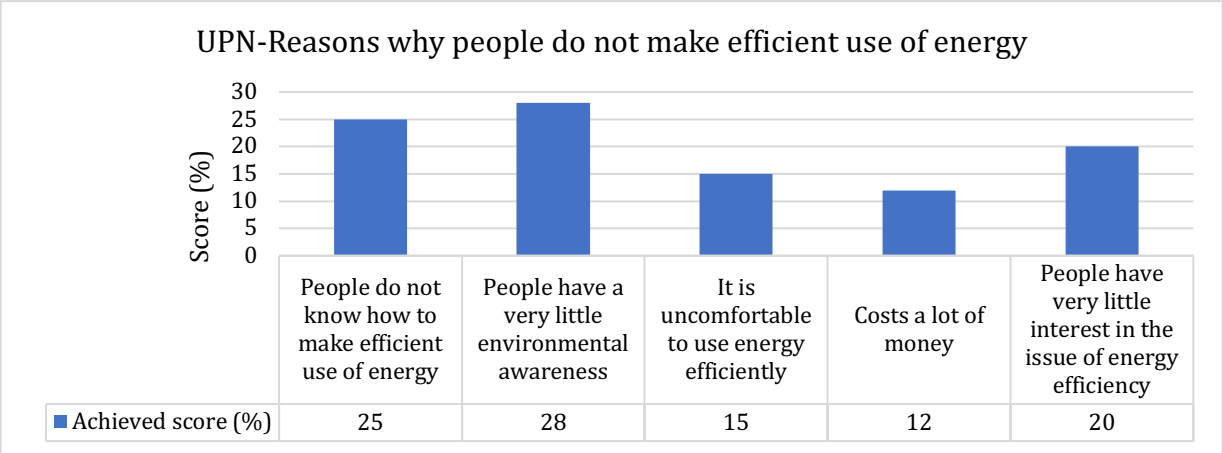


Graphic 5- 110 UNI-H Reasons to make efficient use of energy, by group

By comparing both groups using the Wilcoxon–Mann–Whitney-Test, the results (Because I am responsible for taking care of the environment z= -0,856, p-value= 0,392; for the future of the earth z= -1,577, p-value= 0,115; To save money z= -0,37, p-value= 0,711; Because it is a popular topic z= -1,687, p-value= 0,092; Nothing motivates me to use energy efficiently z= -0,954, p-value= 0,34) lead us to conclude that the groups do not differ by ranking the reason to make efficient use of energy. From now on and in future conclusions the rankings given by the entire group will be used.

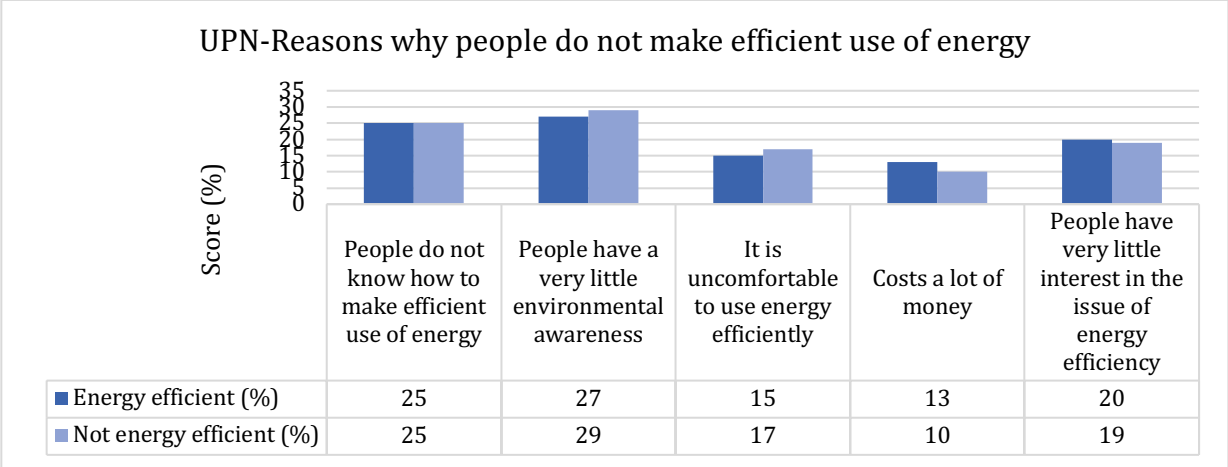
5.5.13 UNI-H Reasons why people do not make efficient use of energy

In the survey the respondents were asked to rank the reasons they think people could have to not make efficient use of energy: The question was answered by 62 University students from Honduras. Graph 5-111 shows the results.



Graphic 5- 111 UNI-H Reasons why people do not make efficient use of energy

As the first reason why people do not make efficient use of energy is because people have very little environmental awareness. The second reason is because people do not know how to do it, as the third reasons they named people lack interest in the topic. As the last two reasons they have named is it is uncomfortable and it costs a lot of money. The results by group are shown on Graph 5-112



Graphic 5- 112 UNI-H Reasons to make efficient use of energy, ,by group

Due to the results of the Wilcoxon–Mann–Whitney-Test (People do not know how to make efficient use of energy z= -0,039, *p*-value= 0,969; People have very little environmental awareness z= -1,577, *p*-value= 0,115; It is uncomfortable to use energy efficiently z= -0,37, *p*-value= 0,711; costs a lot of money z= -1,687, *p*-value= 0,092; People have very little interest in the topic of energy efficiency z= -0,954, *p*-value= 0,34), it is considered that there are not

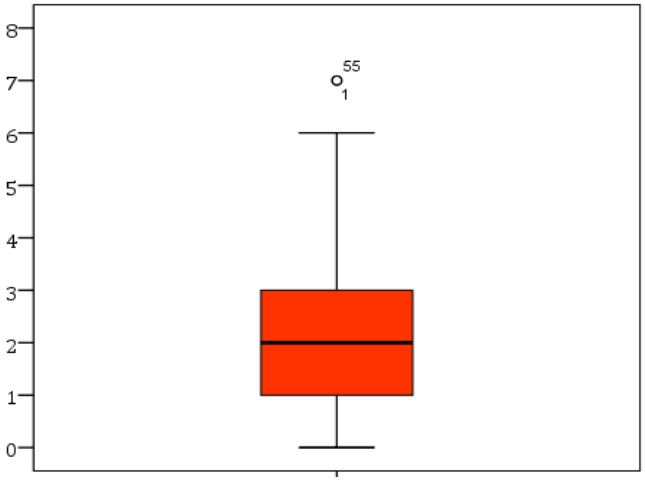
significant differences between the groups, from now on and in future conclusions the rankings given by the entire group will be used.

5.6 University students Germany

This section describes the results of a survey that was targeted at 106 university students in Germany who were enrolled in the first semester of either physics, biology or chemistry. The results of the first category are shown on Graph 5-113.

5.6.1 UNI-G Energy efficiency behavior

In the category of energy efficiency behavior, the results of 8 questions regarding the efficient use of energy at home are shown. On Graph 5-113 the results of 100 valid answers given by German university students are shown.



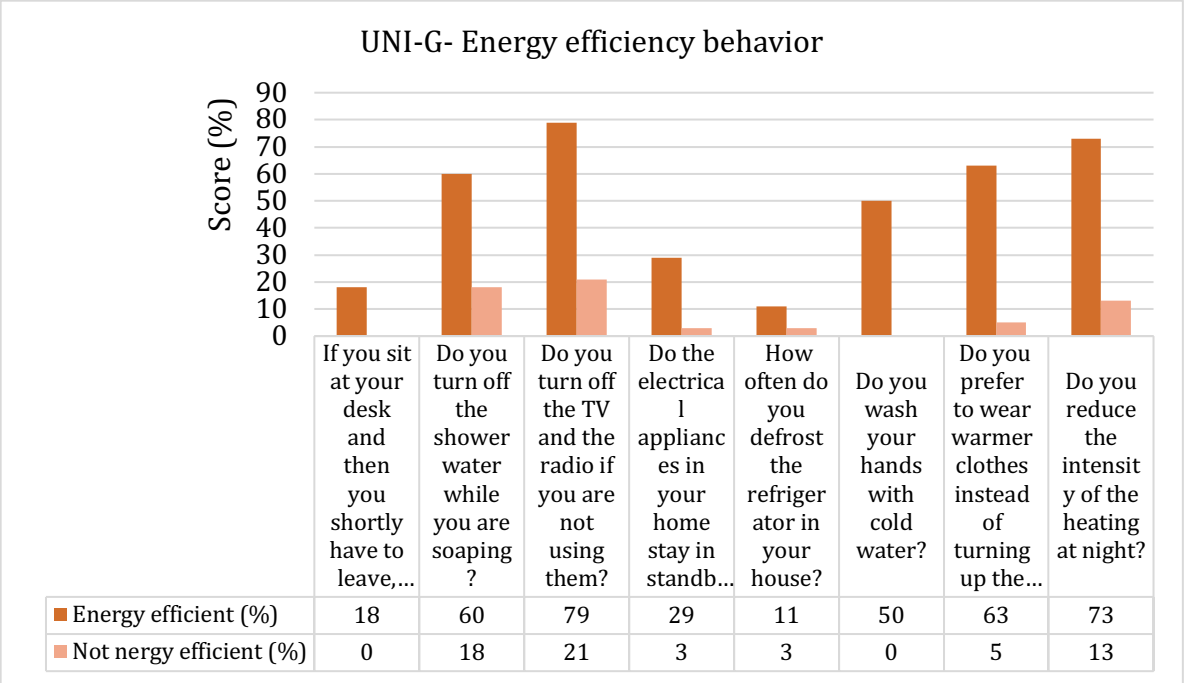
Graphic 5- 113 UNI-G- Energy efficiency behavior

The graph shows a dataset spreading from 0 to 7 on the scale, suggesting heterogeneity across the group. The median is located at 2, 50% of the group scored 2 or less and 75% of the group scored 3 or less.

A skewness of 0,687 leads to describe the data as moderately skewed down. The dataset has 2 outliers which could require further analysis in future conclusions. The 100 valid answers were divided into three groups: the energy efficient, the not energy efficient and the group who score right in the median. By making a median split, 38 respondents scored under the median, this group will be named from now on as the not energy efficient group. 38 respondents who scored above the median will be named from now on as the energy efficient group. 24 respondents scored in the median, that is, they scored 2 on the scale; this group does not belong to either of the two other groups, because

they scored right in the median they cannot be considered as either energy efficient nor not energy efficient.

Graph 5-114 shows the results of the category by question.



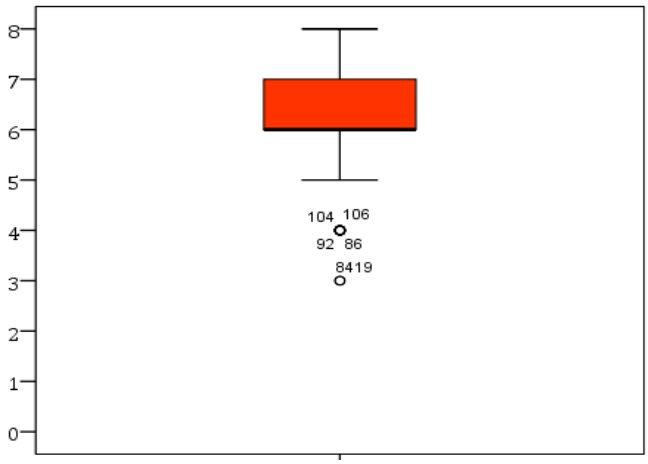
	If you sit at your desk and then you shortly have to leave,...	Do you turn off the shower water while you are soaping ?	Do you turn off the TV and the radio if you are not using them?	Do the electrical applianc es in your home stay in standb...	How often do you defrost the refriger ator in your house?	Do you wash your hands with cold water?	Do you prefer to wear warmer clothes instead of turning up the...	Do you reduce the intensit y of the heating at night?
Energy efficient (%)	18	60	79	29	11	50	63	73
Not nergy efficient (%)	0	18	21	3	3	0	5	13

Graphic 5- 114 UNI-G Energy efficiency behavior, by question

On the graph it can be seen that the groups can be distinguished in each question. In each question the results of the energy efficient group scored greater. The difference between the groups ranges from a minimum of 18% to a maximum of more than 60%. There were however some questions in which the energy efficient group also got a low score but the most important thing in the analysis is to see that both groups can be distinguished in each question of the category. From now on the results by category will also describe the results by subgroup, that is, the results of the energy efficient group and the not energy efficient group.

5.6.2 UNI-G Energy efficiency preconceptions

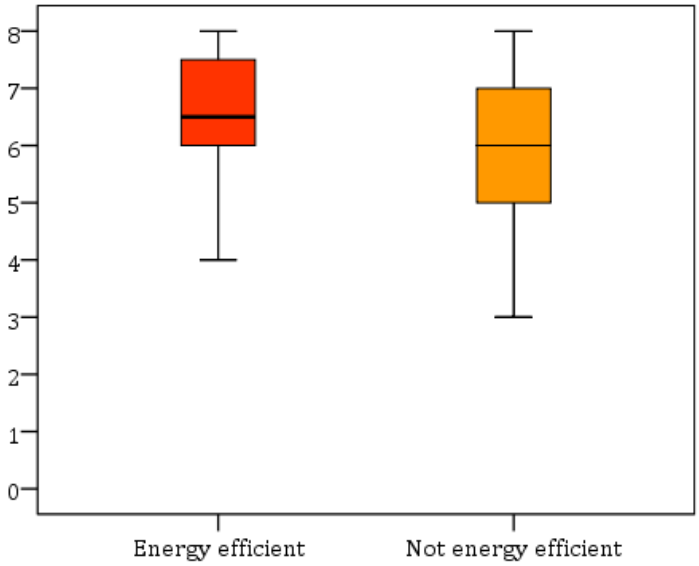
In this category the results of 102 valid answers are described. On Graph 5-115 are shown the results. The graph shows a dataset spreading from 3 to 8 on the scale.



Graphic 5- 115 UNI-G Energy efficiency preconceptions

The group seems to be heterogeneous in the category energy efficiency preconceptions. By the data location it can be seen that the 50% of the group scored 6 or more and 75% of the group also scored 6 or more. The dataset also has at the beginning of the scale 6 outliers which could require special attention in future conclusions. A skewness -0.456 allow us to describe the data distribution as approximately symmetrical in a range from 3 to 8 on the scale. The data analysis by subgroup is described on Graph 5-116.

By comparing the data dispersion of both groups, both groups seem to be differ on the interquartile range and on the overall range. By the data location, the median of the energy efficient group is greater by one point, while 75% of the energy efficient group scored above the median of the not energy efficient group. A skewness of -0,464 for the energy efficient group and -0,252 for the not energy efficient group leads us to describe both batches of data as approximately symmetrical. Although there appears to be some differences between the data distributions of both groups, the value of the Wilcoxon-Mann-Whitney-Test for two independent samples (z= -1,131, p-value= 0,258) make us conclude that the energy efficient group and the not energy efficient group cannot be distinguished in the preconceptions about energy efficiency category.

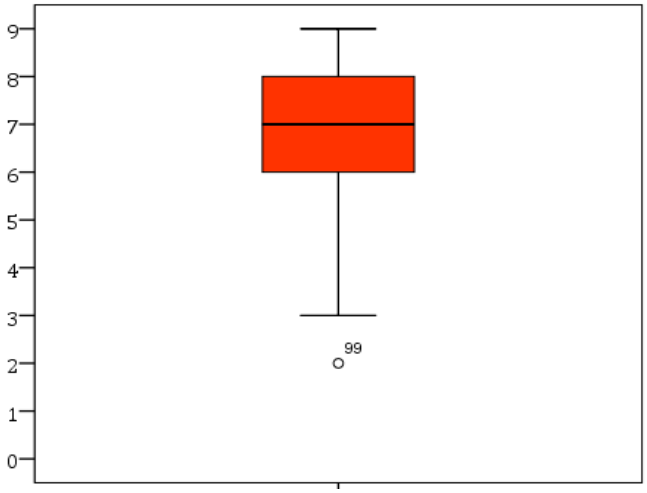


Graphic 5- 116 UNI-H Energy efficiency preconceptions , by group

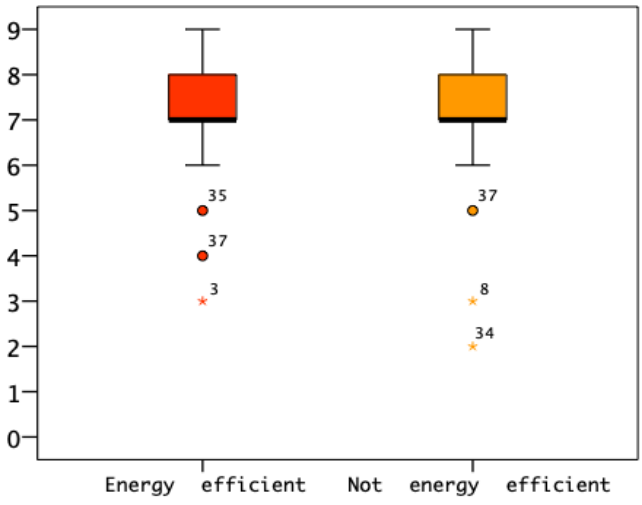
5.6.3 UNI-G Level of concern

In the category level of concern 102 valid answers given by Germany university students were analyzed. Graph 5-117 deals with the results.

Graph 5-117 shows a dataset spreading from 2 to 9 on the scale, showing heterogeneity across the group. 50% of data is located in a range from 7 to 9 and 75% of the group scored 6 or more. There is an outlier at the beginning of the scale of those who scored 2 on the level of concern scale. From a skewness of -1,044 we can describe the data as highly skewed up. The data of the category by subgroup is shown on Graph 5-120. The graph shows the data analysis of 37 valid answers from the energy efficient group and 36 valid answers from the not energy efficient group.



Graphic 5- 117 UNI-G Level of concern



Graphic 5- 118 UNI-G Level of concern, by group

As can be seen on Graph 5-118, both datasets appear to be reasonably similar in the interquartile range as well as in the overall range. The median of both groups is located at 7 on the scale, while 75% of both groups scored 7 or more on the level of concern scale. A skewness of -0.922 for the energy efficient group and -1,577 for the not energy efficient group leads us to conclude that the data distribution of the energy efficient group can be described as moderately skewed up in a range from 3 to 9 and the dataset of the not energy efficient group is highly skewed up in range from 2 to 9. By comparing both data distributions using the Wilcoxon-Mann-Whitney-Test (z= -0,215, *p*-

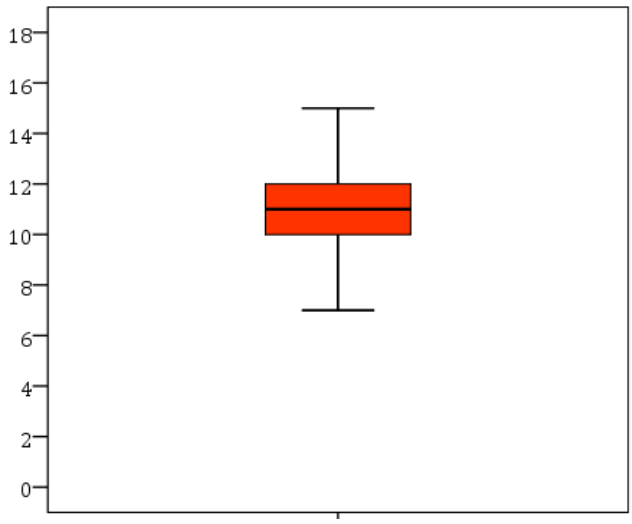
value= 0,830) we can conclude that both groups cannot be distinguished in the category level of concern.

5.6.4 UNI-G Level of responsibility

In this category six levels of agreement questions were analyzed. Each question had four possible answers. The scoring of each answer has already been explained in previous sections. In this investigation and according the level of responsibility is considered a feeling which belongs to the affective domain and can be assessed with a Likert scale.

By answering the six questions of the category each participant had the chance to score between 0 and 18 points. From the data analysis of 98 valid answers it was possible to find the level of responsibility of the group.

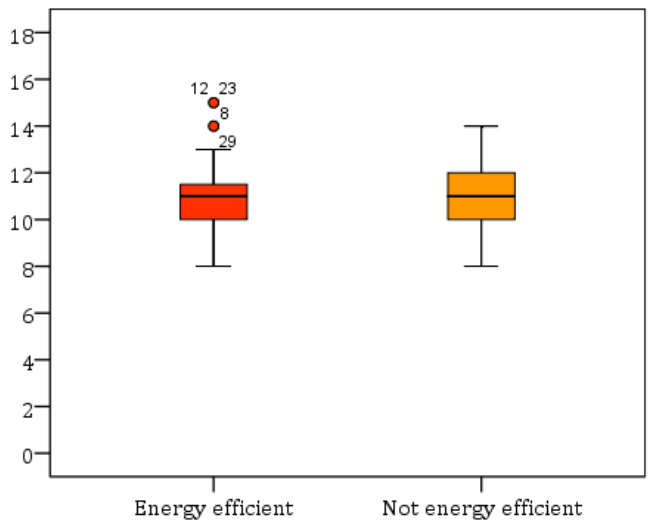
The dataset on Graph 5-119 spreads from 7 to 15 on the scale, the group can then be considered as heterogeneous in level of responsibility. The median is located at 11 on the scale, while 75% of the groups scored 10 or more. The 50% of the group in the middle of the distribution ranges from 10 to 12 and shows a high level of agreement which each other. A skewness of -0,052 lead us to describe the data as approximately symmetrical in a range of 7 to 15 on the level of responsibility scale.



Graphic 5- 119 UNI-G Level of responsibility

The results of the energy efficient group and the not energy efficient in level of responsibility are shown on Graph 5-120.

By comparing the data dispersion of both batches of data, the groups seems to differ in the interquartile range as well as in the overall range, although the median of both groups are at the same level. The energy efficient group also has some outliers that scored at the end of the scale and which could require further analysis in future conclusions. A skewness of -0,317 for



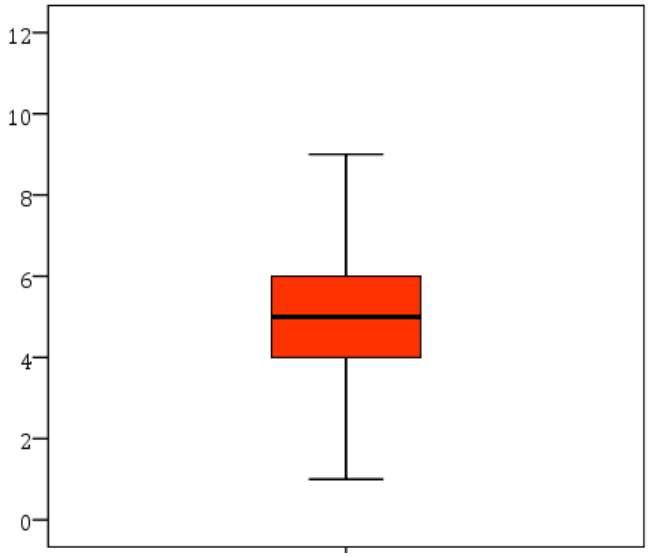
Graphic 5- 120 Level of responsibility, by group

the energy efficient group and -0,314 for the not energy efficient group leads us to describe the data as approximately symmetrical. In order to test if the differences between both groups are significant, the Wilcoxon-Mann-Whitney-Test was used. From the test value (z= -1,149, p-value= 0,251) it is clear that both groups cannot be distinguished in the category of level of responsibility regarding environmental protection, climate problems and the efficient use of energy.

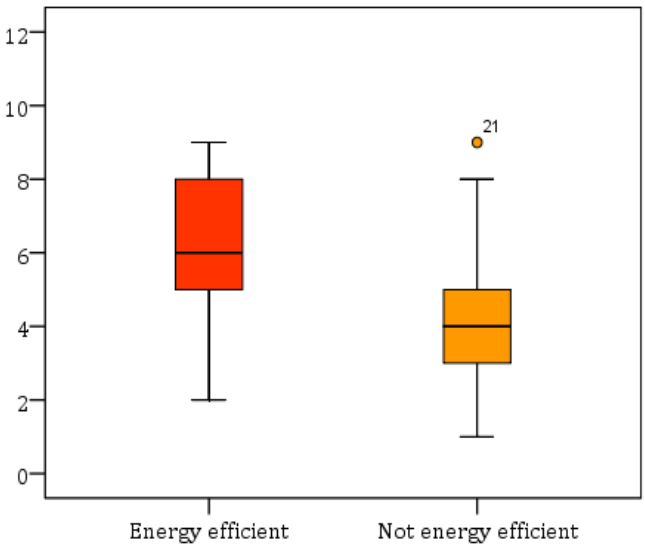
5.6.5 UNI-G Level of exposure to information

Three frequency questions were included in this category. Each question had five possible answers: always, very often, sometimes, rarely and never. By answering the three question of the category the respondent had the chance to score between 0 and 12 points. After analyzing 204 valid answers, the results of this category are shown on Graph 5-121.

The dataset on the graph spreads from 0 to 9 on the scale, suggesting heterogeneity in the level of exposure to information. From the data location it can be seen that the median is located at 5 on the scale and that 75% of the group scored 6 or more. With a skewness of 0,121 we can describe the data distribution as approximately symmetrical. The results of 37 valid answer from the energy efficient group and 38 valid answers from the not energy efficient group are shown on Graph 5-122.



Graphic 5- 121 Level of exposure to information

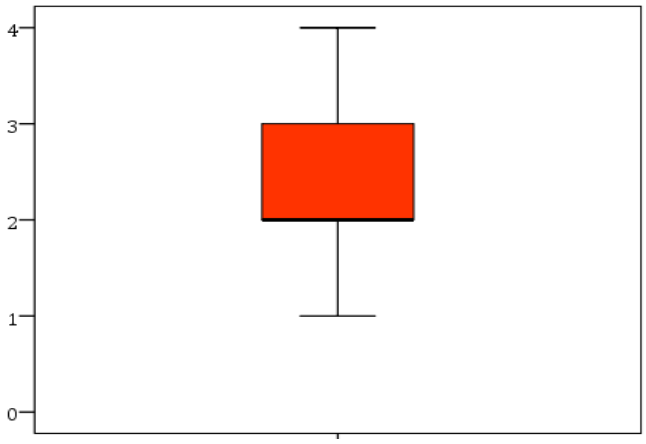


Graphic 5- 122 Level of exposure to information, by group

The data dispersion of both data distributions seems to be differ in the interquartile range as well as in the overall range. The data location of both data distributions is also different, that is, the median of the energy efficient group is greater by one point. From a skewness of -0,314 for the energy efficient group and 0,703 for the not energy efficient group, we can describe the data distribution of the energy efficient group as approximately symmetrical, ranging from 2 to 9 on the scale, while from the skewness results of the not energy efficient group can be described as moderately skewed down. Overall, the two datasets look as if they differ, and in fact the Wilcoxon-Mann-Whitney-Test (z= -4,119, *p*-value= 0,000) leads us to conclude that the groups are distinguished in the category level of exposure to information. Due to the fact that the median for the energy efficient group is higher, we can conclude that the energy efficient group has a higher level of exposure to information.

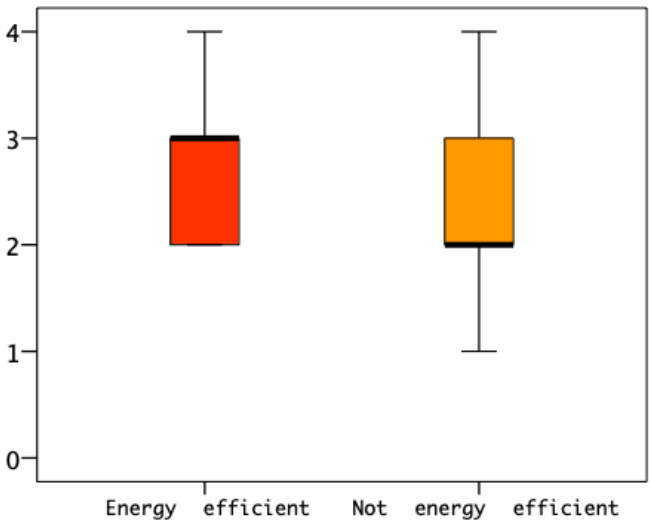
5.6.6 UNI-G-Level of importance of the topic "energy saving".

This category aimed to find out how important the topic "energy saving "is for the respondents. The category has only one question: How important is energy saving for you? To answers the question, the respondents had to choose between five possible answers. By answering the question, the respondents had the chance to score from between 0 to 4 in the category. On Graph 5-123 the results of 105 valid answers are shown.



Graphic 5- 123 Level of importance of energy saving,

The graph shows a dataset spreading from 1 to 4, from the data dispersion we could describe the group as heterogeneous in the category level of importance. It can be seen on the graph that 50% of the group scored 2 or more, although the dataset seems to be accumulated at the end of the scale with a skewness of 0,460 so we can describe the data distribution as approximately symmetrical in a range from 1 to 4. In this category 37 valid answers from the energy efficient group and 38 valid answers from the not energy efficient group were analyzed with the results are shown on Graph 5-124.

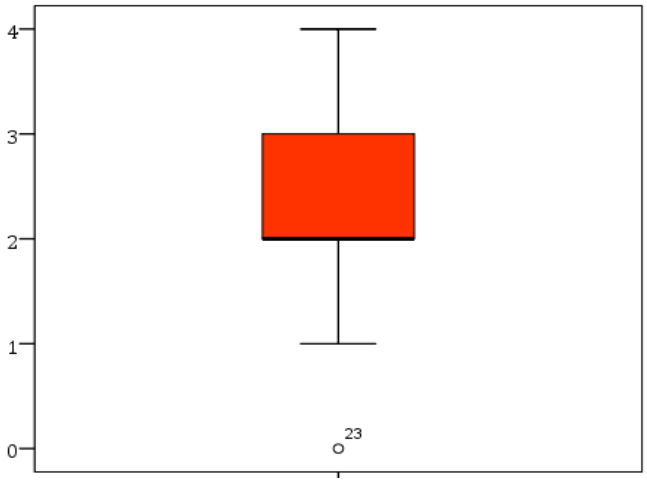


Graphic 5- 124 UNI-G Level of importance of energy saving, by group

On the graph two data distributions with different patterns are shown, from the data dispersion of both groups we can see that that they slightly differ in the interquartile range as well as in the overall range. From the data location it can be seen on the graph that the medians are both at the same level. The skewness is not particular marked in either case; a skewness of 0,621 for the energy efficient group and 0,419 for the not energy efficient group leads us to describe the data distribution of the energy efficient group as approximately symmetrical while the data distribution of the not energy efficient group could be described as moderately skewed down. Though both groups have some differences in data distribution, the Wilcoxon–Mann–Whitney-Test (z= -1,195, *p*-value= 0,232) leads us to conclude that both groups are not distinguished in the category level of importance of energy saving.

5.6.7 UNI-G Level of willing to know more about energy efficiency

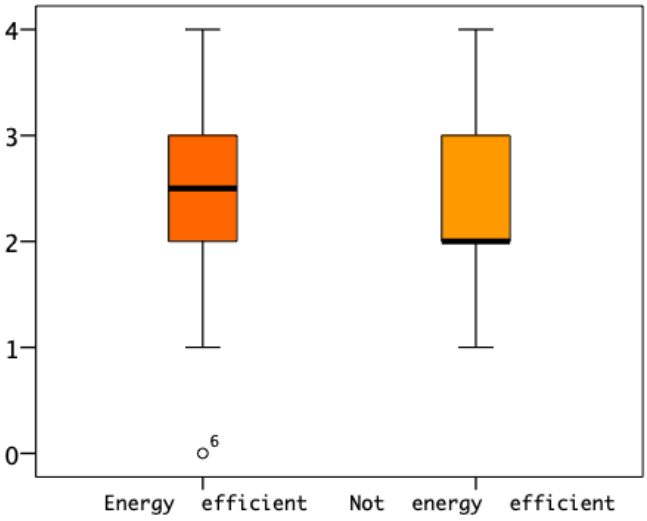
This category has just one question; by answering the question the participant had the chance to achieve a score of between zero and four. Graph 5-125 shows the data distribution, taking into account the answers of 103 university students from Germany. The dataset on Graph 5-125 spreads across the entire scale, we can consider the level of willing to know more about energy efficiency as heterogeneous across the group, although on some parts of the scale students seems to have a high level of agreement which each other.



Graphic 5- 125 Level of willing to know more about energy efficiency

75% of the data ranges from 2 to 4 on the scale; the data seem to be accumulated at the end of the scale, but a skewness of 0,101 leads us to conclude that the data distribution can be considered as approximately symmetrical across the scale. The analysis of the category by groups is shown on Graph 5-126.

From the data dispersion both groups appear to be reasonably similar at the interquartile range as well as in the overall range. When the data location is compared, the median of the energy efficient group is greater by one point. The skewness of both data distributions is not particularly marked in either case, with a skewness of -0,507 for the energy efficient group and 0,864 for the not energy efficient group. The data distribution of the energy efficient group can be described as moderately skewed up and the data distribution of the not energy efficient group can be considered as moderately skewed down. The Wilcoxon-Mann-Whitney-Test (z= -0,865, p-value= 0,387)

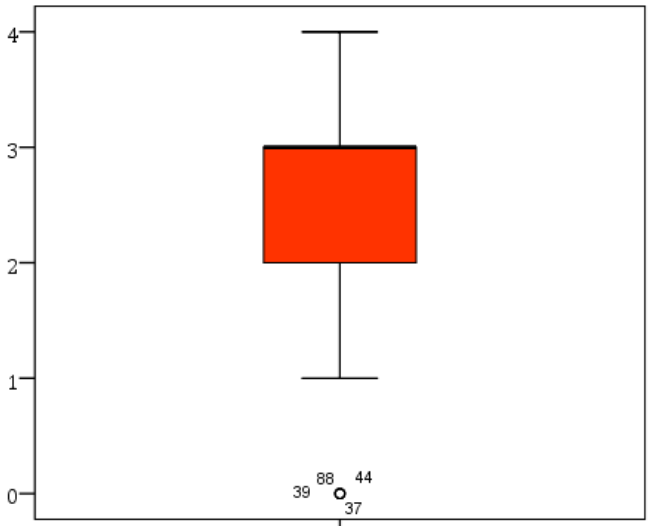


Graphic 5- 126 UNI-H Level of willing to know more about energy efficiency, by group

leads us to conclude that the energy efficient group and the not energy efficient group cannot be distinguished in the category level of willing to know more about energy efficiency.

5.6.8 UNI-G Level of engagement as a future teacher

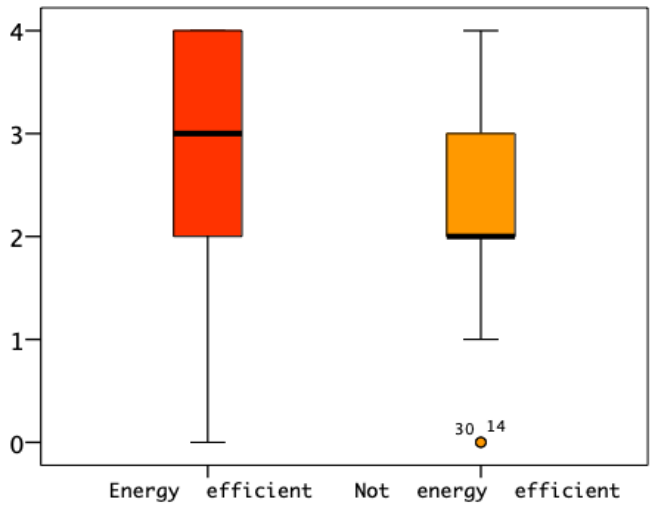
The category level of engagement aimed to find out the respondent's level of commitment as a future teacher regarding the implementation of new programs related to the efficiently use of energy. This category has only one frequency scale question with five possible answers and to each answer was given a score point. By answering the question, the respondent had the chance to achieve a score from 0 to 4. On Graph 5-127 the results of 106 valid answers are shown.



Graphic 5- 127 UNI-G Level of engagement as a future teacher

The dataset on Graph 5-127 spreads from 0 to 4, suggesting varied views across the group. 75% of the data is located in a range from 2 to 4 and on some parts of the scale the students' views are more similar. From a skewness of -0,534 we can describe the data as moderately skewed up, ranging across the entire scale. The data analysis of 38 valid answers from the energy efficient groups and 38 valid answers from the not energy efficient group is shown on Graph 5-128.

As can be seen on the graph, the data distribution of both groups seems to be different, by comparing the data dispersion both groups appear to differ in the interquartile range although the overall range is reasonably similar for both groups.The median of the energy efficient group is greater by one point, although 75% of both groups scored 2 or more.



Graphic 5- 128 UNI-G Level of engagement as a future teacher, by group

A skewness of -0,772 for the energy efficient group and -0,490 for the not energy efficient group leads is to describe the data distribution of the energy efficient group as moderately skewed up, while the data distribution of the not energy efficient group can be described as approximately symmetrical. By comparing the data distribution of both groups using the Wilcoxon-Mann-Whitney-Test, the results (z= -1,664, p-value= 0,096) leads us to conclude that the energy efficient group and the not energy efficient group cannot be distinguished in the category level of engagement as a future teacher.

Once the data of the seven categories was analyzed it was pertinent to know if there exists any relation between the categories. By using the Spearman's rank correlation coefficient or Spearman's rho, some correlations between the categories were found. A clear explanation is given with diagram 5- 6.

5.6.9 UNI-G Correlations between the categories

As it can be seen on the diagram, it was found that energy efficiency behavior is correlated to the level of engagement as a teacher and the level of expose to information. The level of expose to information is correlated to the level of importance that the respondents have given to the topic and the level of engagement as a future teacher. Furthermore, the level of engagement as a future teacher was found to be correlated to the level of importance and the preconceptions about energy efficiency.

A correlation between the level of importance of the topic and the level of willing to know more about the topic was also found. In the next section the results of the association questions are described.

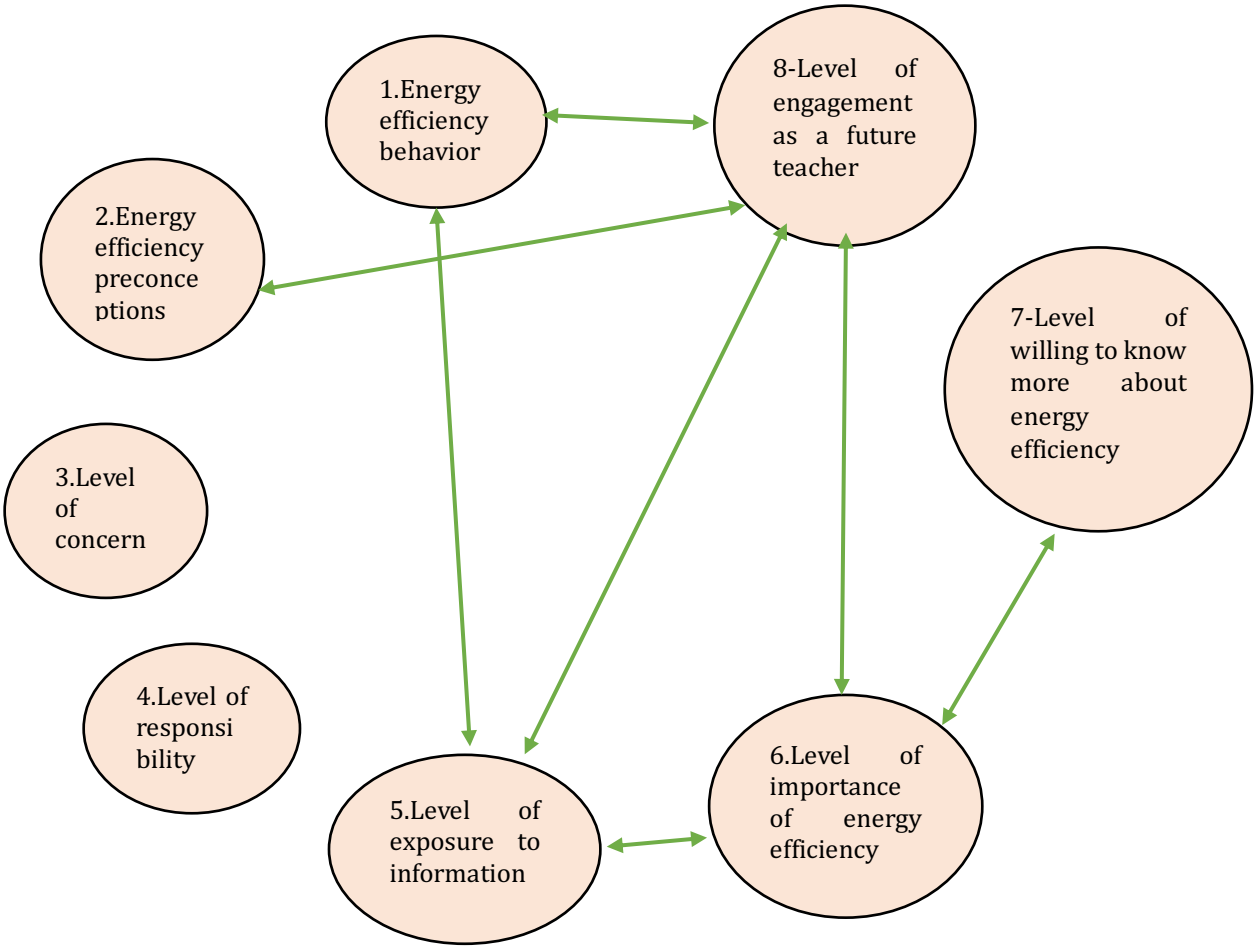
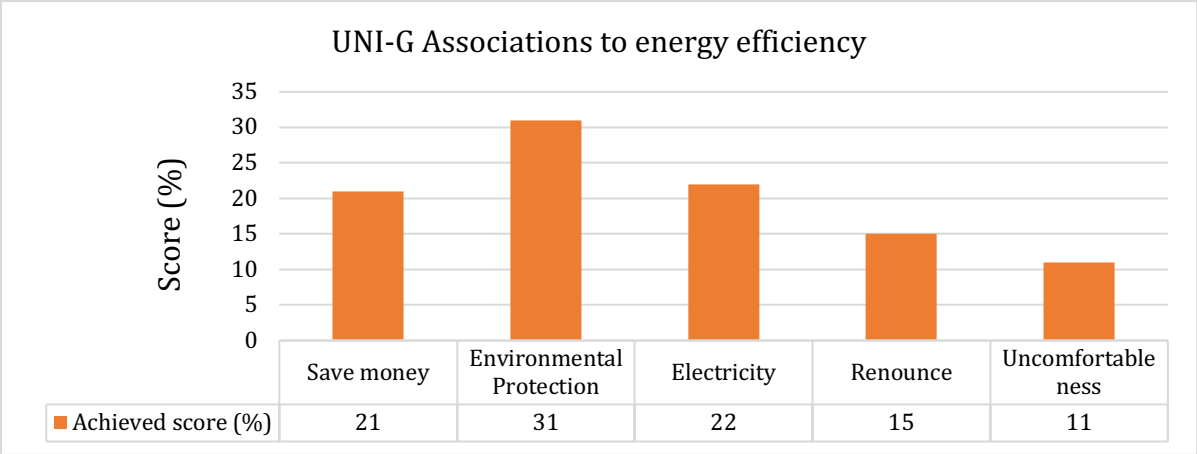


Diagram 5- 6 UNI-G correlations between categories

5.6.10 UNI-G Associations to energy efficiency

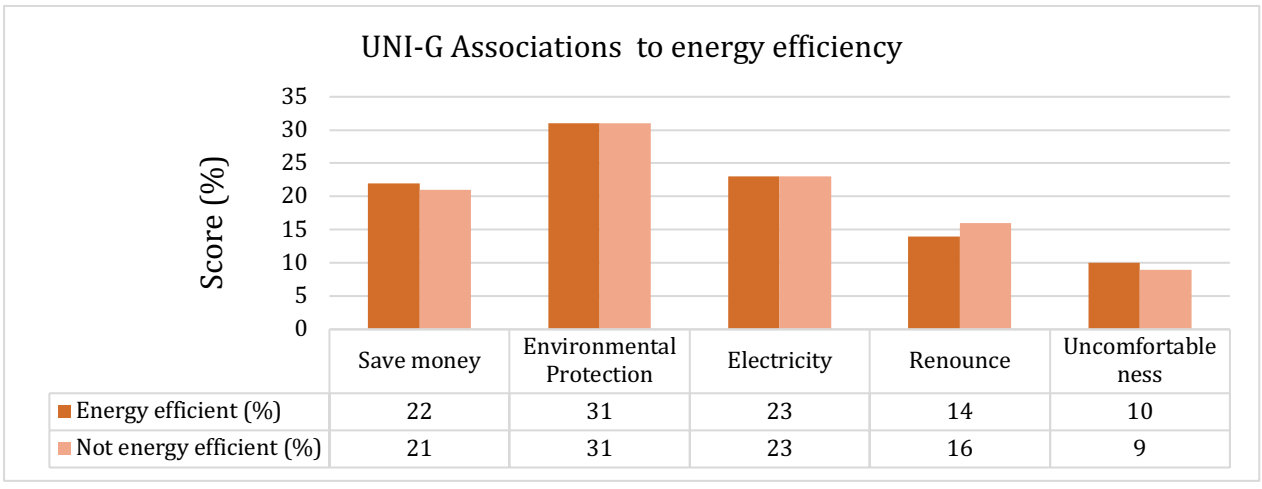
As it was explaining in the previous sections, from the Likert-scale instrument that was used to collect the data, 4 association questions were analyzed. In the first association question five terms were given to the students; they must rank these five terms from the term most associated with energy efficiency to the term least associated with energy efficiency. The term with the highest score is the term most associated with energy efficiency, the term with the lowest score is the term least associated with energy efficiency for them.



Graphic 5- 129 UNI-G Association to energy efficiency

It can be seen on the graph that the term most associated with energy efficiency for 86 university students from Germany is environmental protection, in second place in the ranking is electricity, in third place is save money. Renounce and uncomfortableness are the terms least associated with energy efficiency for this groups of university students.

On Graph 5-130 the rankings given by the energy efficient group and the not energy efficient group are shown. The Wilcoxon–Mann–Whitney-Test was used to find out whether the energy efficient group and the not energy efficient made different associations regarding the topic of energy efficiency.



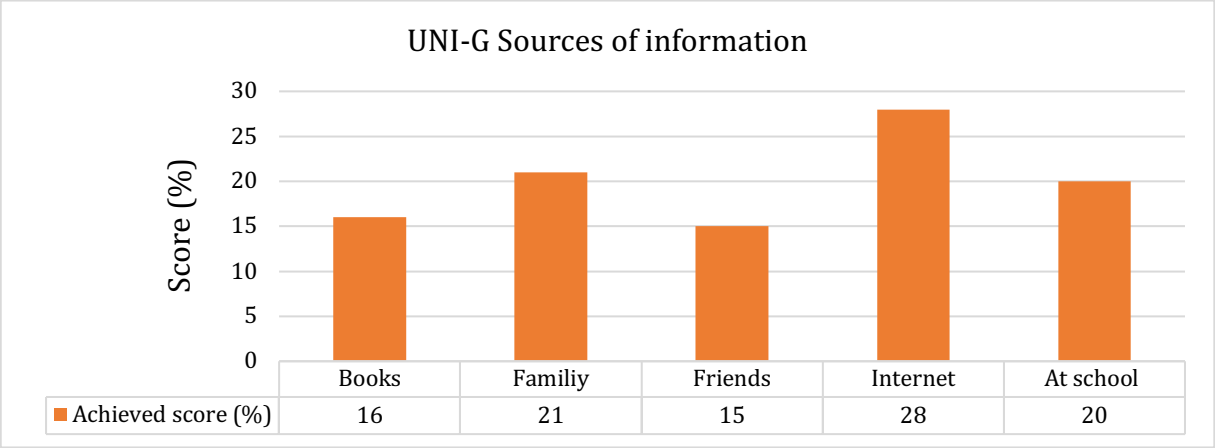
Graphic 5- 130 UNI-G Associations to energy efficiency, by group

The following the test results (Save money z= -0,73, p-value= 0,466; Environmental protection z= -0,16, p-value= 0,873; Electricity, z= -0,131, p-value= 0,896; Renounce, z= -1,333, p-value= 0,183; Uncomfortableness z= -0,049, p-value= 0,961) leads us to conclude

that both groups are not distinguished by ranking the terms to energy efficiency. For this reason, in future comparisons the rankings given by the entire group will be used.

5.6.11 UNI-G Sources of information

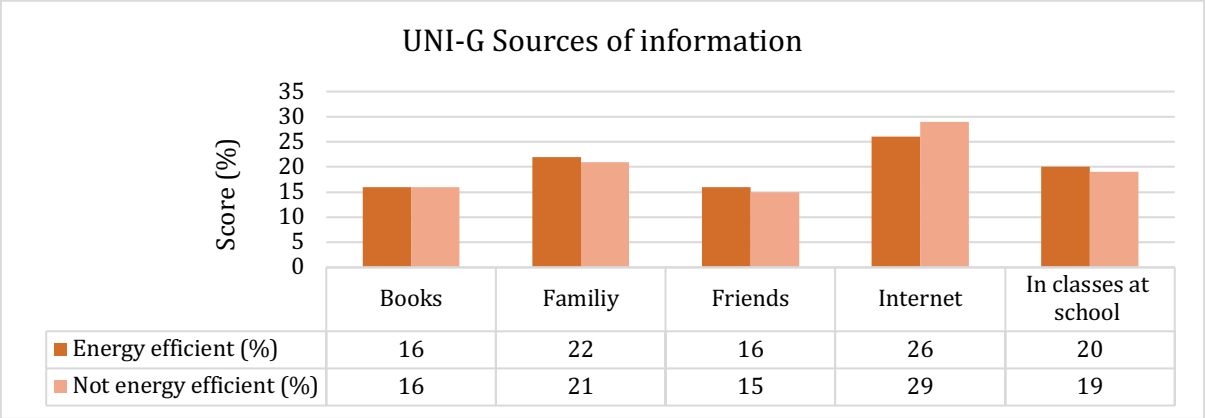
This association question aimed to find out where the information about environmental topics that the university students might get is coming from. On Graph 5-131 is shown the rankings given by Which is the most used source of information by the university students from Germany?



Graphic 5- 131 UNI-G Sources of information

The graphs show that the most used source of information for 93 university students from Germany is internet, in second position is family following by at school in third position and by books in fourth position. The least used source of information for this group of participants is friends with 15% of achievement.

On Graph 5-132 the rankings given by 33 valid answers from the energy efficient group and 33 valid answers from the not energy efficient group are shown. The Wilcoxon–Mann–Whitney-Test was used to find out whether the energy efficient group and the not energy efficient gave the same rankings with the sources of information.

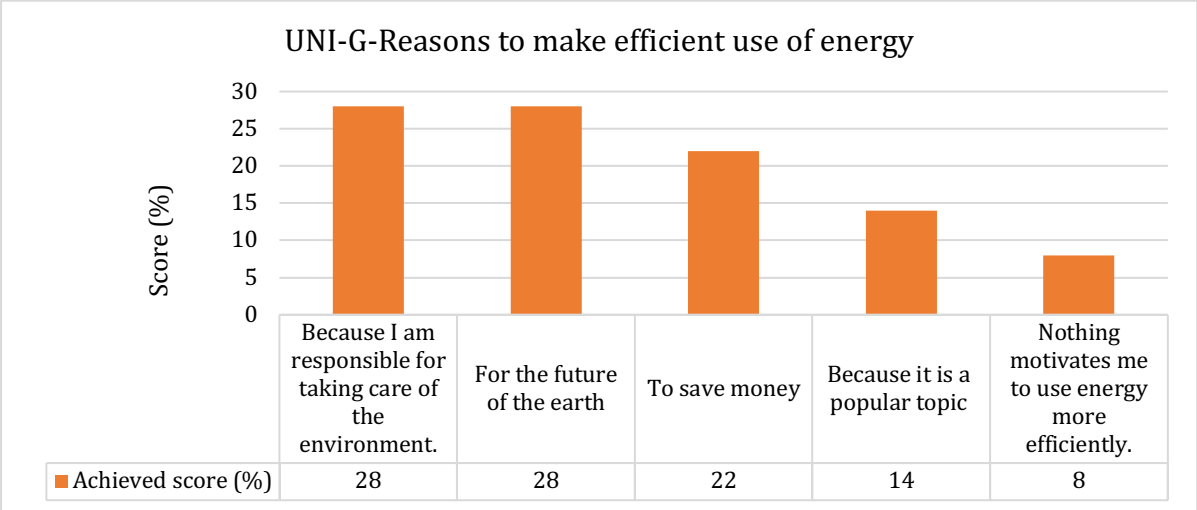


Graphic 5- 132 UNI-G Sources of information

The results of the Wilcoxon–Mann–Whitney-Test (Books z= -0,198, *p*-value= 0,843; Family z= -0,906, *p*-value= 0,365; Friends, z= -0,233, *p*-value= 0,816; Internet z= -1,418, *p*-value= 0,156; In classes at School z= -0,388, *p*-value= 0,698) leads us to conclude that both groups are not distinguished by ranking their sources of information. For this reason, in future conclusions the rankings given by the entire group will be used.

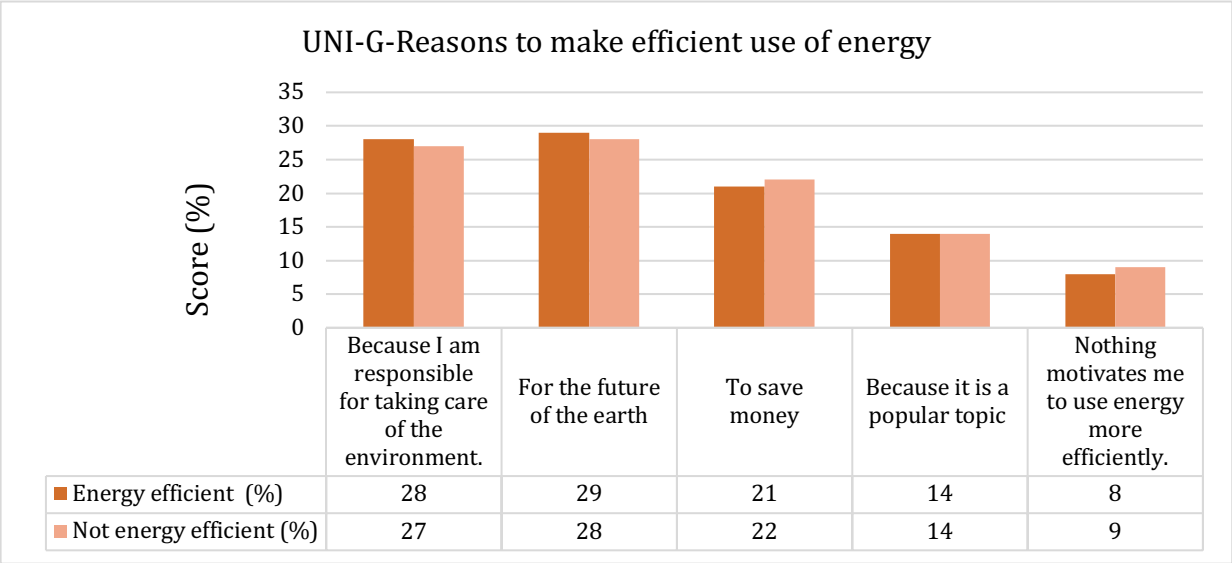
5.6.12 UNI-G Reasons to make efficient use of energy

The association question about the reasons students could have to make efficient use of energy was answered by 94 university students from Germany. On Graph 5-133 the rankings given by the groups of respondents are shown.



Graphic 5- 133 UNI-G Reasons to make efficient use of energy

Graph 5-133 shows that the number one reason to make efficient use of energy for the 94 students from Germany is because they feel responsible for the environment and because of the future of the earth. The second reason is to save money, following by the popularity of the topic. As the last reason they ranked Nothing motives me to use energy more efficiently. On Graph 5-134 the analysis made of 33 valid answers from the energy efficient group and 33 valid answers from the not energy efficient group are shown.



	Because I am responsible for taking care of the environment.	For the future of the earth	To save money	Because it is a popular topic	Nothing motivates me to use energy more efficiently.
Energy efficient (%)	28	29	21	14	8
Not energy efficient (%)	27	28	22	14	9

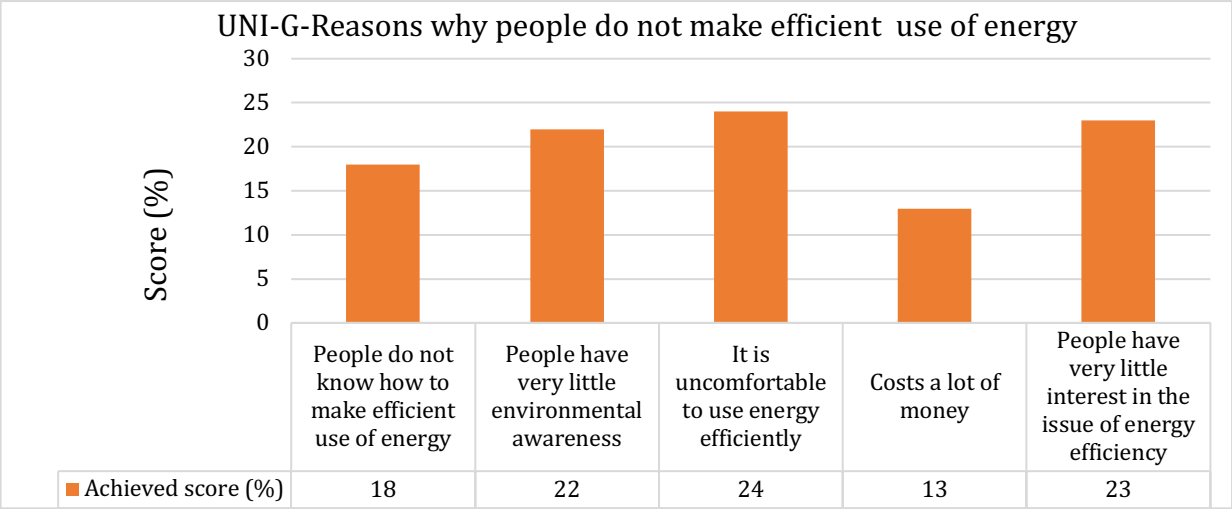
Graphic 5- 134 UNI-G Reasons to make efficient use of energy

By comparing both groups, using the Wilcoxon–Mann–Whitney-Test, the results (because I am responsible for taking care of the environment z= -0,488, *p*-value= 0,625; for the future of the earth z= -0,321, *p*-value= 0,748; to save money;, z= -0,132, *p*-value= 0,895; because it is a popular topic z= -0,41, *p*-value= 0,682; nothing motivates me to use energy more efficiently z= -0,376, *p*-value= 0,707) leads us to conclude that the groups do not differ by ranking the reason to make efficient use of energy. From now on and in future conclusions the rankings given by the entire group will be used.

5.6.13 UNI-G Reasons why people do not make efficient use of energy

In the survey the respondents were asked to rank the reasons they think people could have to not make efficient use of energy. As with the other association questions in this part, the respondents were given five reasons to rank. Graph 5-44 deals with the results of 91 valid answers. On Graph 5-135 the results are shown.

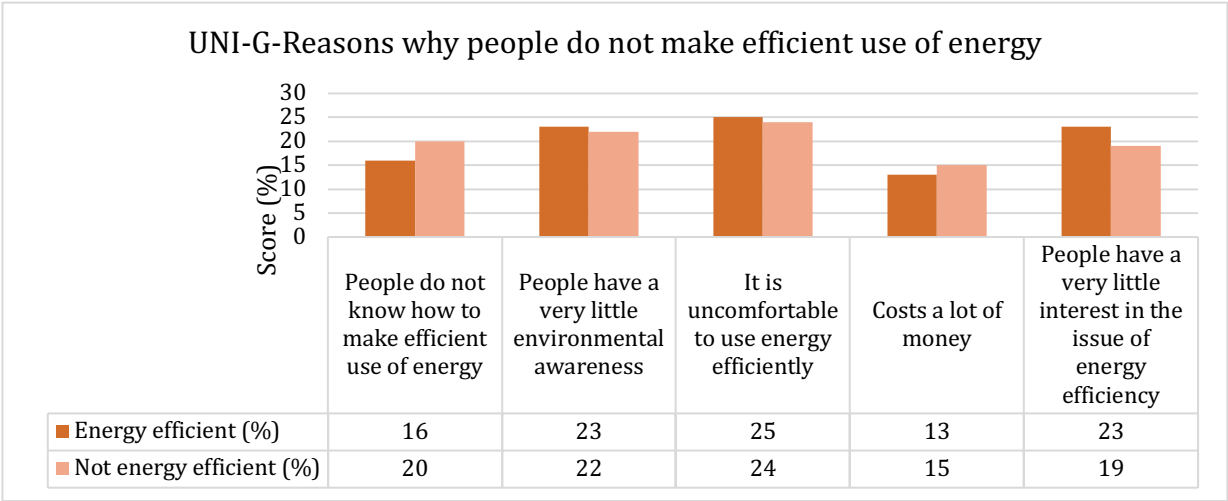
As it can be seen on the graph, the group of university students suppose that the main reason why people do not make efficient use of energy is because it is uncomfortable, in second place



Graphic 5- 135 UNI-G Reasons why people do not make efficient use of energy

in the ranking with a difference of only 1% is the opinion that people are not interested in the topic. The third position in the ranking is people's poor environmental awareness. The fourth and the last reasons in the ranking are people do not know how to do it and it costs a lot of money.

On Graph 5-136 the rankings given by 32 respondents from the energy efficient group and 32 respondents from the not energy efficient group are shown.



Graphic 5- 136 UNI-G Reasons why people do not make efficient use of energy

Due to the results of the Wilcoxon–Mann–Whitney-Test (People do not know how to make efficient use of energy, z= -1,088, *p*-value= 0,277; People have very little environmental

awareness. z= -0,064, *p*-value= 0,949; It is uncomfortable to use energy efficiently, z= -0,776, *p*-value= 0,438; it costs a lot of money z= -1,312, *p*-value= 0,189; People have very little interest in the topic of energy efficiency z= -1,588, *p*-value= 0,112) we consider that there are not significant differences between the energy efficient group and the not energy efficient group by ranking the reasons why people do not make efficient use of energy.

The results of the six groups (year eight and year eleven school children and university students both in Germany and in Honduras) targeted in the research were described from section 5.1 to section 5.6. In section II of this chapter the comparisons made between the six participants groups.

II- Comparing groups

Following the information in previous chapters, in this section the comparisons made of the 6 participating groups are described. The aim of the comparison is to find out whether the groups can be distinguished in the 7 categories and in the 4 association questions according to their level of education and taking into account the cultural context of each group. Although the data of the university students was divided into 8 categories, to make the comparison by level of education only the 7 categories which the 3 different levels of education have in common will be used. The university students have one more category in which they were asked about their level of engagement as future teacher, this category is not included on the secondary school children questionnaire.

Due to the fact that in the previous section the data distribution in each category was already fully discussed, in this section will only be described whether the groups can be distinguished in each category. Only when the groups are distinguished in one particular category is it shown on a graph the data distributions of this category for both groups. To conclude whether the data distribution of each category, as well as each association question, can be distinguished, the Wilcoxon-Mann-Whitney-Test was used.

5.7 Comparison among the Honduran groups

As in previous sections, in order to give a shorter name to each Honduran group, the year eight secondary school children will be named as 8-H, the year eleven secondary school children as 11-H, and the university students as UNI-H. The comparisons among groups was made as follow 8-H and 11-H, 11-H and UNI-H, 8-H and UNI-H. The three Honduran groups were compared with respect to each common category and each common association question.

5.7.1 Comparison between 8-H and 11-H, by category

In this first section are described the results of comparing 8-H and 11-H by category. In the second section the comparisons of the 4 association questions are described. In order to find whether both groups can be distinguished in each category the Wilcoxon-Mann-Whitney-Test was used; the results are shown next to each category. From the test results, the conclusion whether both groups can be distinguished are shown in column 3 of Table 5-1. The green color in column 3 of Table 5-1 means that the group cannot be distinguished in the category, while when the groups are distinguished in a category no green color appears, rather the name of the group which scored higher in the category is used.

Category	Wilcoxon-Mann-Whitney-Test (8-H,11-H)	Distinguishable / indistinguishable
Energy efficiency behavior	Z=-2,059 p-value= 0,04	11-H
Preconceptions about energy efficiency	Z=-1,860 p-value= 0,063	
Level of concern	Z=-1,708 p-value= 0,088	
Level of responsibility	Z=-1,717 p-value= 0,086	
Level of exposure to information	Z=-1,109 p-value= 0,268	
Level of importance of the topic “energy saving”	Z=-1,303 p-value= 0,192	
Want to know more about energy efficiency	Z=-1,296 p-value= 0,195	

Table 5- 1 Comparison between 8-H and 11-H, by category

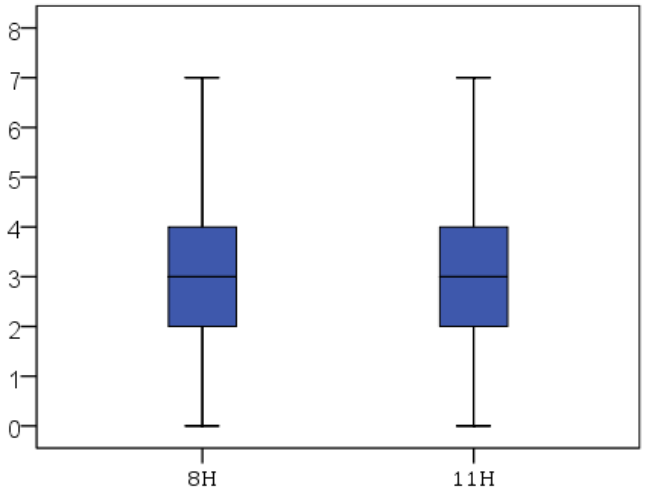
As it can be seen in Table 5-1, the year eight secondary school children from Honduras and the year eleven secondary school children from Honduras can be distinguished only in the

energy efficiency behavior category, while in the other six categories of analysis the group could not be distinguished.

8-H and 11-H, Energy efficiency behavior

On Graph 5-137 are shown the data distribution of both groups in the category energy efficiency behavior.

The graph shows two similar patterns; the groups seems to be similar in data dispersion and they seem to be overall similar in data location. Nevertheless, the Wilcoxon-Mann-Whitney-Test (z=-2.059 p-value= 0.04) is conclusive. The year eleven is the group that has the highest mean rank therefore the group should have a greater number of high scores within it, from the test results and the mean rank of both groups we have concluded that the year eleven secondary school children from Honduras achieved a higher score in the category energy efficiency behavior when they were compared to the year eight secondary school children from Germany.



Graphic 5- 137 8-H and 11-H, energy efficiency behavior

As a conclusion of comparing the year eight secondary school children from Honduras and the year eleven secondary school children by category, according to the results of the Wilcoxon-Mann-Whitney-Test, the 8-H and the 11-H were found to be distinguished only in energy efficiency behavior, although both groups have the same median, the 11-H got the highest mean rank, therefore they should have a greater number of high scores within it. In the data distribution of the other 6 categories in table 5-1 the groups could not be distinguished.

Once the comparisons of the categories was made, in the next section are described the results of comparing both groups by association questions.

5.7.2 Comparison between 8-H and 11-H, by association question

8-H and 11-H, Association with energy efficiency

In Table 5-2 is shown the results of the Wilcoxon-Mann-Whitney-Test for the associations that both groups made regarding the topic energy efficiency.

Term	Wilcoxon-Mann-Whitney-Test		Distinguishable / indistinguishable
Save money	Z=-0,906	p-value= 0,365	
Environmental Protection	Z=-2,188	p-value= 0,029	11-H
Electricity	Z=-0,354	p-value= 0,724	
Renounce	Z=-0,835	p-value= 0,404	
Uncomfortableness	Z=-1,6	p-value= 0,11	

Table 5- 2 comparison between 8-H and 11-H, by association questions, association with energy efficiency

In the findings of comparing both groups (8-H and the 11-H), from the test results in Table 5-2 and the results of Graph 5-15 and Graph 5-59, we can conclude that the year eleven secondary school children from Honduras reported a stronger relation between energy efficiency and environmental protection than the year eight secondary school children from Honduras. By ranking the other four terms (save money, electricity, renounce and uncomfortableness), the groups (8-H and the 11-H) were found not to be distinguished.

8-H and 11-H, Sources of information

In Table 5-3 are shown the results of comparing both groups (8-H and 11-H) in the ranking of the information sources (sources that the students use to get information about environmental problems and the efficient use of energy).

Sources of information	Wilcoxon-Mann-Whitney-Test		Distinguishable / indistinguishable
Books	Z=-0,307	p-value= 0,759	
Family	Z=-1,344	p-value= 0,179	
Friends	Z=-2,132	p-value= 0,033	8-H
Internet	Z=-1,44	p-value= 0,15	
In classes at school	Z=-0,931	p-value= 0,352	

Table 5- 3 Comparison between 8-H and 11-H, by association question, sources of information

The results in Table 5-3, Graph 5-17 and Graph 5-61, show that the year eight secondary school children from Honduras reported using friends as a source of information more frequently than their older peers (11-H). By ranking books, family, internet and in classes at school as sources of information, there was not found a statistically significant difference between the groups.

8-H and 11-H, Reasons to make efficient use of energy

The both groups of secondary school children were compared in their reasons to make efficient use of energy; in Table 5-4 are shown the results.

Reasons to make efficient use of energy	Wilcoxon-Mann-Whitney-Test		Distinguishable / indistinguishable
Because my parents say I have to.	Z=-2,317	p-value= 0,02	8-H
It is good for the environment	Z=-2,604	p-value= 0,009	11-H
To save money	Z= -0,832	p-value= 0,405	
Because it is a popular topic	Z= -1,526	p-value= 0,127	
Because at school they say I have to	Z= -0,44	p-value= 0,66	

Table 5- 4 Comparison between 8-H and 11-H, by association question, Reasons to make efficient use of energy

The key findings of comparing both groups (8-H and 11-H), from the results of Table 5-4 and the results of Graphic 5-19 and Graphic 5-63, are that year eight secondary school children from Honduras reported to be more influenced by their parents when they are willing to make efficient use of energy than the year eleven secondary school children from Honduras. While for the year eleven secondary school children from Honduras taking care of the environment is a stronger motivation to use energy efficiently. By ranking the other tree reason with a green color in Table 5-4, no statistically significant difference was found between the groups.

8-H and 11-H, Reasons why people do not make efficient use of energy

In Table 5-5 are shown the results of comparing the year eight secondary school children from Honduras and the year eleven secondary school children from Honduras in their opinions about why people do not use energy efficiently.

In the findings from the test results in Table 5-5 and Graph 5-21 and Graph 5-65, it is reported that between the year eight secondary school children from Honduras and the year eleven secondary school children from Honduras no statistically significant difference was found by ranking the reasons why people do not use energy efficiently.

Reasons	Wilcoxon-Mann-Whitney-Test		Distinguishable / indistinguishable
People do not know how to make efficient use of energy	Z=-1,598	p-value= 0,11	
People have very little environmental awareness	Z=-1,441	p-value= 0,149	
It is uncomfortable to use energy efficiently	Z= -1,994	p-value= 0,046	
Costs a lot of money	Z= 0,525	p-value= 0,599	
People have very little interest in the issue of energy efficiency	Z= -1,8	p-value= 0,072	

Table 5- 5 Comparisons between 8-H and 11-H, by association question, reasons why people do not use energy efficiently

5.7.3 Comparison between 11-H and UNI-H, by category

The year eleven secondary school children from Honduras and the university students from Honduras were compared according to their scores in 7 categories of analysis using the Wilcoxon signed-rank test. In Table 5-6 are shown the results.

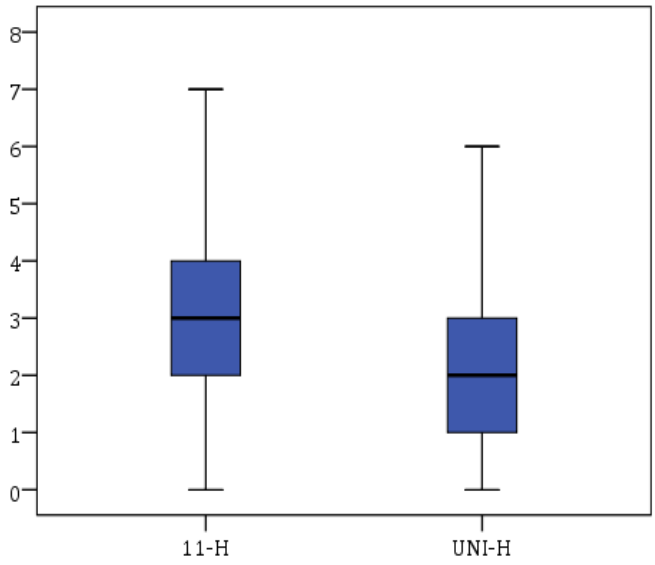
Category	Wilcoxon-Mann-Whitney-Test (11H-UNI-H)		Distinguishable / indistinguishable
Energy efficiency behavior	Z= -2,849	p-value= 0,004	11-H
Preconceptions about energy efficiency	Z=-5,336	p-value= 0,00	UNI-H
Level of concern	Z=-4,172	p-value= 0,00	UNI-H
Level of responsibility	Z=-0,870	p-value= 0,384	
Level of exposure to information	Z=-0,437	p-value= 0,662	
Level of importance of the topic “energy saving”	Z=-2,050	p-value= 0,040	UNI-H
Level of willing to know more about energy efficiency	Z=-5,135	p-value= 0,00	UNI-H

Table 5- 6 Comparison between 11-H and UNI-H, by category

The results of Table 5-6 show that the year eleven secondary school children from Honduras and the university students from Honduras can be distinguished by scoring in the following categories: level of energy efficiency, preconceptions about energy efficiency, level of concern, level of importance of the topic and level of willing to know more about the topic. The data distribution of both groups, 11-H and UNI-H, showed that the university students from Honduras reported a higher score in 4 of the 5 categories mentioned above in which both groups were found to be distinguished. The following will describe the category data distribution of both groups, 11-H and UNI-H, in which they were found to be distinguished.

11-H and UNI-H, Energy efficiency behavior

On Graphic 5-138 can be seen the data distribution of 139 valid answers from 11-H and 103 valid answers from UNI-H in the category energy efficiency behavior.

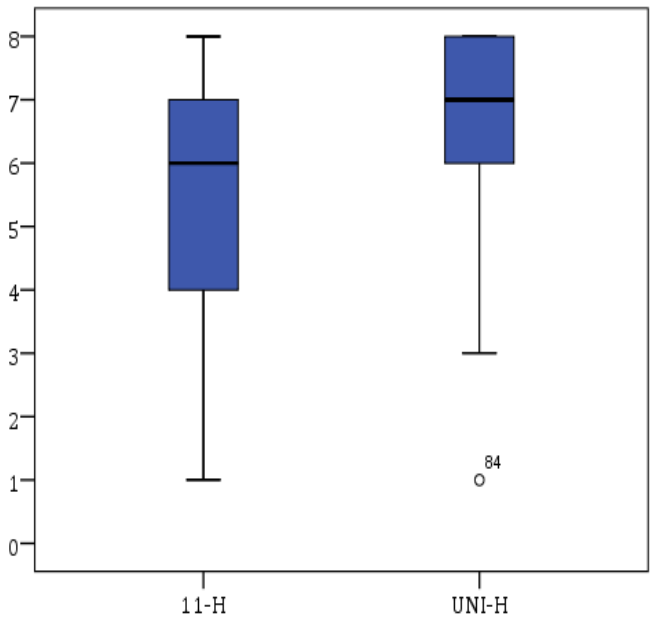


Graphic 5- 138 11H and UNI-H, Energy efficiency behavior

Both data distributions on Graphic 5-142 differ in data dispersion as well as in data location. Both data distributions have different interquartile ranges as well as a different overall ranges; the median for 11-H is greater by one point. From the test results in Table 5-9 and the value for the median of both groups (11-H and UNI-H), we can conclude that the year eleven secondary school children from Honduras reported higher energy efficiency behavior when they were compared to the university students
from Honduras.

11-H and UNI-H, Preconceptions about energy efficiency

Graph 5-139 illustrates the results of 161 valid answers from 11-H and 104 valid answers from UNI-H in the category preconceptions about energy efficiency.



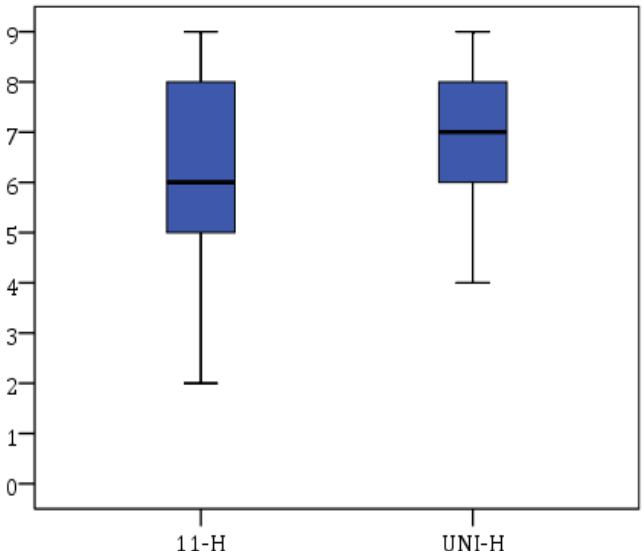
Graphic 5- 139 11-H and UNI-H, preconceptions about energy efficiency

The graph shows two different patterns; the groups differ in the interquartile range and also differ in data location, it can be seen on Graphic 5-139 that the median of UNI-H is greater by a point. A skewness of -0.537 for 11-H allows us to described the data distribution as moderately skewed up, ranging from 1 to 8 on the scale, while a skewness of -1.287 for UNI-H leads us to describe the data distribution as highly skewed up on a range from 1 to 8. In this regard, the results of the Wilcoxon-Mann-Whitney-Test in Table 5-9 and the value for the median of 11-H and UNI-H leads us to conclude that the university students from Honduras reported a higher score in the category preconceptions about energy efficiency when they were compared to year eleven secondary school from Honduras.

11-H and UNI-H, Level of concern

When 11-H with 162 valid answers and UNI-H with 105 valid answers were compared in their level of concern it was found that both groups can be distinguished. In order to see if the data distribution can tell us where these differences come from, the data distribution of both group in the category level of concern are shown on Graphic 5-140.

Both groups have a different interquartile range and a different overall range, that is, the groups differ in data dispersion for the category level of concern. The groups also differ in data location; the median of UNI-H is greater by one point. From the test's results in Table 5-9 and the values of the median for both groups it can clearly be seen that the university

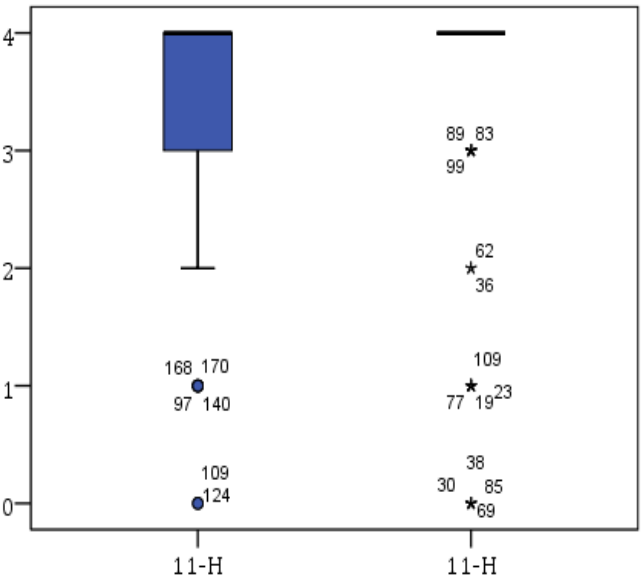


Graphic 5- 140 11-H and UN-H, Level of concern

students from Honduras reported a higher level of concern than the year eleven secondary school children from Honduras.

11-H and UNI-H, Level of importance of energy saving

The data distribution of 163 valid answers from 11-H and 102 valid answers from UNI-H are shown on Graphic 5-141.

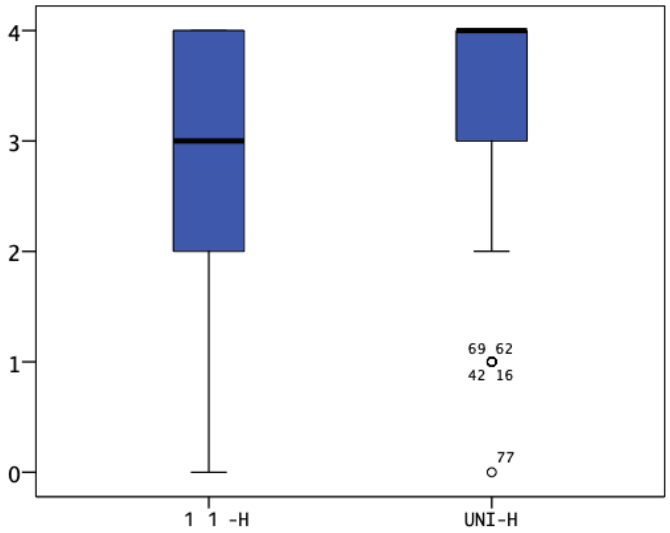


Graphic 5- 141 11-H and UNI-H, Level of importance of energy saving

The groups differ in the interquartile range and in data location. While the median of both groups are at the same level, from the skewness of both groups, -1.623 for 11-H and -2.134 for UNI-H, we can describe the data distribution of UNI-H as more skewed up than the data distribution of 11-H. The test's results in Table 5-9 and the mean rank of both groups leads us to conclude that for the university students from Honduras, the topic energy efficiency is more important than for the year eleven secondary school children from Honduras.

11-H and UNI-H, Level of willing to know more about energy efficiency

169 valid answers from 11-H and 106 valid answers from UNI-H are shown on Graphic 5-142. The graph shows two different patterns in both data distributions, the groups differ in data dispersion and in data location. The interquartile range of both groups is different but the overall range for both groups is the same. The median of UNI-H is greater by one point.



Graphic 5- 142 11-H and UNI-H, Level of willing to know more about energy efficiency

The data distribution for 11-H can be described as moderately skewed up with a skewness of -0.680, while the data distribution of UNI-H can be described as highly skewed up with a skewness of -1.865. It was found from the test's results and the values of the median for both groups that the university students from Honduras reported a higher level of willing to know more about energy efficiency than the year eleven secondary school children from Honduras.

5.7.4 Comparison between 11-H and UNI-H, by association question

As it was mentioned before, the university students and the secondary school children from Honduras can be compared in two of the four association that were analyzed in the research.

11-H and UNI-H Association with energy efficiency

In Table 5-7 the results for the Wilcoxon-Mann-Whitney-Test with the association question "association with energy efficiency" can be seen. By comparing the results of both groups, 11-H and UNI-H, in their associations with energy efficiency, from the results in Table 5-7 and the results on Graph 5-59 and Graph 5-105 it can be concluded that the year eleven secondary school from Honduras made a stronger association between save money and energy efficiency, as well as electricity and energy efficiency, while the university students reported making a stronger association between energy efficiency and renounce.

Term	Wilcoxon-Mann-Whitney-Test		Distinguishable / indistinguishable
Save money	Z=-2,129	p-value= 0,033	11-H
Environmental Protection	Z=-1,611	p-value= 0,107	
Electricity	Z=-2,847	p-value= 0,004	11-H
Renounce	Z=-2,396	p-value= 0,017	UNI-H
Uncomfortableness	Z=-0,125	p-value= 0,9	

Table 5- 7 Comparison between 11-H and UNI-H, association question, association to energy efficiency

11-H and UNI-H Sources of information

Both groups, 11-H and UNI-H, were compared by their sources of information about environmental problems and the efficient use of energy. With the comparison it was aimed to find out whether both groups use in the same frequency the five given sources of information. In Table 5-8 are shown the results of this comparison.

Sources of information	Wilcoxon-Mann-Whitney-Test		Distinguishable / indistinguishable
Books	Z=-0,486	p-value= 0,627	
Family	Z=-4,041	p-value= 0,000	11-H
Friends	Z=-0,716	p-value= 0,474	
Internet	Z=-1,978	p-value= 0,048	UNI-H
In classes at school	Z=-2,085	p-value= 0,037	UNI-H

Table 5- 8 Comparison between 11-H and UNI-H, association question, sources of information.

When comparing both groups, 11-H and UNI-H, the results in Table 5-8 and the results of Graph 5-61 and Graph 5-107 leads us to conclude that the year eleven secondary school children from Honduras use more frequently family as a scourge of information about environmental problem and the efficient use of energy, while the university students from Honduras use internet and in classes at school more frequently. By using books and friends as sources of information both groups were found not to be distinguished.

In previous sections the year eight and the year eleven secondary school children from Honduras and the year eleven children with the university students were compared. Due to the fact that in five of the seven categories the groups were found to be distinguish and the year eleven secondary school children from Honduras reported having a higher energy efficiency behavior than the university students from Honduras, it was decided to make a comparison between the year eight secondary school children and the university students in

order to find out whether both groups differs in the categories as well as in the association questions, taking into account the differences in their level of education.

5.7.5 Comparison between 8-H and UNI-H, by category

In this section the results are described of comparing the year eight secondary school children from Honduras by category results with the university students from Honduras. Although the university students' data is reported in 9 categories, by comparing the university students with the secondary school children, the comparison is made only in the categories that both groups have in common., that is, both groups (8-H and UNI-H) are compared by the results of 7 categories and 2 association questions. In Table 5-9 are shown the results of comparing the year eight secondary school children from Honduras and the university students from Honduras by category results.

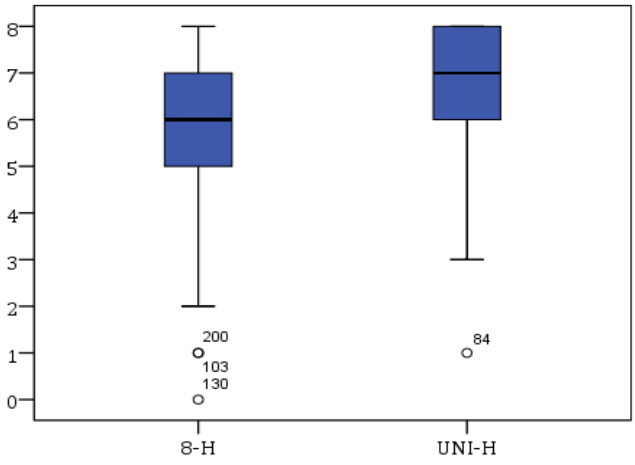
Category	Wilcoxon-Mann-Whitney-Test (8-H,UNI-H)		Distinguishable / indistinguishable
Energy efficiency behavior	Z=-1,159	p-value= 0,246	
Preconceptions about energy efficiency	Z=-4,123	p-value= 0,000	UNI-H
Level of concern	Z=-6,036	p-value= 0,000	UNI-H
Level of responsibility	Z=-2,352	p-value= 0,000	UNI-H
Level of exposure to information	Z=-0,569	p-value= 0,570	
Level of importance of the topic “energy saving”	Z=-1,039	p-value= 0,299	
Level of willing to know more about energy efficiency	Z=-5,746	p-value= 0,000	UNI-H

Table 5- 9 Comparison between 8-H- and UNI-H, by category

The test's results in Table 5-9 reported that the year eight secondary school children from Honduras and the university students from Honduras cannot be distinguished in the following categories: energy efficiency behavior, level of exposure to information, and level of importance of energy saving. The following shows the data distribution of the categories in which both groups (8-H and UNI-H) were found to be distinguished.

8-H and UNI-H, Preconceptions about energy efficiency

On Graphic 5-143 are shown the data distributions of both groups (8-H and 11-H) for 205 valid answers from 8-H and 104 valid answers from UNI-H in the category energy preconceptions about energy efficiency. The groups differ in the interquartile range as in the overall range, although the overall range of 8-H is greater, ranging across the entire scale, while the overall range of UNI-H ranges from 1 to 8; both data distribution suggests heterogeneity in their scores. A skewness of -0.801 for 8-H and-1. 287 for UNI-H leads us to describe the data distribution of 8-H as moderately skewed up and the data distribution of UNI-H as highly skewed up; the median of UNI-H is also greater by one point.



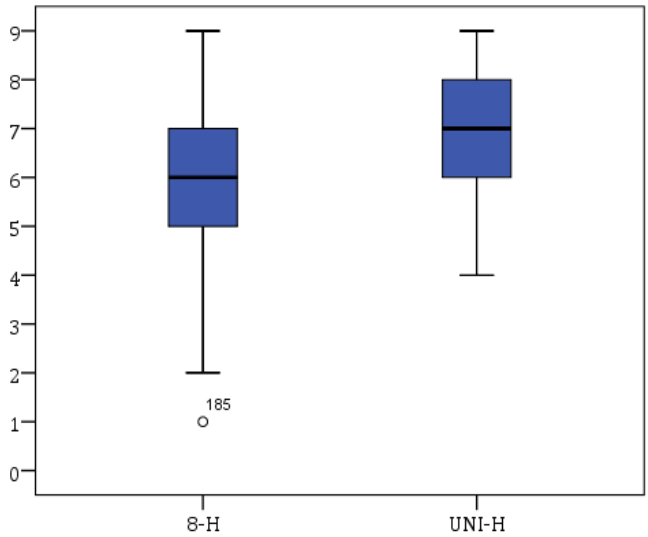
Graphic 5- 143 8-H and UNI-H, preconceptions about energy efficiency

From the findings of the test results and the median for both groups we can conclude that the university students from Honduras achieved a higher score in the category energy efficiency preconceptions than the year eight secondary school children from Honduras.

8-H and UNI-H, Level of concern

On Graph 5-144 are shown the data distributions of 209 valid answers from 8-H and 105 valid answers from 11-H in the category level of concern.

As it can be seen on Graph 5-144, the data distribution of both groups differs in their data dispersion and in their data location. By comparing the data dispersion, the overall range of 8-H is greater, ranging from 1 to 9, while UNI-H ranges from 4 to 9. Over 50% of 8-H scored 6 or less while

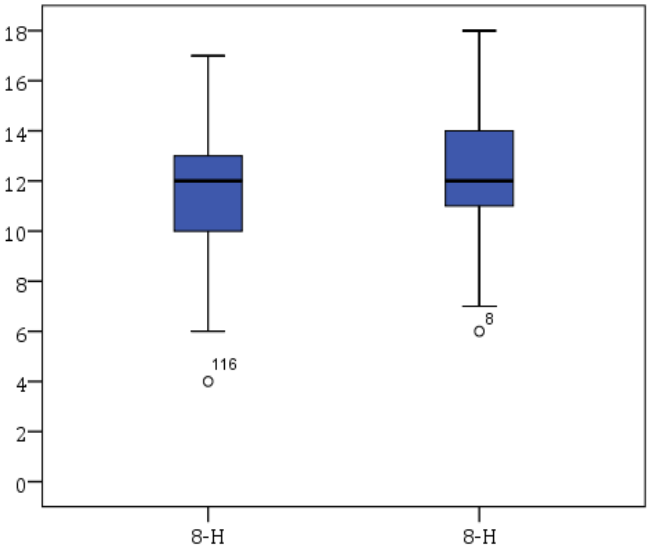


Graphic 5- 144 8-H and UNI-H, Level of concern

over 50% of UNI-H scored 7 or more. From the test results in Table 5-9 and the median for both groups, we can conclude that the university students from Honduras reported a higher level of concern about environmental problems and the efficient use of energy than the year eight secondary school children from Honduras.

8-H and UNI-H, Level of responsibility

On Graph 5-145 are shown the results of 196 valid answers from 8-H and 100 valid answers from UNI-H in the category level of responsibility.

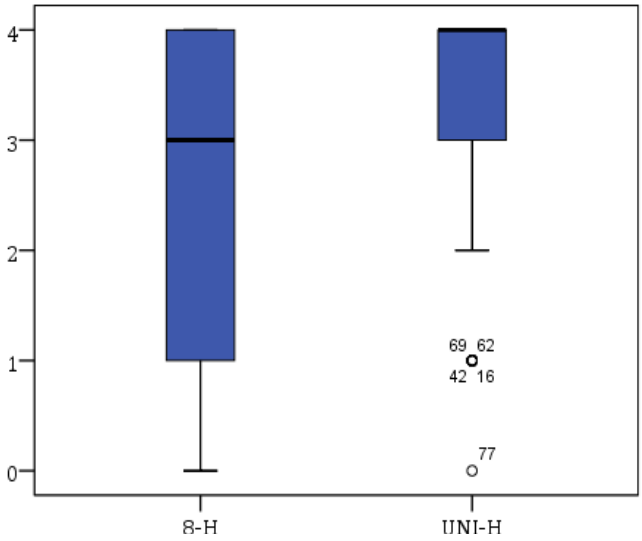


Graphic 5- 145 8-H and UNI-H, Level of responsibility

Graph 5-145 shows that the groups slightly differ in their data dispersion as well as in the data location, both median are at the same level, the data distribution of 8-H, with a skewness of -0.318, can be described as approximately symmetric, ranging from 4 to 17 in an 18-point scale. The data distribution for UNI-H, with a skewness of 0.046, can also be described as approximately symmetric in a range from 5 to 18. Although both data distribution appears to be similar at some parts of the scale, from the test results in Table 5-9 and the mean Rank for both groups, it can be concluded that the university students from Honduras reported a higher level of responsibility regarding environmental problems and the efficient use of energy.

8-H and UNI-H, Level of willing to know more about energy efficiency

On Graph 5-1 are shown the results of 207 valid answers from 8-H and 106 valid answers from UNI-H. The data distribution on Graph 5-146 differs both in its data dispersion and in its data location.



Graphic 5- 146 8-H and UNI-H, Level of willing to know more about energy efficiency

It can clearly see in the data location of both groups that the median of UNI-H is greater by one point than the median of 8-H.

From the test results, in Table 5-9 and from the value of the median for both groups, it was found that the university students from Honduras reported a higher level of willing to know more about energy efficiency than the year eight secondary school children from Honduras.

5.7.6 Comparisons between 8-H and UNI-H, by association question

As it was explained previously, the comparison between 8-H and UNI-H by the association question is made by comparing the results of two questions that both groups have in common, that is, their association to the topic energy efficiency and their sources of information about environmental problems and the efficient use of energy. The other two association questions (reasons to make efficient use of energy and reasons why people do not make efficient use of energy) of the Likert-scale instrument have different answer possibilities for UNI-H, the foundation of putting different options for UNI-H is fully explained in chapter 4.

8-H and UNI-H, Associations with energy efficiency

In Table 5-10 are shown the results of comparing the year eight secondary school children from Honduras and the university students from Honduras in their associations with energy efficiency.

Term	Wilcoxon-Mann-Whitney-Test(8H,UNI-H)		Distinguishable / indistinguishable
Save money	Z=-2,982	p-value= 0,03	8-H
Environmental Protection	Z=-3,412	p-value= 0,01	UNI-H
Electricity	Z=-2,897	p-value= 0,04	UNI-H
Renounce	Z=-3,034	p-value= 0,02	UNI-H
Uncomfortableness	Z=-1,166	p-value= 0,244	

Table 5- 10 Comparison between 8-H and UNI-H, by association question, association with energy efficiency

The key findings from Table 5-10, Graph 5-15 and Graph 5-105 are that the year eight secondary school children from Honduras reported a stronger association with energy efficiency with save money, while the university students from Honduras reported stronger associations between energy efficiency and environmental protection, electricity and renounce:

With the association between energy efficiency and uncomfortableness a statistically significant difference between the groups was not found.

8-H and UNI-H, Sources of information

Table 5-11 illustrates the results of comparing the year eight secondary school children and the university students according to their sources of information about environmental problems and the efficient use of energy.

Sources of information	Wilcoxon-Mann-Whitney-Test (8H,UNI-H)		Distinguishable / indistinguishable
Books	Z=0,057	p-value= 0,955	
Family	Z=-4,985	p-value= 0,000	8-H
Friends	Z=-2,483	p-value= 0,013	8-H
Internet	Z=-3,363	p-value= 0,001	UNI-H
In classes at school	Z=-3,104	p-value= 0,002	UNI-H

Table 5- 11 Comparisons between 8-H and UNI-H, association question, by sources of information

The results in Table 5-11, on Graph 5-17 and Graph 5-107 leads us to conclude that the year eight secondary school children from Honduras use family and friends as a sources of information about environmental problems and the efficient use of energy more frequently than the university students from Honduras. While the university students from Honduras reported getting information more frequently from the internet and in classes at school.

Summary

Comparisons were made from the results in each category and each association question among the year eight secondary school children, year eleven secondary school children and the university students. The comparisons were made taking into account the level of education of each participating group.

As it was fully explained in previous sections, from the results of comparing the year eleven with the university students it was decided to also compare the year eight secondary school children with the university students. Also shown is the data distribution of the categories where the groups were found to be distinguished, as well as the results of comparing the three groups with the association questions, from them later some conclusion will be made at the end of this section. Shown in the following two tables is a summary of the comparison among these three groups.

8-H, 11-H and UNI-H, Comparisons by category

Category	**8-H 11-H**	**11-H UNI-H**	**8-H UNI-H**
1.-Energy efficiency behavior	11-H	11-H	
2.-Preconceptions about energy efficiency		UNI-H	UNI-H
3.-Level of concern		UNI-H	UNI-H
4.-Level of responsibility			UNI-H
5.-Level of exposure to information			
6.-Level of importance of the topic "energy saving"		UNI-H	
7.-Level of willing to know more about energy efficiency		UNI-H	UNI-H

Table 5- 12 8-H, 11-H-UNI-H, Comparisons by category

8-H, 11-H and UNI-H, Comparisons by association question

Association with energy efficiency	**8-H 11-H**	**11-H UNI-H**	**8-H UNI-H**
Save money		11-H	8-H
Environmental Protection	11-H		UNI-H
Electricity		11-H	8-H
Renounce		UNI-H	UNI-H
Uncomfortableness			
Source of information			
Books			
Family		11-H	8-H
Friends	8-H		8-H
Internet		UNI-H	UNI-H
In classes at school		UNI-H	UNI-H
Reasons to make efficient use of energy			
Because my parents say I have to.	8-H		
It is good for the environment	11-H		
To save money			
Because it is a popular topic			
Because at school they say I have to			
Reasons why people do not make an efficient use of energy	8-H 11-H	11-H UNI-H	8-H UNI-H
People do not know how to make efficient use of energy.			
People have a very little environmental awareness			
It is uncomfortable to use energy efficiently			
Costs a lot of money			
People have a very little interest in energy efficiency			

Table 5- 13 8-H, 11-H, UNI-H, comparison by association questions

8-H, 11-H and UNI-H, Correlations between categories

In previous chapters the correlation between the categories of each participant group was made. A correlation between two categories let us know whether this two categories influence each other, that is to say, if the energy efficiency behavior is positive correlated with the level of exposure to information, this means that the higher the level of exposure to information, the higher the energy efficiency behavior.

Diagram 5-7 shows the comparison between the three groups in the correlation between categories. The correlation between categories for the year eight secondary school children is represented with the color blue, for the year eleven secondary school children the color red is used and for the University students green.

- Of the three groups, the year eleven secondary school children from Honduras reported having the highest energy efficiency behavior. By comparing the university students and the year eight secondary school children, no statistically significant difference was found within the groups in their energy efficiency behavior.

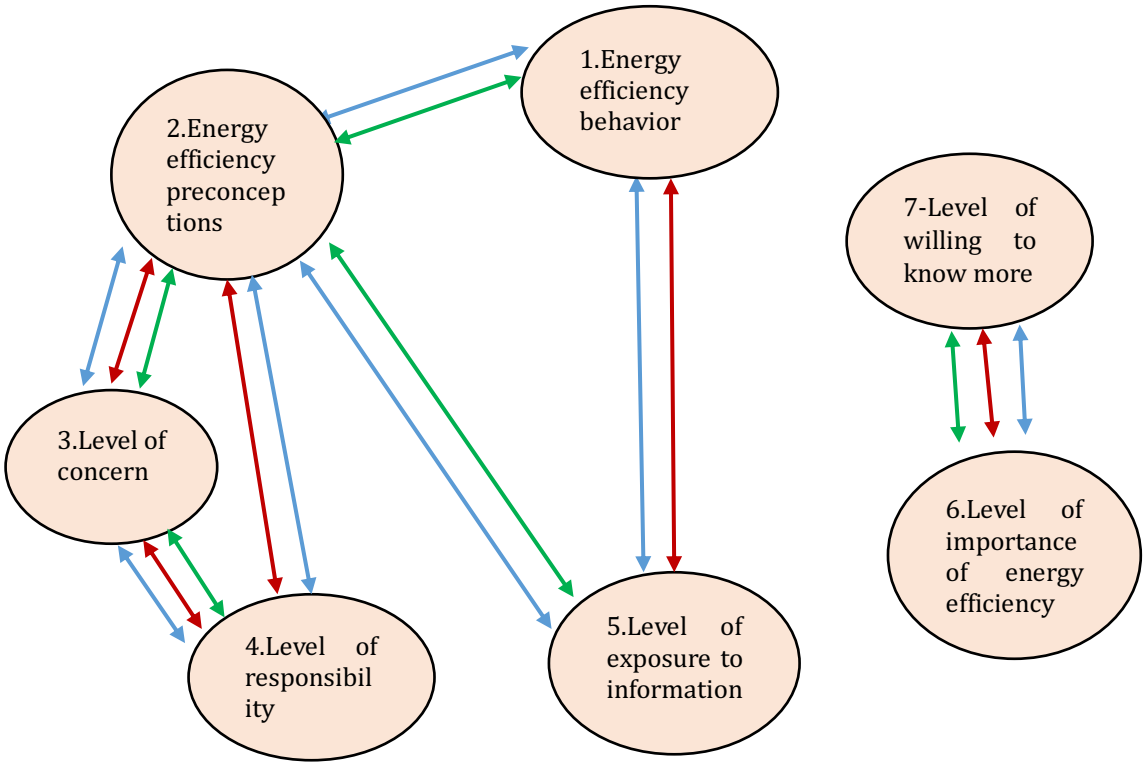


Diagram 5- 7 8-H,11-H, UNI-H- Correlation between categories

- From the three groups, in the category energy efficiency preconceptions the university students got the highest score. By comparing the scores of the year eight secondary school children and the year eleven, both groups can not be distinguished.
- Of the three groups, the university students reported having the highest level of concern regarding environmental problems and the efficient use of energy. The year eight and the year eleven groups are not to be distinguished in their level of concern.

- The university students reported having a higher level of responsibility in environmental problems and the efficient use of energy than the year eight secondary school children. By comparing the university students to the year eleven secondary school children, the groups were found not to be distinguished in their level of responsibility; the same finding was obtained when comparing the year eleven secondary school children and the year eight secondary school children.
- The three groups were found not to be distinguished in their level of exposure to information.
- The university students gave the topic a higher level of importance than the year eleven secondary school children. When comparing the university students to the year eight secondary school children, the groups were found not to be distinguished in the score; the same results was found when comparing the year eight and the year eleventh group.
- In the category level of willing to know more about energy efficiency scale, the university students reported having the highest level of willing to know more about energy efficiency. Between the year eight and the year eleven groups no statistical difference was found.
- From the three Honduran groups, the university students from Honduras made the weakest association between energy efficiency save money and electricity, while the three groups are indistinguishable by making associations between energy efficiency and renounce. The year eight secondary school children made the weakest association between environmental protection and energy efficiency.
- Of the three groups, the university students from Honduras reported using less their family as a source of information, instead they used internet and in classes at school. Of the three groups, the year eight secondary school children from Honduras reported using friends as a source of information more frequently
- The year eight group reported having as a principal reason to make efficient use of energy their parents, while the year eleven would use energy more efficient because it is good to the environment. The school children and the university students were not compared and this question, due to the age of the university students the questions was different.

- By ranking the reasons why people might not make efficient use of energy, the year eight secondary school children from Honduras and the year eleven secondary school children from Honduras could not be distinguished. The school children and the university students were not compared and this question, due to the age of the university students the questions was different.
- The level of concern was found to be correlated with energy efficiency preconceptions in the three groups, as well as the level of responsibility and level of concern. The level importance given to the topic energy saving and the level of willing to know more about the topic was also found to be correlated in the results of the three groups.
- For the two groups of secondary school children, there was found a correlation between energy efficiency behavior and the level of exposure to information, as well as the preconception about energy efficiency and the level of responsibility.
- The efficient use of energy and the preconceptions in energy efficiency were found to be correlated for the results of the year eight secondary school children and the university students as well as the level of exposure to information and the preconceptions about energy efficiency.

5.8 Comparison among the German groups

The present section describes the comparisons made among the German groups. As in the comparisons with the Honduran groups, the three German groups are compared with each other according to their level of education. The groups are compared by category and by association question.

As it was explained previously, although the data of the university students was analyzed in 9 categories, to make comparisons within the country only the categories that the groups have in common will be taken into account, that is, 7 categories. Comparison with the association question follows the same rule, the university students and the secondary school children have in common two association questions, therefore, they are compared by the results of the two association questions. By comparing the secondary school children with each other, the year eight secondary school children and the year eleven secondary school

children, the comparison is made taking into account 7 categories and 4 association questions.

5.8.1 Comparison between 8-G and 11-G, by category

In Table 5-14 are shown the results of the comparison between 8-G and 11-G, by category. In this first section are described the comparisons among the 7 categories, while in the second section the comparisons of the 4 association questions are described. In order to find whether both groups can be distinguished in each category the Wilcoxon-Mann-Whitney-Test was used; the results are shown next to each category. From the test results, the conclusion whether both groups can be distinguished are shown in column 3 in Table 5-13. The green color in column 3 in Table 5-14means that the group cannot be distinguished in the category, when the groups are distinguished in a category, there is no green color, rather the name of the group which scored highest in the category appears instead.

Category	Wilcoxon-Mann-Whitney-Test (8-G,11-G)	Distinguishable / indistinguishable
Energy efficiency behavior	Z= -3,004 p-value= 0,003	8-G
Preconceptions about energy efficiency	Z= -0235 p-value= 0,814	
Level of concern	Z= -4,532 p-value= 0,00	11-G
Level of responsibility	Z= -0,857 p-value= 0,392	
Level of exposure to information	Z= -5,259 p-value= 0,00	11-G
Level of importance of the topic “energy saving”	Z= -0,136 p-value= 0,892	
Want to know more about energy efficiency	Z= -6,213 p-value= 0,00	11-G

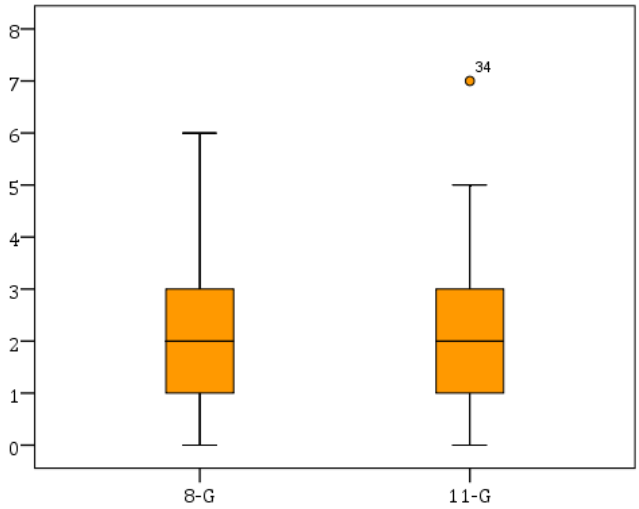
Table 5- 14 Comparison between 8-G and 11-G, by category

As it can be seen in Table 5-14, the groups can be distinguished in 4 of the 7 categories. The test results and the median of both data distributions (8-G and 11-G) leads us to conclude that the year eleven secondary school children from Germany have a higher level of concern, a higher level of exposure to information and they also give to the topic energy saving a higher level of importance when comparing the group to the year eight secondary school children

from Germany. But 11-G also have lower energy efficiency behavior. The data distribution in each category in which the groups were found to be distinguished is shown.

8-G and 11-G, Energy efficiency behavior

On Graph 5-147 are shown the results of energy efficiency behavior for both groups (8-G and 11-G).

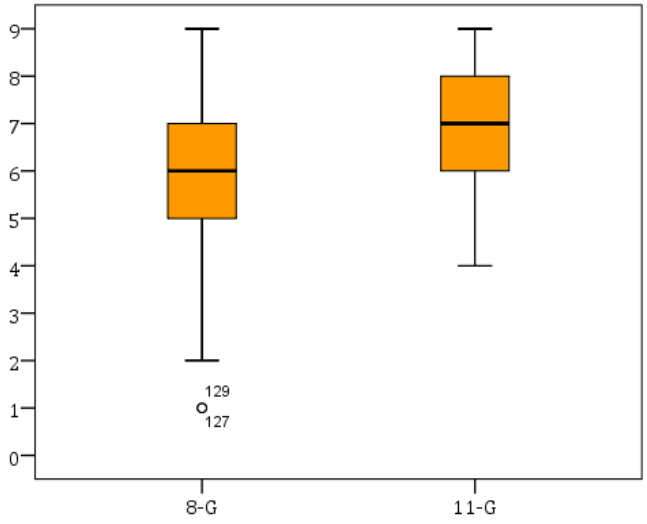


Graphic 5- 147 8-G, 11-G, Energy efficiency behavior

The data distribution of 8-G and 11-G in the category energy efficiency behavior appears to differ in the overall range, while in the data location and the interquartile range the groups appear to be similar. A skewness of 0.446 for 8-G allows us to describe the data distribution of this group as approximately symmetric, ranging, from 0 to 6 on an 8-point energy efficiency scale. The skewness 0.787 for 11-G allows us to describe the batch of data as moderately skewed up in a range from 0 to 7 on the scale. Nevertheless, the data distribution of 8-G and 11-G seems to be similar, the results of the Wilcoxon-Mann-Whitney-Test in Table 5-14 leads us to conclude that the groups are distinguished in their energy efficiency behavior. Although both groups have the same median, the 8-G got the highest mean rank, therefore they should have a greater number of high scores within it. We can conclude that the year eight secondary school children from Germany have higher energy efficiency behavior when comparing them to the year eleven secondary school children from Germany.

8-G and 11-G, Level of concern

When comparing 8-G and 11-G in the category level of concern, the results of the Wilcoxon-Mann-Whitney-Test test in Table 5-14 shows that the groups are distinguished in their level of concern. In this manner on Graph 5-148 are shown the data distribution of both groups in the category level of concern.

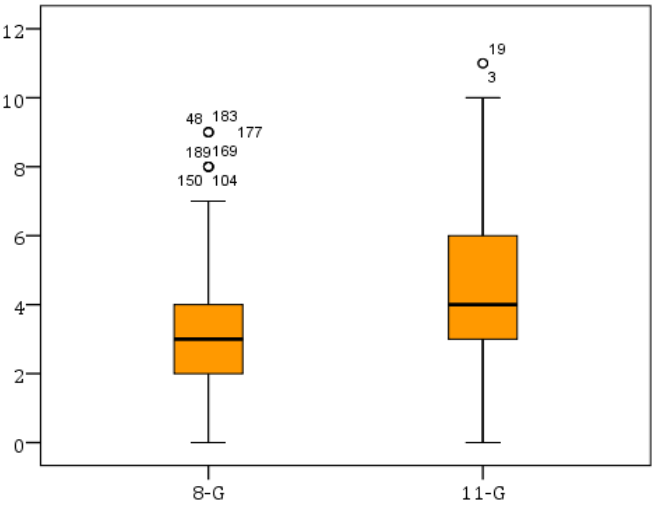


Graphic 5- 148 8-G, 11-G, Level of concern

As it can be seen on the graph, 8-G and 11-G differ in the interquartile range and in the overall range. The overall range for 8-G is greater. By comparing the data location for both groups, the groups seem to differ also, the median of 11-G is greater by one point. From the test results in Table 5-14 and the value of the median for both groups we can conclude that the year eleven secondary school children from Germany have a higher level of concern about environmental problems and the efficient use of energy when comparing them to the year eight secondary school children from Germany.

8-G and 11-G, Level of exposure to information

When comparing 8-G and 11-G in their level of exposure to information the results of the Wilcoxon-Mann-Whitney-Test in Table 5-14 show that the groups are distinguishable in their level of exposure to information. On Graph 5-149 are shown that data distribution of 8-G and 11-G in the category level of exposure to information.



Graphic 5- 149 8-G, 11-G, Level of exposure to information

The graph illustrates that the data distribution of both groups differ in the interquartile range as in the overall range. On the data location, both groups also differ, the median of 11-G is greater by one point. From a skewness of 0.686 for 8-G, the data distribution can be described as moderately skewed down, ranging from 0 to 9 on a 12-point scale. From a skewness of 0,424 the data distribution for 11-G can

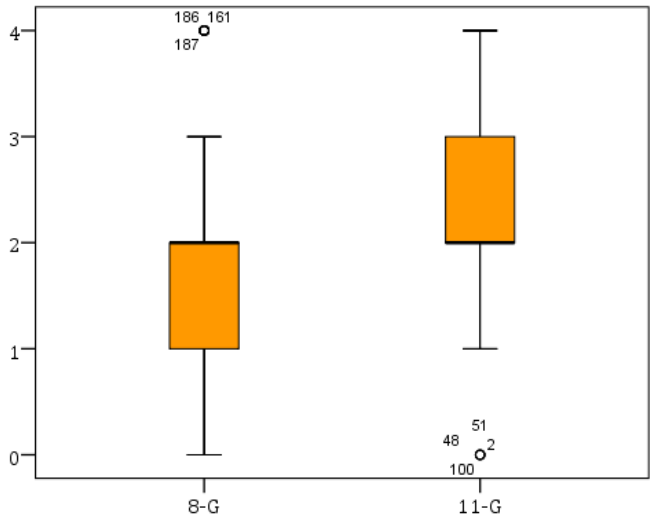
also be described as approximately symmetric, ranging from 1 to 11 on the scale.

From the test results in Table 5-14 and the value of the median for both groups, we can conclude that the year eleven secondary school children from Germany have a higher level of exposure to information when comparing them to the year eight secondary school children from Germany.

8-G and 11-G, Level of willing to know more about energy efficiency

On Graph 5-150 are shown the results of 8-G and 11-G in the category level of willing to know more about energy efficiency.

The graph shows that although both groups have the same overall range, the data distribution of both groups differ in the interquartile range. By comparing the data location of both groups, the median of both groups is located at number 2 on the scale. The data distribution of both groups range across the entire scale; a skewness of 0.058 for 8-G and -0.276 11-G, and the negativity of the skewness for 11-G leads us to conclude that the data distribution of 11-G is more skewed up.



Graphic 5- 150 8-G, 11-G, Level of willing to know more about energy efficiency

Although both groups have the same median, the 11-G got the highest mean rank, therefore they should have a greater number of high scores within it. From the test results in Table 5-14 we can conclude that the year eleven secondary school children from Germany have a higher level of willing to know more about energy efficiency when comparing them to the year eight secondary school children from Germany.

5.8.2 Comparison between the 8-G and 11-H, by association question

In this section the results of the secondary school children from Germany in four association questions are compared.

8-G and 11-G, Association with energy efficiency

In Table 5-15 are shown the results of the Wilcoxon-Mann-Whitney-Test, and the groups who reported having the stronger association with energy efficiency and the list of terms given in the question. The color green in the table means that the groups are not distinguished in their associations.

Term	Wilcoxon-Mann-Whitney-Test (8-G,11-G)		Distinguishable / indistinguishable
Save money	Z=-0,943	p-value= 0,346	
Environmental Protection	Z=-2,761	p-value= 0,006	11-G
Electricity	Z=-2,354	p-value= 0,019	8-G
Renounce	Z=-0,9	p-value= 0,368	
Uncomfortableness	Z=-0,016	p-value= 0,987	

Table 5- 15 Comparison between 8-G and 11-G, by association question, association with energy efficiency

The results in Table 5-15 and the results on Graph 5-37 and Graph 5-81 show that the year eleven secondary school children from Germany reported a stronger association between energy efficiency and environmental protection, while the year eight secondary school children from Germany found a stronger association between energy efficiency and electricity. In associating energy efficiency with save money, renounce and uncomfortableness, the groups were found not to be distinguished.

8-G and 11-G, Sources of information

In Table 5-16 are shown the results of comparing 8-G and 11-G by their sources of information about environmental problems and the efficient use of energy.

Sources of information	Wilcoxon-Mann-Whitney-Test (8-G,11-G)		Distinguishable / indistinguishable
Books	Z=-1,276	p-value= 0,202	
Family	Z=-2,507	p-value= 0,012	8-G
Friends	Z=-0,887	p-value= 0,375	
Internet	Z=-0,647	p-value= 0,518	
In classes at school	Z=-2,278	p-value= 0,023	11-G

Table 5- 16 Comparison between 8-G and 11-G, by association question, by sources of information

The results in Table 5-16 and of Graph 5-39 and Graph 5-83 show that the year eight secondary school children from Germany use more frequently family as a source of information, while the year eleven group use in classes at school. By using books, friends and

internet as sources of information about environmental problems and the efficient use of energy, the groups were found not to be distinguished.

8-G and 11-G, Reasons to make efficient use of energy

The two groups of children were asked to rank the reasons they would have to use energy efficiently. In Table 5-17 are shown the results of comparing both groups by ranking these reasons.

Reasons to make an efficient use of energy	Wilcoxon-Mann-Whitney-Test (8-G,11-H)		Distinguishable / indistinguishable
Because my parents say I have to.	Z=-3,424	p-value= 0,001	8-G
It is good for the environment	Z=-2,257	p-value= 0,024	11-G
To save money	Z= -1,698	p-value= 0,089	
Because it is a popular topic	Z= -0,171	p-value= 0,864	
Because at school they say I have to	Z= -1,29	p-value= 0,197	

Table 5- 17 Comparison between 8-G and 11-G, by association questions, by reasons to make efficient use of energy

From the test results in Table 5-17 and Graph 5-41 and Graph 5-85 it can be concluded that the year eight secondary school children from Germany are more influenced by the parents in willing to make efficient use of energy, while they older peers (11-G) would consider making efficient use of energy because of the environment. By the other three reasons in the color green in column 3 in Table 5-17, the year eight secondary school children from Germany and the year eleven secondary school children from Germany were found not to be distinguishable.

8-G and 11-G, Reasons why people do not use energy efficiently

The comparison between 8-G and 11-G in ranking five reasons why people do not make efficient use of energy are shown in Table 5-18.

Reasons why people do not use energy efficiently	Wilcoxon-Mann-Whitney-Test (8-G,11-G)		Distinguishable / indistinguishable
People do not know how to make efficient use of energy.	Z= -0503	p-value= 0,615	
People have very little environmental awareness	Z=- 0,305	p-value= 0,761	
It is uncomfortable to use energy efficiently	Z= -1,849	p-value= 0,064	
Costs a lot of money	Z= -0,916	p-value= 0,36	
People have very little interest in the issue of energy efficiency	Z= -1,578	p-value= 0,115	

Table 5- 18 Comparison between 8-G and 11-G, by association question, by reason why people do not make efficient use of energy

The results in Table 5-18 and of Graph 5-43 and Graph 5-87 lead us to conclude that year eight secondary school children from Germany and the year eleven secondary school children from Germany are not distinguished by ranking the reasons people could have to not make efficient use of energy.

5.8.3 Comparison between 11-G and UNI-G, by category

The year eleven secondary school children from Germany and the university students from Germany where compared by the results of 7 categories and 2 association questions. The results by comparing both groups by category are shows in Table 5-19.

Category	Wilcoxon-Mann-Whitney-Test (11-G,UNI-G)		Distinguishable / indistinguishable
Energy efficiency behavior	Z= -2,074	p-value= 0,038	UNI-G
Preconceptions about energy efficiency	Z= -1,619	p-value= 0,105	
Level of concern	Z= -0,039	p-value= 0,969	
Level of responsibility	Z= -0,111	p-value= 0,911	
Level of exposure to information	Z=-1,959	p-value= 0,05	
Level of importance of the topic "energy saving"	Z= -1,963	p-value= 0,05	UNI-G
Want to know more about energy efficiency	Z= -0,142	p-value= 0,887	

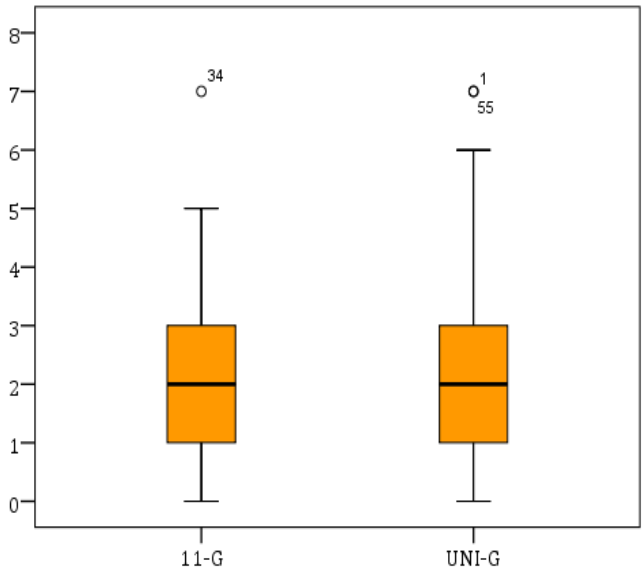
Table 5- 19 Comparison between 11-G and UNI-G, by category.

The results in Table 5-19 show that the university students from Germany and the year eleven secondary school children from Germany can be distinguished only in the category energy

efficiency behavior. In the other six categories of analysis, the university students and the year eleven secondary school children from Germany were found to be indistinguishable. The data distribution of both groups in the category energy efficiency behavior are shown on Graph 5-155.

11-G and UNI-G, Energy efficiency behavior

The data dispersion in both groups seems to be similar in the interquartile range as in the overall range; on the data location, the median of both groups are at the same level, 2 on an 8-point scale. A skewness of 0.787 for 11G and 0.687 for UNI-G leads us to conclude that the data distribution of both groups is moderately skewed down. Even though both groups seem to be similar in their data distribution:

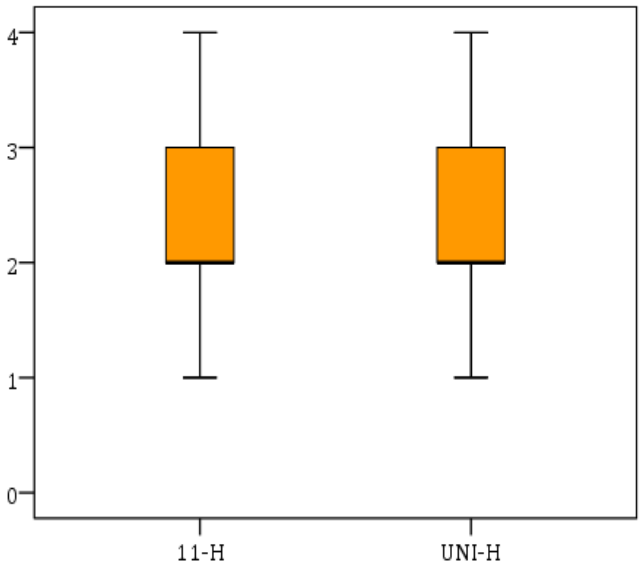


Graphic 5- 151 11-G and UNI-G, Energy efficiency behavior

The result of the Wilcoxon-Mann-Whitney-Test leads us to conclude that the year eleven secondary school children from Germany and the university students from Germany can be distinguished in energy efficiency behavior. Although both groups have the same median, the UNI-G got the highest mean rank, therefore they should have a greater number of high scores within it. We can conclude that the university students from Germany have higher energy efficiency behavior.

11-G and UNI-G, Energy efficiency behavior

The groups seem not to differ in their data distribution; each group has the same interquartile range and overall range and also both medians are at the same level from the results of the of the test in Table 5-19 And the lowest mean rank of the year eleven group,



Graphic 5- 152 11-G and UNI-G, Energy efficiency behavior

we can conclude that the year eleven secondary school children is the one with the greatest number of lower scores in it. And that the group of the university students has the highest mean rank, therefore they have a greater number of high scores within it. The German university students reported a higher score in the category level of importance to the topic energy efficiency when they were compared with the German year eleven group.

5.8.4 Comparison between 11-G and UNI-G, by association question

The year eleven secondary school children and the university students from Germany were compared in the association they made to energy efficiency and in their sources of information about environmental topics and the efficient use of energy. In Table 5-20 are shown the results of comparing both groups in the two association questions.

11-G and UNI-G, Association with energy efficiency

Term	Wilcoxon-Mann-Whitney-Test (11G, UNI-G)		Distinguishable / indistinguishable
Save money	Z=-1,366	p-value= 0,172	
Environmental Protection	Z=-0,758	p-value= 0,449	
Electricity	Z=-0,203	p-value= 0,839	
Renounce	Z=-2,947	p-value= 0,003	11-G
Uncomfortableness	Z=-0,761	p-value= 0,447	

Table 5- 20 11-G and UNI-G, 11-G and UNI-G, Association with energy efficiency

The results in Table 5-20 and on Graphs 5-81 and Graph 5-129 leads us to conclude that the year eleven secondary school children from Germany make a stronger association between energy efficiency and renounce when they were compared to the university students from

Germany. By associating the other four terms that appear in Table 5-20, the groups were found not to be distinguished.

11-G and UNI-G, Sources of information

The comparison between the year eleven secondary school children from Germany and the university students in their sources of information are shown in Table 5-21.

Sources of information	Wilcoxon-Mann-Whitney-Test (11-G-UNI-G)		Distinguishable / indistinguishable
Books	Z= -0,452	p-value= 0,651	
Family	Z= -2,381	p-value= 0,017	UNI-G
Friends	Z= -1,232	p-value= 0,218	
Internet	Z= -1,871	p-value= 0,061	
In classes at school	Z= -2,425	p-value= 0,015	11-G

Table 5- 21 11-G and UNI-G, association questions, Sources of information

From the results in Table 5-21 and on Graph 5-83 and Graph 5-131 we can conclude that the university students from Germany use family as a source of information more frequently than the year eleven secondary school children from Germany, while this group, 11-G, reported getting information more frequently in classes at school. When both groups were compared in using books, friends and internet, no significant difference was found between them.

5.8.5 Comparison between 8-G and UNI-G, by category

It was intended to make the comparison within a country taking into account the smallest difference in the levels of education, that is, the year eight secondary school children were compared to the year eleven secondary school children, and these in turn were compared to the university students. But the results showed that year eleven secondary school children and the university students differ in one category as well as in two association questions. In this regard it was decided to make a comparison between the year eight secondary school children and the university students in order to find whether these two groups can be distinguished in a particular category. In Table 5-22 are shown the results of this comparison.

As it can be seen in the table, the groups differ in the level of concern, level of exposure to information and level of willing to know more about energy efficiency. From the test results and the median of both groups it can be concluded that the university students from Germany have a higher level of concern, a higher level of exposure to information and a higher level of

willing to know more about energy efficiency when comparing them to the year eight secondary school children.

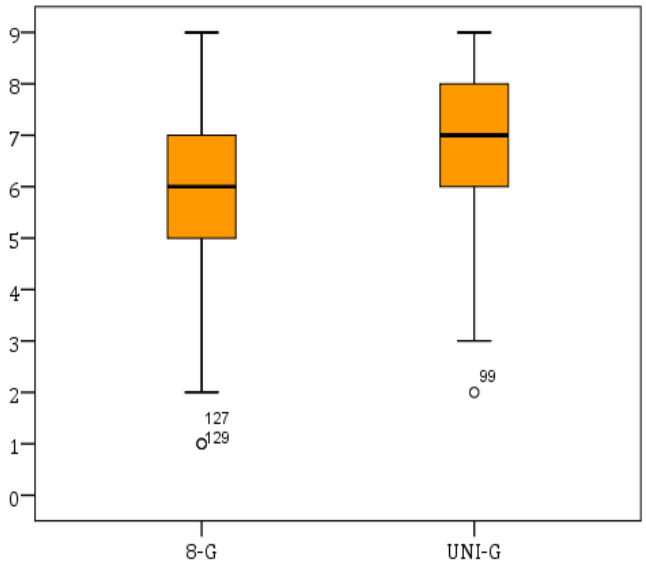
Category	Wilcoxon-Mann-Whitney-Test (8-G,UNI-G)		Distinguishable / indistinguishable
Energy efficiency behavior	Z=-0,454	p-value= 0,650	
Preconceptions about energy efficiency	Z= -1,401	p-value= 0,161	
Level of concern	Z= -4,199	p-value= 0,000	UNI-G
Level of responsibility	Z= -1,073	p-value= 0,283	
Level of exposure to information	Z= -7,356	p-value= 0,000	UNI-G
Level of importance of the topic "energy saving"	Z= -1,832	p-value= 0,067	
Level of willing to know more about energy efficiency	Z= -6,26	p-value= 0,000	UNI-G

Table 5- 22 comparison between 8-G and UNI-G, by category

The data distribution of both groups in each category where the groups were found to be distinguished are shown on the following graphs.

8-G and UNI-G, Level of concern

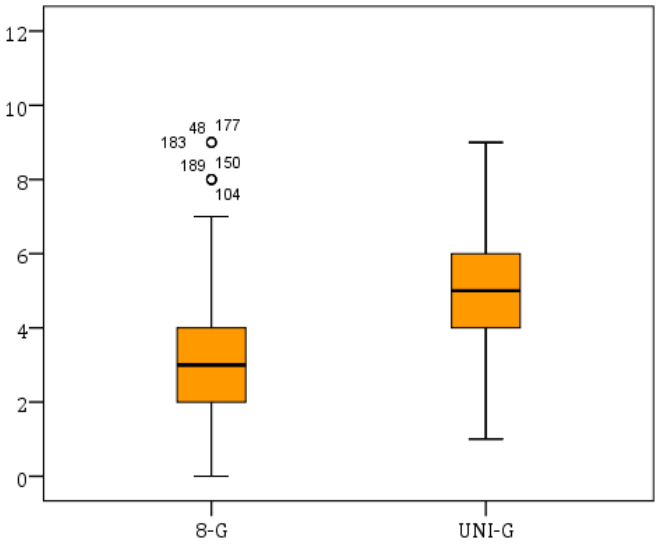
As it can be seen on the graph the groups differ in the interquartile range and in the overall range. By the data location it can clearly be seen that the median of the university students is greater by one point. From the Wilcoxon-Mann-Whitney-Test in Table 5-22 and the median of both groups, it can be concluded that the university students from Germany have a higher level of concern when comparing them to the year eight secondary school children from Germany.



Graphic 5- 153 8-G and UNI-G, Level of concern

8-G and UNI-G, Level of exposure to information

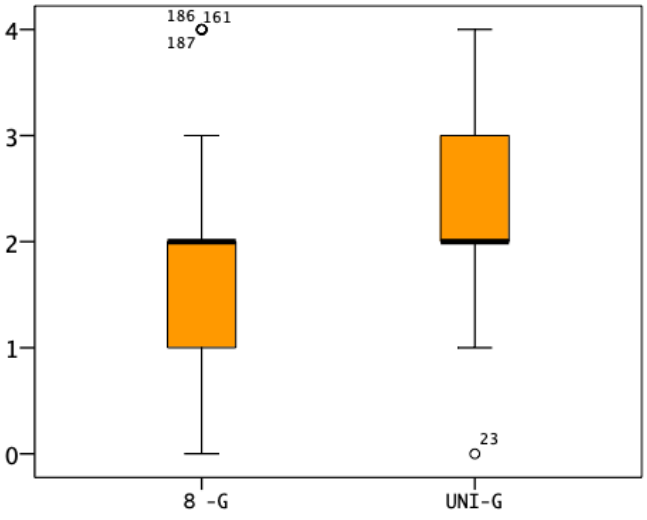
On Graph 5-154 are shown two different data distributions; the groups differ in the data dispersion in the interquartile and in the overall range. In the data location of both groups it can clearly be seen that the median of the university students is greater by two points. From the results in Table 5-22 and the value of the median for both groups, it can be concluded that the university students from Germany have a higher level of exposure to information when comparing them to the year eight secondary school children from Germany.



Graphic 5- 154 8-G and UNI-G, Level of exposure to information

8-G and UNI-G, Level of willing to know more about the topic

On Graph 5-155 are shown the data distribution of 8-G and UNI-G in the category level of willing to know more about energy efficiency. The groups differ in the data dispersion and in the data location, although the median of both groups are at the same level, the data distributions for both groups is different. From the test results in Table 5-22 and the mean rank for both groups it can be concluded that the university students from Germany have a higher level of willing to know more about the topic energy efficiency when they were compared to the year eight secondary school children from Germany.



Graphic 5- 155 8-G and UNI-G, Level of willing to know more about the topic

5.8.6 Comparison between 8-G and UNI-G, by association question

The comparison between the secondary school children and the university students from the results of two association questions is shown in Tables 5- 23 and 5-24.

8-G and UNI-G Association with energy efficiency

The results of comparing the groups mentioned above are shown in Table 5-23.

Term	Wilcoxon-Mann-Whitney-Test (8G, UNI-G)		Distinguishable / indistinguishable
Save money	Z=-0,500	p-value= 0,617	
Environmental Protection	Z=-3,550	p-value= 0,000	UNI-G
Electricity	Z=-1,943	p-value= 0,052	
renounce	Z=-2,154	p-value= 0,031	8-G
uncomfortableness	Z=-0,791	p-value= 0,429	

Table 5- 23 comparison between 8-G and UNI-G, by association question, by association with energy efficiency

The results in Table 5-23 and on Graph 5-37 and Graph 5-129 show that the university students from Germany reported a stronger association between energy efficiency and environmental protection, while the year eight secondary school children from Germany reported a stronger association between energy efficiency and renounce. By associating the term energy efficiency with save money, electricity and uncomfortableness the groups were found not to be not distinguished.

8-G and UNI-G, Sources of information

Both groups were asked to range their sources of information about environmental problems and the efficient use of energy. The results of comparing the rankings made by the year eight secondary school children and by the university students from Germany are shown in Table 5-24.

Sources of information	Wilcoxon-Mann-Whitney-Test (8-G, UNI-G)		Distinguishable / indistinguishable
Books	Z=-0,671	p-value= 0,502	
Family	Z=-0,129	p-value= 0,897	
Friends	Z=-2,087	p-value= 0,037	UNI-H
Internet	Z=-1,2	p-value= 0,230	
In classes at school	Z=-0,598	p-value= 0,550	

Table 5- 24 Comparison between 8-G, UNI-G, by association question, by sources of information

As it can be seen in Table 5-24, the university students use more frequently friends as a source of information when comparing them to the year eight secondary school children. By using books, family, internet and in classes at school as sources of information no statistically significant difference was found between the groups.

SUMMARY

The German respondents were compared according to their level of education, by category and by association questions. In the following two tables is shown a summary of these comparisons. Next to the name of each category of analysis is shown the name of the group which scored higher in the category. In the first line in columns 2, 3 and 4 of the table is shown the name of the groups who were compared, for example, 8-G and 11-G in the first line in column 2 means that the two groups were compared in the 7 categories in column 1.

8-G, 11-G and UNI-G, Comparisons by category

Category	**8-G 11-G**	**11-G UNI-G**	**8-G UNI-G**
1.- Energy efficiency behavior	8-G	UNI-G	
2.- Preconceptions about energy efficiency			
3.- Level of concern	11-G		UNI-G
4.- Level of responsibility			
5.- Level of exposure to information	11-G		UNI-G
6.- Level of importance of the topic “energy saving”		UNI-G	
7.- Level of willing to know more about energy efficiency	11-G		UNI-G

Table 5- 25 8-G, 11-G, UNI-G, comparison by category

8-G, 11-G and UNI-G, Comparisons by association question

In Table 5-26 are shown the results of comparing the three groups with each other in the association question.

Association with energy efficiency	**8-G 11-G**	**11-G UNI-G**	**8-G UNI-G**
Save money			
Environmental Protection	11-G		UNI-G
Electricity	8-G		
Renounce		11-G	8-G
Uncomfortableness			
Sources of information			
Books			
Family	8-G	UNI-G	
Friends			UNI-G
Internet			
In classes at school	11-G	11-G	
Reasons to make efficient use of energy			
Because my parents say I have to.	8-G		
It is good for the environment	11-G		
To save money			
Because it is a popular topic			
Because at school they say I have to			
Reasons why people do not make an efficient use of energy			
People do not know how to make efficient use of energy.			
People have a very little environmental awareness			
It is uncomfortable to use energy efficiently			
Costs a lot of money			
People have a very little interest in the issue of energy efficiency			

Table 5- 26 8-G, 11-G, UNI-G, association questions

8-G, 11-G and UNI-G, Correlations among categories

In previous chapters the correlations among the categories in each participant group were made, diagram 5-8 shows the comparison of the three groups in Germany.

The diagram shows a correlation only when this was present in more than one group. The correlation among categories for the year eight secondary school children is represented with the color blue, for the year eleven secondary school children the color red and for the university students the color green

- Of the three groups, the year eleven secondary school children from Germany reported having the lowest energy efficient behavior. When comparing the university students

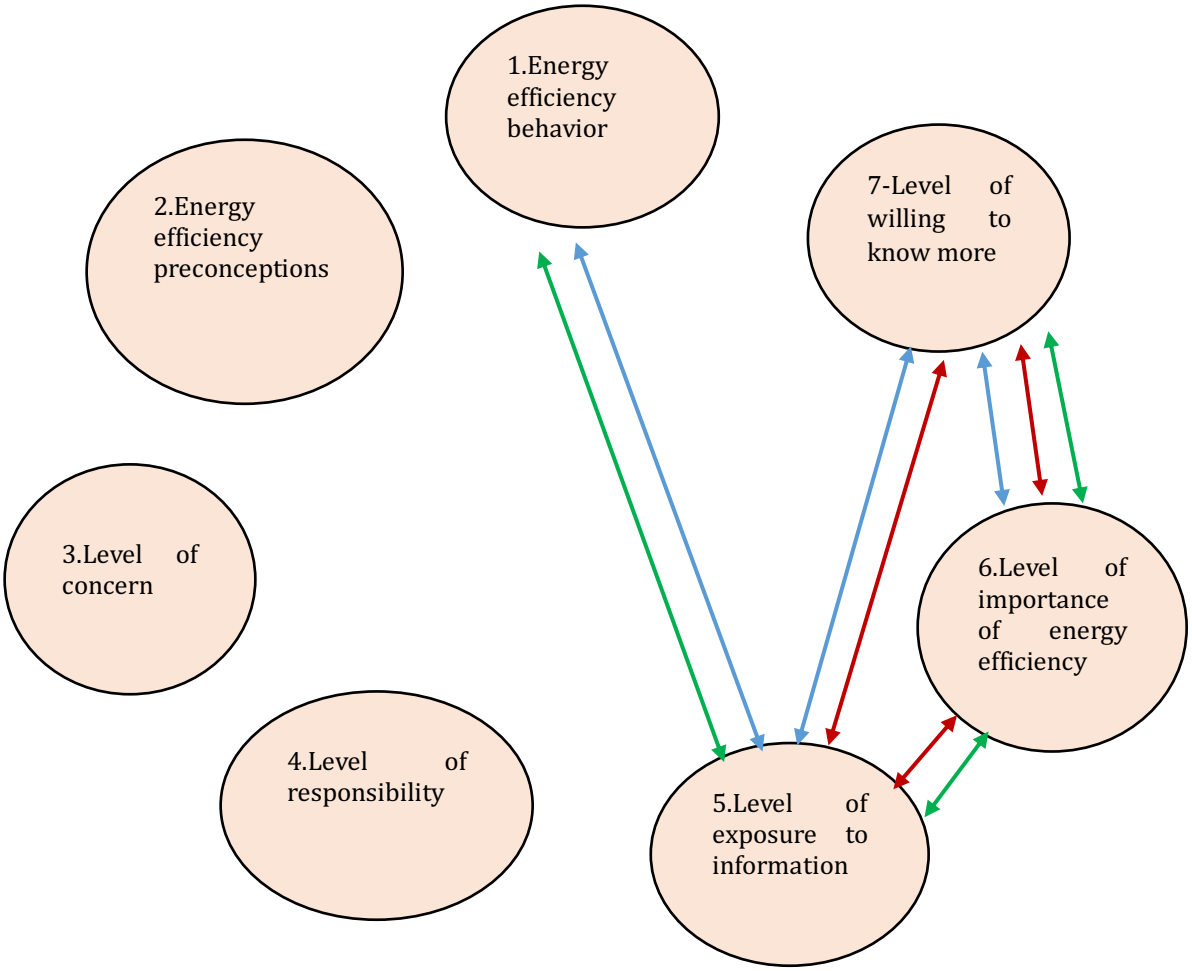


Diagram 5- 8 8-G, 11-G, UNI-G- Correlation between categories

and the year eight secondary school children in the category energy efficiency behavior, no statistically significant difference was found between the groups.

- When comparing the three groups with each other using the Wilcoxon signed-rank test, the three groups were found not to be distinguished by score in the category energy efficiency preconceptions.
- Of the three groups, the year eight secondary school children from Germany reported having the lowest level of concern about environmental problems and the efficient use of energy. When comparing the university students and the year eleven secondary school children from Germany, the groups were found not to be distinguished in their level of concern.
- When comparing the three groups with each other using the Wilcoxon signed-rank test, the three groups were found not to be distinguished by score in the category level of responsibility.
- Of the three groups, the year eight secondary school children from Germany reported having the lowest level of exposure to information. When comparing the university students and the year eleven secondary school children from Germany, the groups were found not to be distinguished in their level of exposure to information.
- When comparing the three groups with each other using the Wilcoxon signed-rank test, the three groups were found not to be distinguished by score in the category level of importance of the topic energy efficiency.
- Of the three German groups, the year eight secondary school children have the lowest level of willing to know more about the topic energy efficiency. When comparing the university students and the year eleven secondary school children from Germany, no statistically significant difference was found between them.
- The year eight secondary school children from Germany reported having the lowest level of concern, level of exposure to information and the lowest level of willing to know more about energy efficiency when comparing them to the year eleven secondary school children and the university students. When the university students and the year eleven children were compared in the 7 categories using the Wilcoxon signed-rank test, they were found to be distinguished in the category energy efficiency behavior, in which the university students have a higher score, and in the category

level of importance of the topic energy efficiency where the university students also got a higher score. In the other 5 categories of analysis the two groups were found not to be distinguished. The three German groups were found not to be distinguished in preconceptions about energy efficiency, level of responsibility and level of importance of the topic energy efficiency.

- When the three groups were compared in their associations with energy efficiency, it was found that of the three groups, the year eight secondary school children from Germany reported making the weakest association between energy efficiency and environmental protection, while when they were compared to the year eleven secondary school children from Germany they reported making a stronger association with electricity. From the three groups the university students reported making the weakest association between energy efficiency and renounce.
- By comparing the three groups in their sources of information, the year eleven secondary school children from Germany reported using family as a source of information less frequently, while of the three groups they are the ones who were informed most in classes at school about the topic related to environmental problems and the efficient use of energy. The university students reported using friends more frequently as a source of information when comparing them to the year eight secondary school children from Germany.
- When the two groups of secondary school children from Germany were compared in the reasons they would have to use energy more efficiently, the year eight secondary school children reported having as a more important reason to use energy efficiently their parents saying they have to do so, while the year eleven secondary school children from Germany reported giving more importance to the protection of the environment.
- When the two groups of secondary school children from Germany were compared in their opinions why people do not use energy efficiently, the two groups were found not to be distinguished in ranking the 5 given reasons why people do not make efficient use of energy.
- When the 7 categories were correlated within each group, it was found that energy efficiency behavior is correlated to the level of exposure to information. At the same

time, the level of exposure to information is correlated to the level of willing to know more and the level of importance of the topic, and these last two categories are also correlated as well.

5.9 Comparison of Germany with Honduras

Following the target investigation, in the following section are the described the results of comparing the groups by country, that is, both groups of year eight secondary school children from Honduras and Germany were compared to each other, and so on with the year eleven groups from both countries and the university students from both countries. They were also compared according to their results in the 7 categories and the 4 association questions. The two participant groups of year eight secondary school children in Honduras and Germany were compared by the results of the 7 categories and the 4 association questions.

5.9.1 Comparison between 8-H and 8-G, by category

As in previous sections, the comparison with categories and association questions was made using the Wilcoxon signed-rank test. In Table 5-27 are shown the results of comparing both groups by category, in column 1 are the name of each category, in column 2 are the results of the Wilcoxon signed-rank test, and from the test results is shown in column 3 whether both groups differ in each category.

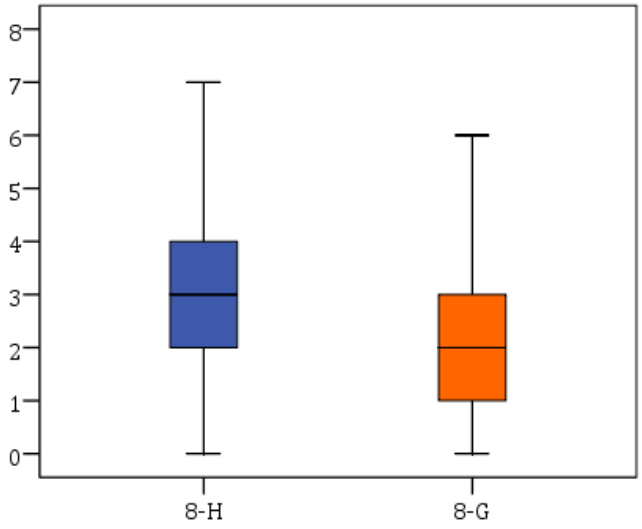
Category	Wilcoxon-Mann-Whitney-Test (8-H,8-G)		Distinguishable / indistinguishable
Energy efficiency behavior	Z= -3,038	p-value= 0,002	8-H
Preconceptions about energy efficiency	Z= -0,283	p-value= 0,777	
Level of concern	Z= -0,773	p-value= 0,440	
Level of responsibility	Z= -3,655	p-value= 0,000	8-H
Level of exposure to information	Z= -12,141	p-value= 0,000	8-H
Level of importance of the topic “energy saving”	Z= -11,388	p-value= 0,000	8-H
Want to know more about energy efficiency	Z= -5,865	p-value= 0,000	8-H

Table 5- 27 Comparison between 8-H and 8-G, by category

From the results in Table 5-27, it can be concluded that the groups differ in 5 of the 7 categories. The groups were found not to be distinguished in their preconceptions about energy efficiency and in their level of concern about environmental problems and the efficient use of energy. On the following graphs we can find out whether the data distribution of both group differ by category, while only the data distribution in which the groups were found to be distinguished will be shown.

8-H and 8-G, Energy efficiency behavior

On Graph 5-156 are shown the data distribution of 180 year eight secondary school children from Honduras and 153 year eight secondary school children from Germany in the category energy efficiency behavior.



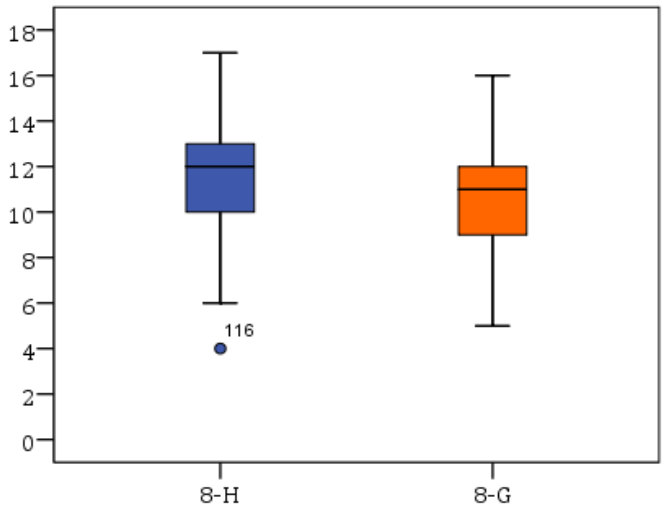
Graphic 5- 156 8-H, 8-G, Energy efficiency behavior

As it can be seen on the graph, the groups differ in the overall range as in the interquartile range. The median of the Honduran group is higher by one point. From the results of the Wilcoxon-Mann-Whitney-Test test and from the median of both groups, we can conclude that the year eight secondary school children from Honduras reported higher energy efficiency behavior when they were compared to the year eight secondary school children from Germany.

8-H and 8-G, Level of responsibility

In the category level of responsibility 196 valid answers from the Honduran group and 143 valid answers from the German group were analyzed.

On Graph 5-157 are shown the results of both groups in the category level of responsibility. The data on Graph 5-157seems to be heterogeneous for both groups, the groups differs in the interquartile range as in the overall range.

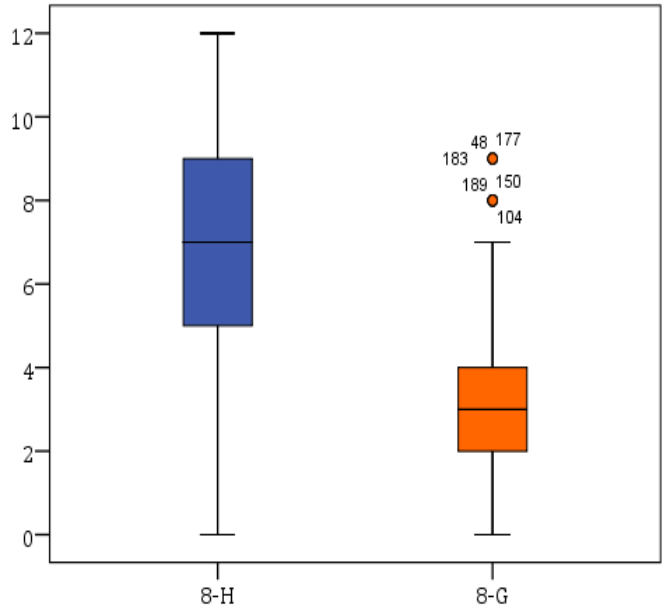


Graphic 5- 157 8-H, 8-G, Level of responsibility

The median of the Honduran group is greater by one point. The results of the Wilcoxon-Mann-Whitney-Test in Table 5-27 and the median for both groups leads us to conclude that the year eight secondary school children from Honduras have a higher level of responsibility regarding environmental problems and the efficient use of energy when they were compared to the year eight secondary school children from Germany.

8-H and 8-G, Level of exposure to information

In order to know whether the groups were exposed to information about environmental problems and the efficient use of energy, 204 valid answers from the Honduran groups and 168 from the Germany groups were analyzed.

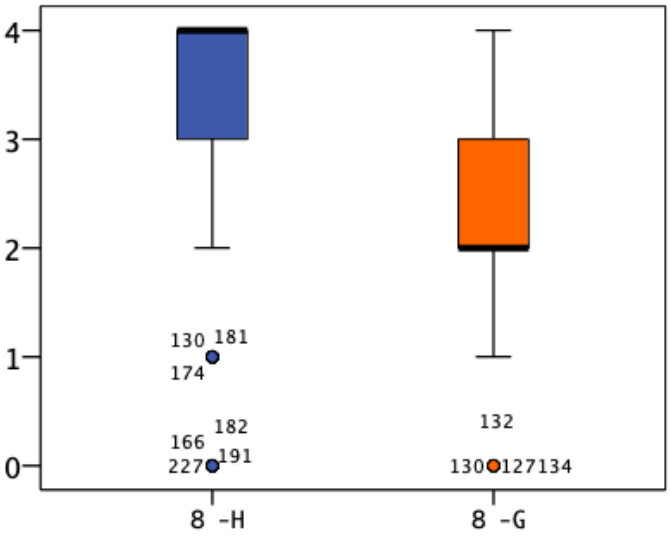


Graphic 5- 158 8-H,8-G, Level of exposure to information

Graph 5- 158 shows the results of both groups in their level of exposure to information. As the graph shows, the groups differ in the interquartile range as in the overall range. The median of the Honduran group is greater by 4 points. From the results of the test in Table 5-27 and the value of the median for both groups, we can conclude that the year eight secondary school children from Honduras reported having a higher level of exposure to information when they were compared to the year eight secondary school children from Germany.

8-H and 8-G, Level of importance of the topic energy saving

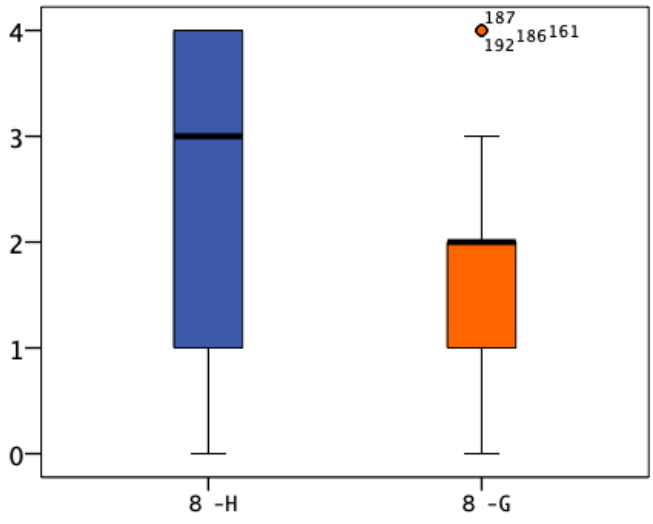
In this category 212 valid from the Honduran group and 181 valid answers from the German group were analyzed. On Graph 5-159 are shown the results.



Graphic 5- 159 8-H, 8-G, Level of importance of the topic "energy saving"

The groups differ in the interquartile range but not in the overall range. The data distribution of both groups spreads across the entire scale, suggesting varied opinions regarding the importance of the topic energy saving. The median for the Honduran group is located at 4 on a 4-point scale, while for the German group the median is located 2 points lower down. From the results of the test in Table 5-27 and the medians of both groups, we can conclude that the year eight secondary school children from Honduras scored higher in the category level of importance of the topic energy saving when they were compared to the year eight secondary school children from Germany.

8-H and 8-G, Level of willing to know more about energy efficiency



Graphic 5- 160 8-H, 8-G, Level of willing to know more about energy efficiency

In the analysis of the present category 207 valid answers from the Honduran group and 169 valid answers from the German group were considering. On Graph 5- 160 are show the results.

The data dispersion of both groups differs in the interquartile range as in the overall range. The median for the Honduran group is greater by one point, the results of the test in Table 5-27 which leads us to conclude that the year eight secondary

school children from Honduras reported having a higher level of willing to know more about energy efficiency.

5.9.2 Comparison between 8-H and 8-G, by association questions

In this section are described the comparison between the year eight secondary school children from Germany and Honduras from the results of four association questions. The results of comparing both groups with association questions was made using the Wilcoxon-Mann-Whitney-Test.

8-H and 8-G, Association with energy efficiency

Term	Wilcoxon-Mann-Whitney-Test (8-H,8-G)		Distinguishable / indistinguishable
Save money	Z=-8,931	p-value= 0,000	8-H
Environmental Protection	Z=-3,261	p-value= 0,001	8-G
Electricity	Z=-3,838	p-value= 0,000	8-G
Renounce	Z=-5,290	p-value= 0,000	8-G
Uncomfortableness	Z=-0,519	p-value= 0,604	

Table 5- 28 Comparison between 8-H and 8-G , by association question, association to energy efficiency

From the results of the Wilcoxon signed-rank test in Table 5-28 and the results on Graph 5-15 and Graph 5-37 we can conclude that the year eight secondary school children from Honduras reported a stronger association of energy efficiency with save money when they were compared to the year eight secondary school children from Germany, while this last group reported stronger associations of energy efficiency with the terms environmental protection, electricity and renounce.

8-H and 8-G, Sources of information

The ranking of the most used sources of information about environmental problems and the efficient use of energy made the year eight secondary school children from Honduras and from Germany are shown in Table 5-29. As in previous sections, the results of the Wilcoxon signed-rank test are in column 2 and the group who achieved the highest score is in column 3.

Sources of information	Wilcoxon-Mann-Whitney-Test (8-H,8-G)		Distinguishable / indistinguishable
Books	Z=-3,316	p-value= 0,001	8-H
Family	Z=-0,822	p-value= 0,411	
Friends	Z=-3,812	p-value= 0,000	8-H
Internet	Z=-5,835	p-value= 0,000	8-G
In classes at school	Z=-1,758	p-value= 0,079	

Table 5- 29 Comparison between 8-H and 8-G , by association question, sources of information

According to the test result in Table 5-29, the groups differ in the use of three sources of information. The year eight secondary school children from Honduras reported using more frequently books and family to get information about environmental problems and the efficient use of energy, while the Germans reported using internet more frequently (see Graph 5-17 and Graph 5-39).

8-H and 8-G, Reasons to make efficient use of energy

The present association question was analyzed by taking into account 137 valid answers from the Honduran group and 137 valid answers from the German group. The results of comparing both group are shown in Table 5-28.

Reasons to make efficient use of energy	Wilcoxon-Mann-Whitney-Test (8-H,8-G)		Distinguishable / indistinguishable
Because my parents say I have to.	Z=-4,907	p-value= 0,000	8-H
It is good for the environment	Z=-4,072	p-value= 0,000	8-G
To save money	Z= -2,382	p-value= 0,017	8-G
Because it is a popular topic	Z= -1,161	p-value= 0,245	
Because at school they say I have to	Z= -2,530	p-value= 0,011	8-H

Table 5- 30 Comparison between 8-H and 8-G , by association question, reasons to make efficient use of energy

From the results in Table 5-30 and the results on Graph 5-19 and Graph 5-41 we can conclude that the year eight secondary school children from Honduras would make efficient use of energy because their parents say they have to and because it was said at school, while for the German group protection of the environment and save money are more important reasons to make efficient use of energy.

8-H and 8-G, Reasons to make efficient use of energy

In Table 5-31 are shown the results of comparing both groups of year eight secondary school children from Germany and Honduras, analyzing the respondents' opinions regarding why people do not make efficient use of energy.

Reasons why people do not use energy efficient	Wilcoxon-Mann-Whitney-Test (8-H,8-G)		Distinguishable / indistinguishable
People do not know how to make efficient use of energy.	Z= -6,139	p-value= 0,000	8-H
People have a very little environmental awareness	Z=-1,435	p-value= 0,151	
It is uncomfortable to use energy efficiently	Z= -1,455	p-value= 0,146	
Costs a lot of money	Z= -1,050	p-value= 0,294	
People have a very little interest in the issue of energy efficiency	Z= -3,089	p-value= 0,002	8-G

Table 5- 31 Comparison between 8-H and 8-G , by association question, reasons why people do not make efficient use of energy

The results of the Wilcoxon-Mann-Whitney-Test and the results on Graph 5-21 and Graph 5-43 leads us to conclude that the year eight secondary school children from Honduras give more importance to the reason that people do not know how to use energy efficiently as a reason why people do not make efficient use of energy. When comparing both groups in their opinions, the German group give more importance to people's lack of interest in the topic.

5.9.3 Comparison between 11-H and 11-G, by category

In order to find whether the groups with the same level of education in both countries differ in the results of the 7 categories and the four association questions, the Wilcoxon-Mann-Whitney-Test was used. From the test results it was concluded that the groups were found not to be distinguished. In Table 5-32 are shown the results of comparing both groups of year eleven secondary school children by category.

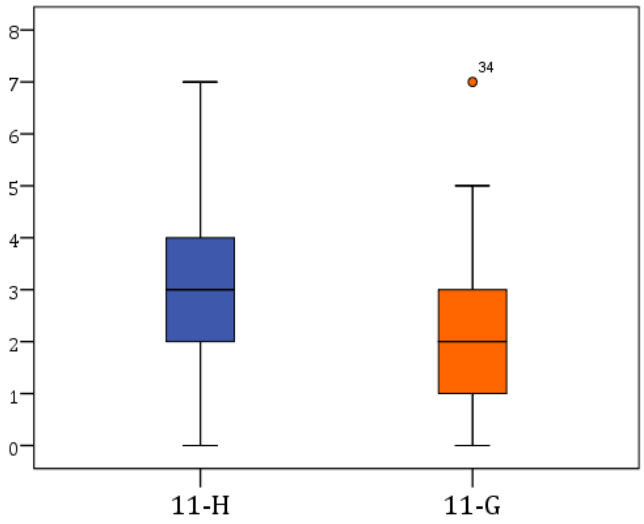
Category	Wilcoxon-Mann-Whitney-Test (11-H,11-G)		Distinguishable / indistinguishable
Energy efficiency behavior	Z= -6,367	p-value= 0,000	11-H
Preconceptions about energy efficiency	Z= -1,681	p-value= 0,093	
Level of concern	Z= -3,640	p-value= 0,000	11-G
Level of responsibility	Z= -4,332	p-value= 0,000	11-H
Level of exposure to information	Z= -7,293	p-value= 0,000	11-H
Level of importance of the topic "energy saving"	Z= -9,685	p-value= 0,000	11-H
Want to know more about energy efficiency	Z= -3,544	p-value= 0,000	11-H

Table 5- 32 Comparison between 11-H and 11-G, by category

As the results in Table 5-32 show, the year eleven secondary school children from both counties differ in 6 of the 7 categories of analysis. The data distribution of the categories of analysis in which both groups differ are shown below.

11-H and11-G, Energy efficiency behavior

In this category 139 valid answers from the Honduran groups and 121 valid answers from the German group were analyzed. The results of both data distributions are shown in Graph 5-161. Although both data distributions are heterogeneous, the groups are different in the interquartile range as in the overall range, the median of the Honduran group is also one point greater.

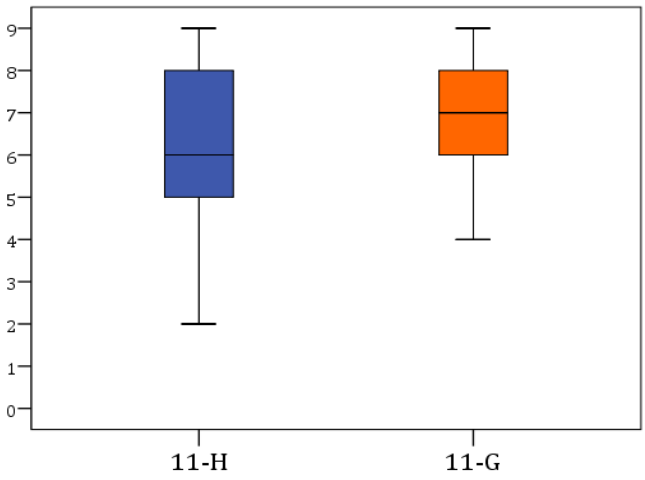


Graphic 5- 161 11-H, 11-G, Energy efficiency behavior

From the test results in Table 5-32 and the value of the median of both groups, it is concluded that the year eleven secondary school children from Honduras scored higher in the category level of energy efficiency when they were compared to the year eleven secondary school children from Germany.

11-H and 11-G, Level of concern

To find the level of concern of the groups, 162 valid answers from the Honduran groups and 125 valid answers from the German group were taken into account.



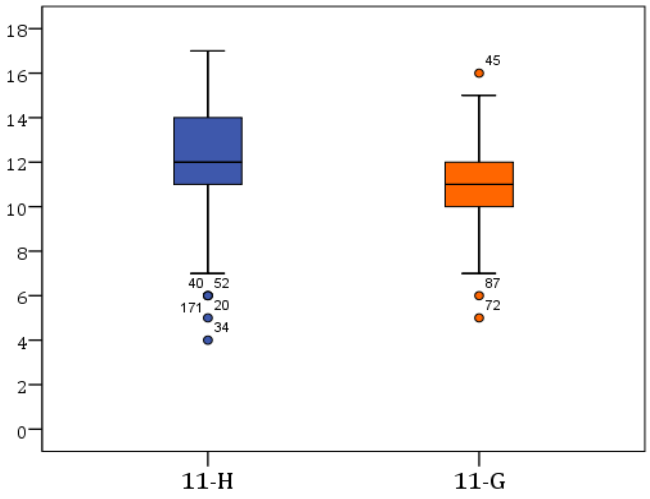
Graphic 5- 162 11-H, 11-G, Level of concern

On Graph 5- 162 are shown both data distributions. It can be seen that both data distributions appear to be heterogeneous but they differ in the overall range as in the interquartile range. The median results and the results of the Wilcoxon-Mann-

Whitney-Test leads us to conclude that the year eleven secondary school children from Germany have a higher level of concern regarding environmental problems and the efficient use of energy than the year eleven secondary school children from Honduras.

11-H and 11-G, Level of responsibility

In the category level of responsibility153 valid answers from the Honduran group and 125 valid answers from the German group were analyzed. On Graph 5-163 are shown the results.



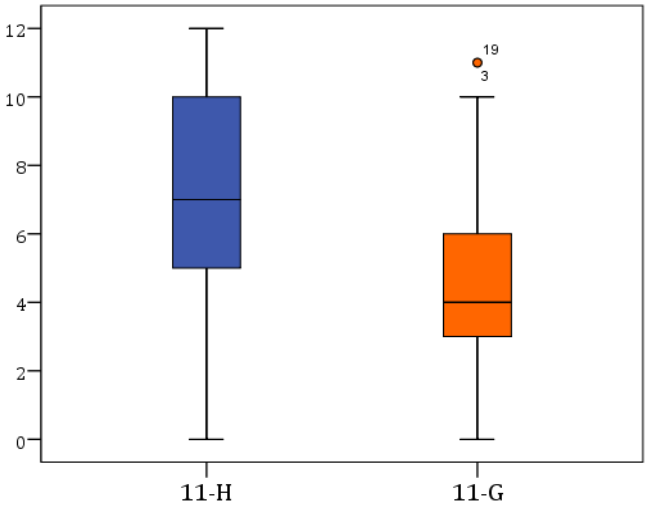
Graphic 5- 163 11-H, 11-G, Level of responsibility

As the graph illustrates, both groups have varied answers, suggesting heterogeneity in the level of responsibility for both groups The groups are different in the data dispersion, that is, the differs by the interquartile range and overall range. The test's results in Table 5-32 and the value of the median for both groups allow us to conclude that the year eleven secondary school children from Honduras reported to have a higher level of responsibility when they were compared to the year eleven secondary school children from Germany.

11-H and 11-G, Level of exposure to information

This category was analyzed with 157 valid answers from the Honduran group and 141 valid answers from the German group, both data distribution are shown on Graph 5- 164

As it can be seen on the graph the groups are heterogeneous in the level of exposure to information but they differ in the interquartile range as in the overall range. It seems on the graph that the median for the Honduran group is higher by three points and over 75% of the Honduran group scored above the median of the German group



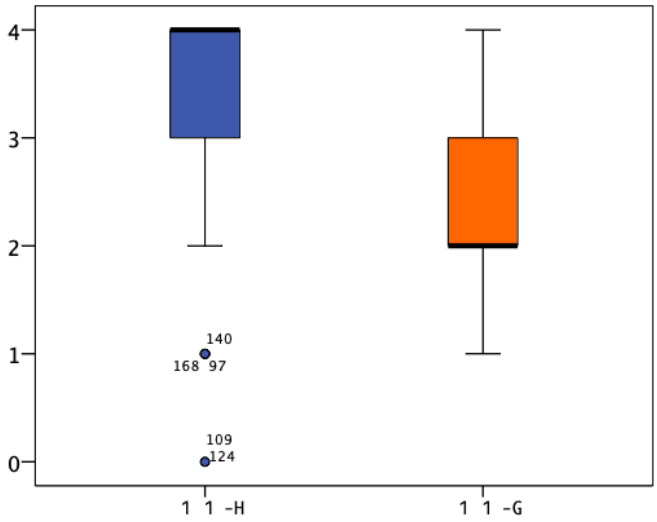
Graphic 5- 164 11-H, 11-G, Level of exposure to information

From the Wilcoxon-Mann-Whitney-Test and the median of both groups we can conclude that the year eleven secondary school children from Honduras reported having a higher level of exposure to information regarding environmental problems and the efficient use of energy when they were compared to the year eleven secondary school children from Germany.

11-H and 11-G, Level of importance of the topic energy efficiency

To find out the level of importance of the topic energy efficiency from both groups of year eleven school children 163 valid answers from the Honduran group and 143 valid answers from the German group were analyzed. Graph 5-165 shows the results.

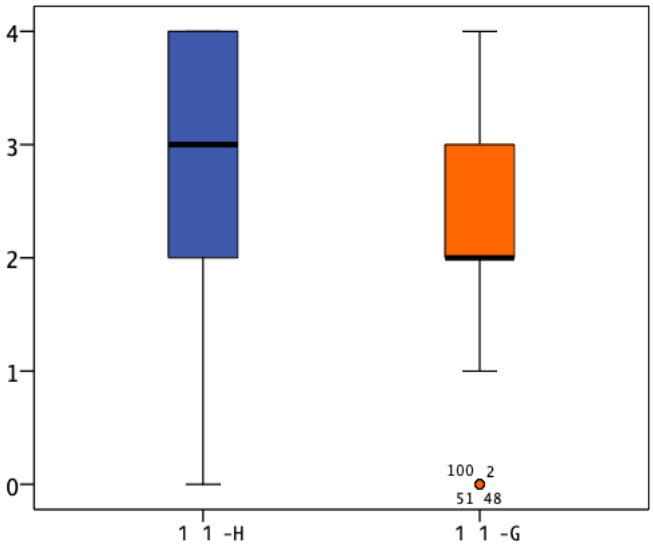
As the graph shows, both groups can be considered as heterogeneous on the level of importance given to the topic energy efficiency, but the groups are different in data dispersion for this category. The data location of both groups is also different in each data distribution, that is, the median of the Honduran group is greater by one point. The Wilcoxon-Mann-Whitney-Test and the value of the median for both groups leads us to conclude that the year eleven secondary school children from Honduras reported a higher score in the category level of importance to the topic energy efficiency when they are compared to the year eleven secondary school children from Germany.



Graphic 5- 165 11-H,11-G, Level of importance of the topic energy efficiency

11-H and 11-G, Level of willing to know more about energy efficiency

In this category were taken into account 169 valid answers from the Honduran group and 140 valid answers from the German group. On Graph 5-166 are shown the results.



Graphic 5- 166 11-H, 11-G, Level of willing to know more about energy efficiency

Both groups are heterogeneous on the level of willing to know more about energy efficiency. The data dispersion of both groups shows that the interquartile range is different in both data distributions. In the data location it can be seen that the median for the Honduran group is greater by one point. From the results of the Wilcoxon-Mann-Whitney-Test and the value of the median for both groups, we can conclude that the Honduran group have a higher level of willing to know more about energy efficiency.

5.9.4 Comparison between 11-H and 11-G, by association question

In this section are described the results of comparing both groups of year eleven secondary school children from Honduras and Germany by the rankings they gave in the four association questions. The first association question is about the association they made with energy efficiency; as was explained in previous sections, they should have given a ranking with the most and the least associated term with energy efficiency.

11-H and 11-G, Association with energy efficiency

The results of comparing 8-H and 11- H in their association with energy efficiency are shown in Table 5-33.

From the results in Table 5-33 and on Graph 5-59 and Graph 5-81, it can be concluded that the year eleven secondary school children from Honduras reported making a stronger association between save money and energy efficiency when they were compared with the

Term	Wilcoxon-Mann-Whitney-Test (11-H,11-G)		Distinguishable / indistinguishable
Save money	Z= -8,763	p-value= 0,000	11-H
Environmental Protection	Z= -4,200	p-value= 0,000	11-G
Electricity	Z= -1,501	p-value= 0,133	
Renounce	Z= -5,294	p-value= 0,000	11-G
Uncomfortableness	Z= -1,842	p-value= 0,066	

Table 5- 33 Comparison between 11-H and 11-G, by association question, association with energy efficiency

year eleven secondary school children from Germany. While the year eleven secondary school children from Germany make a stronger association with energy efficiency the terms environmental protection and renounce. By associating electricity and uncomfortableness, the groups were found not to be distinguished.

11-H and 11-G, Sources of information

The results in Table 5-34 and on Graph 5-61 and Graph 5-83 leads us to conclude that the year eleven secondary school children from Honduras reported using more frequently books as source of information, while the German group use internet and in classes at school more frequently. By using family and friends as a source of information, both groups were found not to be distinguished.

Sources of information	Wilcoxon signed-rank test (8-G,11-G)		Distinguishable / indistinguishable
Books	Z= -4,703	p-value= 0,000	11-H
Family	Z= -1,556	p-value= 0,120	
Friends	Z= -0,751	p-value= 0,453	
Internet	Z= -4,798	p-value= 0,000	11-G
In classes at school	Z= -2,024	p-value= 0,043	11-G

Table 5- 34 Comparison between 11-H and 11-G, by association question, sources of information

11-H and 11-G, Reasons to make efficient use of energy

The results of comparing both groups in their reasons for making efficient use of energy are shown in Table 5-35.

When comparing both groups, the test results in Table 5-35and on Graph 5-63 and Graph 5-85 allows us to conclude that the Honduran group reported to be willing to make efficient use of energy because their parents say they have to do so.

Reasons to make efficient use of energy	Wilcoxon-Mann-Whitney-Test (11-H,11-G)		Distinguishable / indistinguishable
Because my parents say I have to.	Z= -5,573	p-value= 0	11-H
It is good for the environment	Z= -3,074	p-value= 0,002	11-G
To save money	Z= -3,058	p-value= 0,002	11-G
Because it is a popular topic	Z= -2,216	p-value= 0,027	11-G
Because at school they say I have to	Z= -0,69	p-value= 0,49	

Table 5- 35 Comparison between 11-H and 11-G, by association question, reasons to make an efficient use of energy

While the Germany group reported giving more importance to care for the environment, to save money and because it is a popular topic as reasons to make efficient use of energy. By ranking because at school they say I have to, the groups were found not to be not distinguished.

11-H and 11-G, Reasons why people do not make efficient use of energy

The results of comparing both groups in their opinion about why people do not make efficient use of energy are shown in Table 5-36

Reasons why people do not use energy efficient	Wilcoxon-Mann-Whitney-Test (11-H,11-G)		Distinguishable / indistinguishable
People do not know how to make efficient use of energy.	Z= -3,488	p-value= 0,000	11-H
People have a very little environmental awareness	Z= -2,365	p-value= 0,018	11-H
It is uncomfortable to use energy efficiently	Z= -5,263	p-value= 0,000	11-G
Costs a lot of money	Z= -1,744	p-value= 0,081	
People have a very little interest in the issue of energy efficiency	Z= -0,418	p-value= 0,676	

Table 5- 36 Comparison between 11-H and 11-G, by association question, reasons why people do not make efficient use of energy

From the results in Table 5-36 and on Graphic 5-65 and Graphic 5-87, we can conclude that the Honduran group is of the opinion that people do not make efficient use of energy because they do not know how to do it and because they have very little environmental awareness. The German group, on the other hand, hold the opinion that people do not make efficient use of energy because it is uncomfortable to do it.

5.9.5 Comparison between UNI-H and UNI-G by category

In this section are described the results of comparing both groups of university students from Germany and Honduras. The groups were compared by the results of the 8 categories and the four association questions. In Table 5-37 are shown the results of comparing both groups by category.

Category	Wilcoxon-Mann-Whitney-Test (UNI-H,UNI-G)		Distinguibles / indistinguibles
Energy efficiency behavior	Z=-1,615	p-value= 0,106	
Preconceptions about energy efficiency	Z= -2,200	p-value= 0,028	UNI-H
Level of concern	Z= -0,921	p-value= 0,357	
Level of responsibility	Z= -4,729	p-value= 0,000	UNI-H
Level of exposure to information	Z= -6,051	p-value= 0,000,	UNI-H
Level of importance of the topic "energy saving"	Z= -8,177	p-value= 0,000	UNI-H
Level of willing to know more about energy efficiency	Z= -8,440	p-value= 0,000	UNI-H
Level of engagement as a future teacher	Z= -6,430	p-value= 0,000	UNI-H

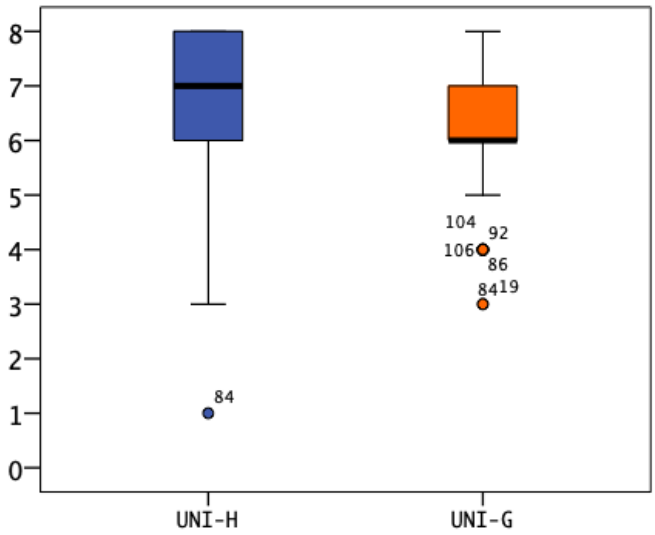
Table 5- 37 Comparison between UNI-H and UNI-G, by category

When the groups were compared by the results of the 8 categories a statistically significant difference between the groups in 6 of the 8 categories of analysis was found. To obtain more explicit information about the difference in these 6 categories, the data distribution of both groups are shown.

UNI-H and UNI-G, Energy efficiency preconceptions

The energy efficiency preconceptions of both groups was analyzed taken into account 104 valid answers from the Honduran group and 102 valid answers from the German group.

The results are shown on Graph 5-167 The graph shows that both groups are heterogeneous,

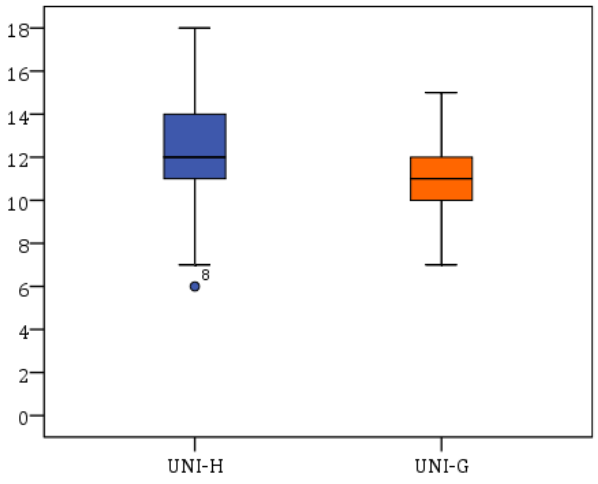


Graphic 5- 167 UNI-H, UNI-G Energy efficiency preconceptions

The Honduran group ranges from 1 to 8 while the German group ranges from 3 to 8. in the category preconception about energy efficiency. They differ in the interquartile range and in the overall range. The data location of both groups on the graph is also different from one another, that is, the median of the Honduran groups is one point higher on an 8-point scale. From the results of the Wilcoxon-Mann-Whitney-Test and the value of the median for both groups, it can be concluded that the university students from Honduras reported a higher score in the category preconceptions about energy efficiency when they were compared to the university students from Germany.

UNI-H and UNI-G, Level of responsibility

The data distribution in the category level of responsibility describes the results of 100 valid answers from the Honduran group and 98 valid answers from the German group. The results are shown on Graph 5-168



Graphic 5- 168 UNI-H, UNI-G, Level of responsibility

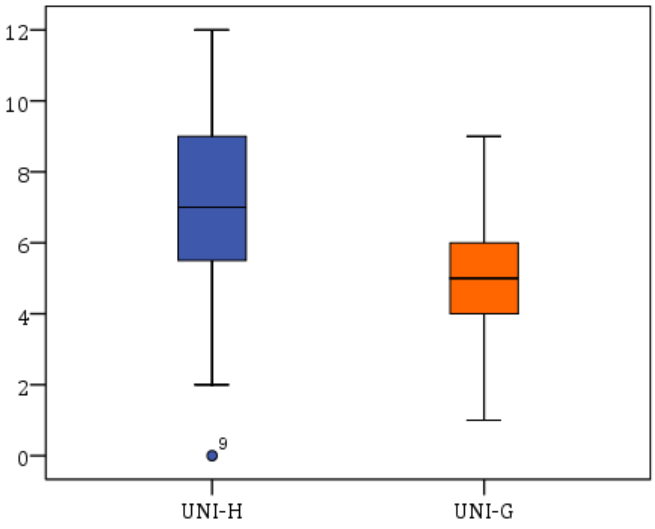
Both groups can be considering as heterogeneous in the category level of responsibility but they differ in the interquartile range and in the overall range. The data location on Graph 5-168 shows that the median of the Honduran group is greater.

From the test results in table 5-37 and the value of the median for both groups, we can conclude that the university students from Honduras reported having a higher level of responsibility regarding environmental

problems and the efficient use of energy when they were compared to the university students from Germany.

UNI-H and UNI-G, Level of exposure to information

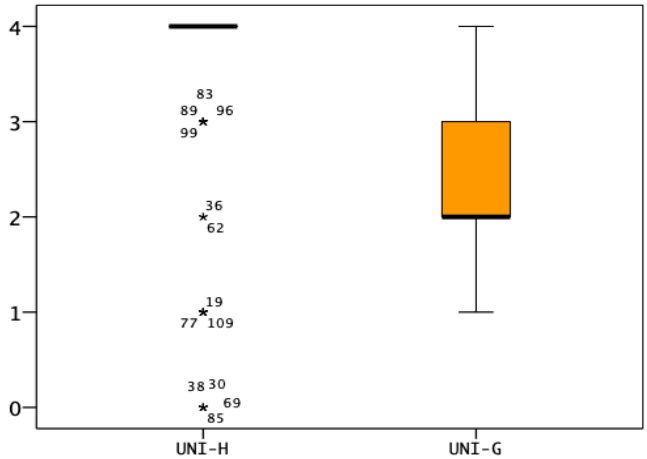
The data distributions on Graph 5- 169 include 100 valid answers from the Honduran group and 104 valid answers from the German group. The results are illustrated on Graph 5-169



Graphic 5- 169 UNI-H, UNI-G, Level of exposure to information

From the results on the graph both groups can be considered heterogeneous in the category level of exposure to information. As it can be seen on the graph, the groups differ in the interquartile range as well as in the overall range. In the data location both groups were found to be different, the median of the Honduran group is greater. From the test results in table 5-37 and the value of the median for both groups, it is concluded that the university students from Honduras reported a higher level of exposure to information regarding climate problems and the efficient use of energy when they were compared to the university students from Germany.

UNI-H and UNI-G, Level of importance of the topic energy saving



Graphic 5- 170 UNI-H, UNI-G, Level of importance of the topic "energy saving"

In the category level of importance of the topic energy saving 102 valid answers from the Honduran group and 105 valid answers from the German group were taken into account.

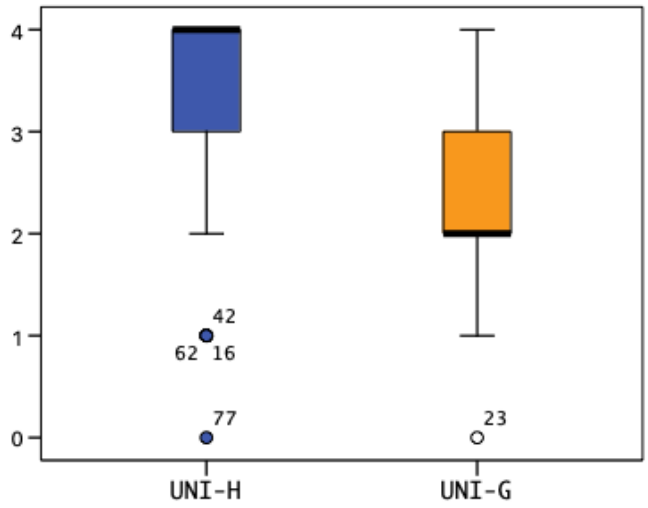
Graph 5-170 shows the results of both groups in this category.

It can be seen on the graph that the groups differ in data dispersion as well as in data

location. The median of the Honduran group is greater and over 85% of the Honduran group scored above the median of the German group. From the test results and the value of the median for both groups it can be concluded that the University students from Honduras reported a higher score in the category level of importance of the topic energy saving when they are compared to the university students from Germany.

UNI-H and UNI-G, Level of willing to know more about energy efficiency

In this category 106 valid answers from the Honduran group and 103 valid answers from the German group were taken into account. Graph 5-171 illustrates the results.

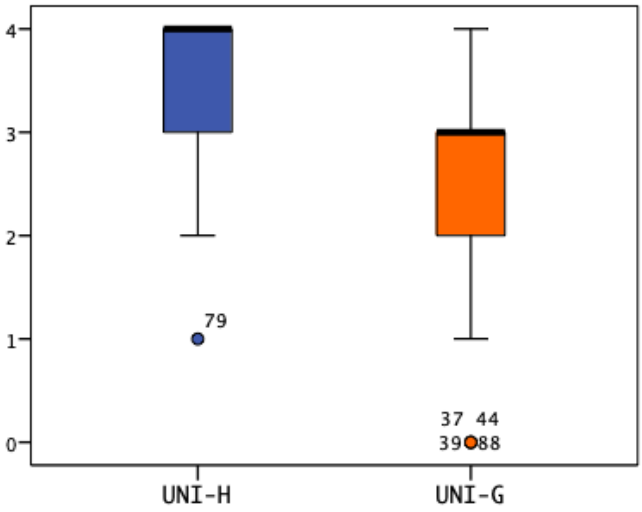


Graphic 5- 171 UNI-H, UNI-G, Level of willing to know more about energy efficiency

The graph shows that both groups are heterogeneous in willing to know more about the topic energy efficiency. It can also be seen on the graph that the median of the Honduran group is greater. From the test results and the value of the median for both groups it can be concluded that the university students from Honduras reported being willing to know more about energy efficiency then the university students from Germany.

UNI-H and UNI-G, Level of engagement as a future teacher

This category was analyzed with 107 valid answers from the Honduran group and 106 valid answers from the German group. On Graph 5-172 are shown the results of both data distributions.



Graphic 5- 172 UNI-H, UNI-G, Level of engagement as future teacher

The groups can be considered as heterogeneous according to the data distributions on the graph, but both groups have a different interquartile range and different overall range as well. The data location of both group shows us that the median for the Honduran group is greater (4 on a 4-point scale).

The results of the test in table 5-37 and the value of the median for both group leads us to conclude that the Honduran group have a higher level of engagement as future teachers when they were compared to the university students from Germany.

5.9.6 Comparison between UNI-H and UNI-G by association question

In this section are described the results of comparing both groups of university students by the rankings they gave in the four association questions.

UNI-H and UNI-G, Association with energy efficiency

In Table 5-38 are shown the five terms given to the university students to associate with energy efficiency. In the second column of the table are shown the results of the Wilcoxon signed-rank test, while the third column shows which group reported making a stronger association between the corresponding term and energy efficiency.

Term	Wilcoxon-Mann-Whitney-Test (UNI-H, UNI-G)		Distinguishable / indistinguishable
Save money	Z= -5,356	p-value= 0,000	UNI-H
Environmental Protection	Z= -3,034	p-value= 0,002	UNI-G
Electricity	Z= -2,764	p-value= 0,006	UNI-G
Renounce	Z= -0,570	p-value= 0,569	
Uncomfortableness	Z= -0,699	p-value= 0,485	

Table 5- 38 Comparison between UNI-H and UNI-G, by association question, association with energy efficiency

When comparing both groups, the results in Table 5-38 and on Graph 5-105 and Graph 5-129 leads us to conclude that the university students from Honduras make a stronger association

between energy efficiency and save money, while the university students from Germany associate stronger energy efficiency with environmental protection and electricity. By associating the terms renounce and uncomfortableness, no statistical difference was found between the groups.

UNI-H and UNI-G, Sources of information

The university students from both countries were compared in their sources of information about environmental problems and the efficient use of energy the results are shown in Table 5-39

Sources of information	Wilcoxon-Mann-Whitney-Test (UNI-H, UNI-G)		Distinguishable / indistinguishable
Books	Z= -3,649	p-value= 0,000	UNI-H
Family	Z= -4,578	p-value= 0,000	UNI-G
Friends	Z= -1,138	p-value= 0,255	
Internet	Z= -0,581	p-value= 0,561	
In classes at school	Z= -2,436	p-value= 0,015	UNI-H

Table 5- 39 Comparison between UNI-H and UNI-G, by association question, sources of information

From the results of the Wilcoxon signed-rank test in Table 5-39 and on Graph 5-107 and Graph 5-131 it can be concluded that the university students from Honduras use books and in classes at school more frequently as a source of information, while the university students from Germany use family more frequently as a source of information. By using internet and friends as a source of information, the groups were found not to be distinguished.

UNI-H and UNI-G, Reasons to make efficient use of energy

The results of comparing the university students from both countries in their reasons for making efficient use of energy are shown in Table 5-40

Reasons to make an efficient use of energy	Wilcoxon-Mann-Whitney-Test (UNI-H, UNI-G)		Distinguishable / indistinguishable
Because I am responsible for taking care of the environment.	Z= -0,788	p-value= 0,430	
For the future of the earth	Z= -0,354	p-value= 0,724	
To save money	Z= -0,343	p-value= 0,732	
Because it is a popular topic	Z= -0,739	p-value= 0,460	
Because at school they say I have to	Z= -0,371	p-value= 0,711	

Table 5- 40 Comparison between UNI-H and UNI-G, by association question, reasons to make an efficient use of energy

As it can be seen in the table, the university students from both countries were found not to be distinguished in the five given reasons to make efficient use of energy.

UNI-H and UNI-G, Reasons why people do not make efficient use of energy

The results of comparing the university students in their opinions about why people do not make efficient use of energy is shown in Table 5-41.

Reasons why people do not use energy efficient	Wilcoxon-Mann-Whitney-Test (UNI-H, UNI-G)		Distinguishable / indistinguishable
People do not know how to make efficient use of energy.	Z= -4,015	p-value= 0,000	UNI-H
People have a very little environmental awareness	Z= -4,013	p-value= 0,000	UNI-H
It is uncomfortable to use energy efficiently	Z= -5,854	p-value= 0,000	UNI-G
Costs a lot of money	Z= -1,485	p-value= 0,138	
People have a very little interest in the issue of energy efficiency	Z= -1,413	p-value= 0,158	

Table 5- 41 Comparison between UNI-H and UNI-G, by association question, reasons why people do not make efficient use of energy

It can be seen in Table 5-41 that according to the results of the Wilcoxon signed-rank test the groups were found to be distinguished in three of the five given reasons why people do not make efficient use of energy.

By comparing the results on both groups on Graphs 5-111 and 5- 135 it can be concluded that the university students from Honduras reported a higher score than the German group in two reasons, that is, people do not know how to make efficient use of energy and people have very little environmental awareness. While the German university students score higher in the opinion that people do not make efficient use of energy because it is uncomfortable.

5.10 Honduras and Germany

In this section a summary of the comparisons that have been made between level of education and between countries is described in the first section the comparisons among the 7 categories that the 6 groups have in common are described, while in the second section there is a summary of comparing the groups in the results of the 2 association question. To compare

the groups, the Wilcoxon-Mann-Whitney-Test was used, it concluded that the two groups are distinguished. With a particular variable the test value should extend the border [-1.96, +1.96] and by comparing the median we can conclude which group scored higher in this particular variable (see chapter 3.7)

5.10.1 Honduras and Germany, Energy efficiency behavior

On Diagram 5-9 are shown the results of comparing the 6 participating groups in the category energy efficiency behavior. The diagram illustrates the results of the Wilcoxon-Mann-Whitney-Test and the median for the energy efficiency behavior score of the groups. The three Honduran groups are in the color blue at the top of the diagram and the German groups are at the bottom of the diagram in the color orange.

The median of each group is under the name of the group in parenthesis and the results of the Wilcoxon-Mann-Whitney-Test are between the two compared groups.

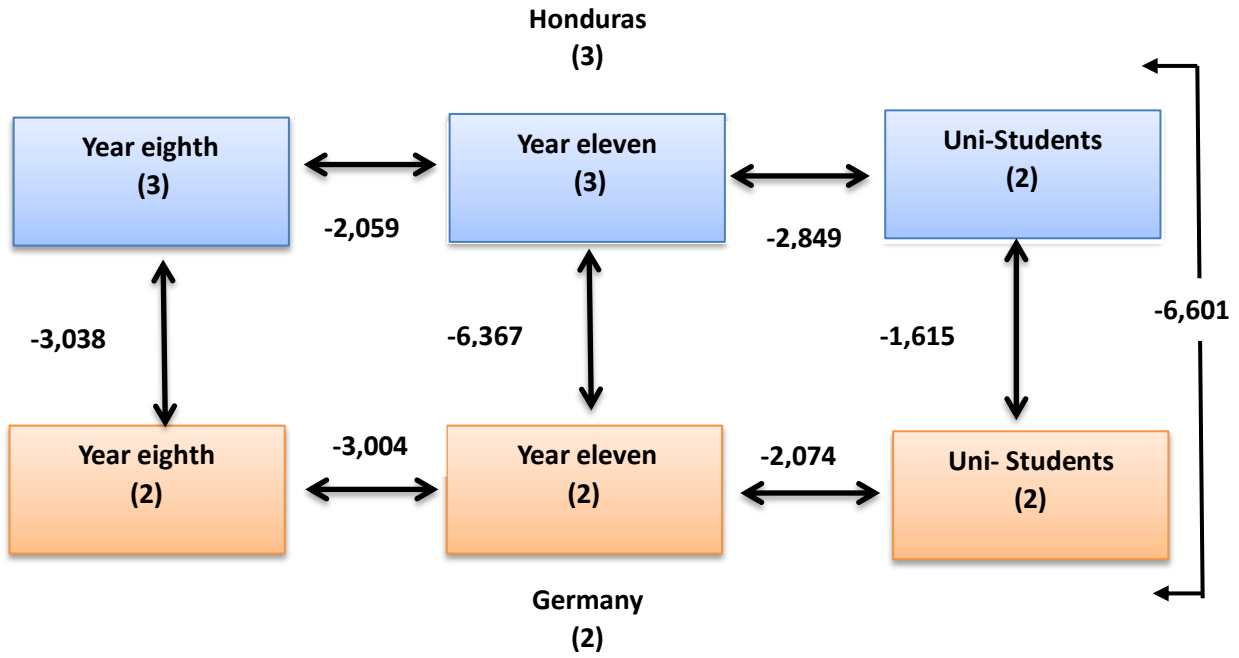


Diagram 5- 9 Honduras and Germany, energy efficiency behavior

By comparing the three Honduran groups with each other, it was found that the year eleven secondary school children reported having the highest energy efficiency behavior, while the university students and the year eight secondary school children were found not to be distinguished in their energy efficiency behavior.

Though in Germany the three groups have the same median, from the results of Wilcoxon-Mann-Whitney-Test and the results of the average rank for the two groups it was concluded that the year eight school children scored higher than the year eleven ones, while when the university students were compared to the secondary school children they were found not to be distinguished with the year eight school children and they got a higher score than the year eleven ones.

By comparing the regions, it was found that the secondary school children from both countries can be distinguished in respect to their efficient use of energy. Due to the fact that the median of the Honduran groups is higher, it can be concluded that the secondary school children from Honduras reported having higher energy efficiency behavior than their peers in Germany. When comparing the university students, the groups were found not to be distinguished in the category energy efficiency behavior.

By comparing the regions as one group, that is, the totality of respondents in Honduras and the totality of respondents in Germany, from the tests results and the median for both regions it can be concluded that the Honduran respondents reported a higher score in the category energy efficiency behavior.

5.10.2 Honduras and Germany, Energy efficiency preconceptions

On Diagram 5-10 are shown the results of comparing the 6 participating groups by using the Wilcoxon-Mann-Whitney-Test, with the median for energy efficiency preconceptions being under the name of each group.

Within the Honduran groups it was found that the university students have a higher score in the category energy efficiency preconceptions when they were compared to the secondary school children. By comparing the Honduran secondary school children with each other it was found that the groups are not distinguished in respect to their preconceptions about energy efficiency.

By comparing the three German groups with each other, the three groups were found not to be distinguished in respect to their energy efficiency preconceptions.

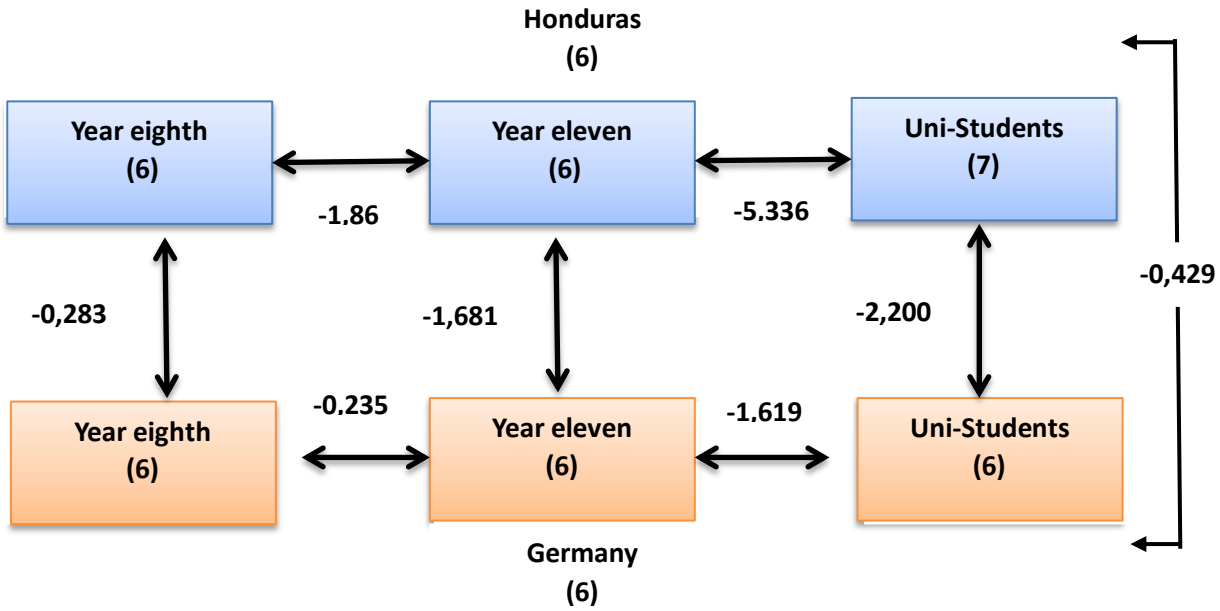


Diagram 5- 10 Honduras and Germany, energy efficiency preconceptions

As it can be seen on the diagram, when comparing the Honduran and German secondary school children with each other the groups were found not to be distinguished in respect to their preconceptions about energy efficiency. When both groups of university students were compared, the results of Wilcoxon-Mann-Whitney-Test and the value of the median for both groups leads us to conclude that the Honduran group reported having a higher score in the category energy efficiency preconceptions.

By comparing the two regions with each other, the results of the Wilcoxon-Mann-Whitney-Test and the median of both regions leads us to conclude that the regions are not distinguished with respect to energy efficiency preconceptions.

5.10.3 Honduras and Germany, Level of concern

On Diagram 5-11 the results of comparing the 6 participating groups in the category level of concern regarding environmental problems and the efficient use of energy are shown. With the Honduran groups, the university students reported having the highest level of concern when they were compared to the secondary school children, while both Honduran groups of secondary school children were found not to be distinguished in the category level of concern. Between the two German groups of secondary school children, the year eleven group

reported having a higher level of concern. While the university students had a higher level of concern than the year eight school children but were indistinguishable from the year eleven ones.

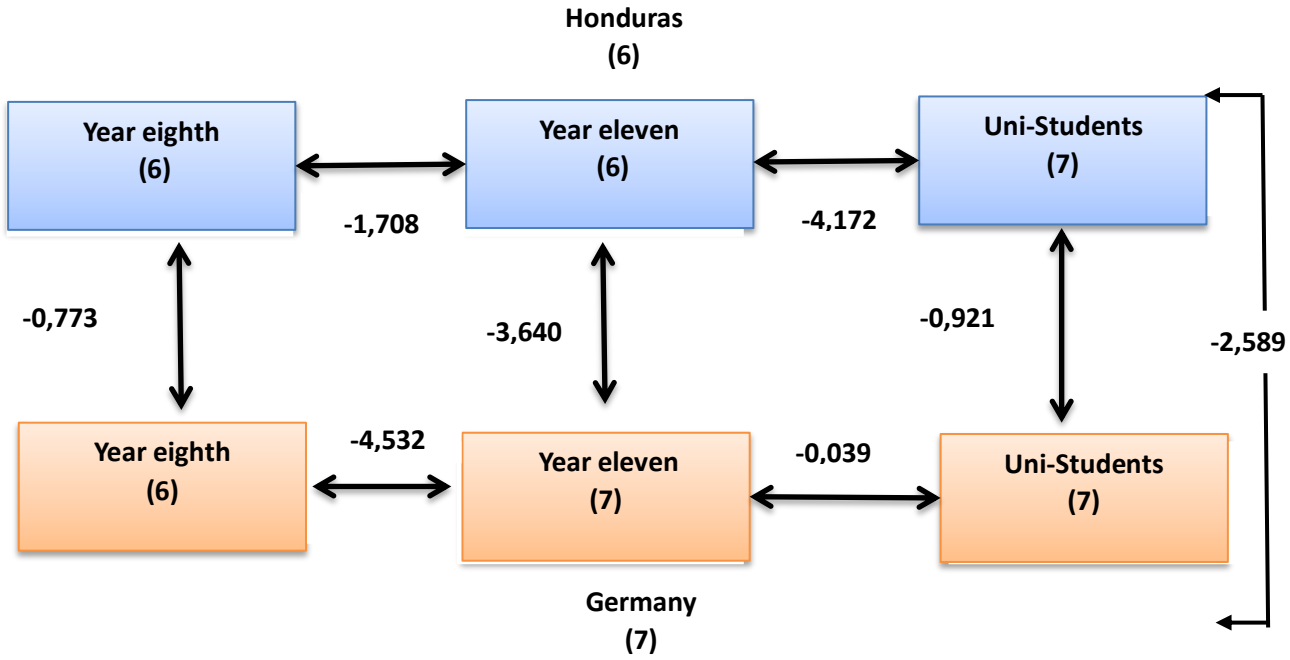


Diagram 5- 11 Honduras and Germany, level of concern

The results of the Wilcoxon-Mann-Whitney-Test on Diagram 5-11 show that between the regions only the year eleven group can be distinguished in the category level of concern. From the median results it can be concluded that the German year eleven group reported having a higher level of concern regarding environmental problems and the efficient use of energy.
By comparing the two regions, the Germans respondents score higher in the category level of concern about environmental topics and the efficient use of energy.

5.10.4 Honduras and Germany, Level of responsibility

Diagram 5-12 illustrates the results of the Wilcoxon-Mann-Whitney-Test and the median of the 6 participating groups in the category level of responsibility.

By comparing the secondary school children from Honduras using the Wilcoxon-Mann-Whitney-Test it was found that the groups are not distinguished in their level of responsibility regarding environmental problems and the efficient use of energy. The university students

have a higher level of responsibility than the year eight group but they were found not to be distinguished from the year eleven group.

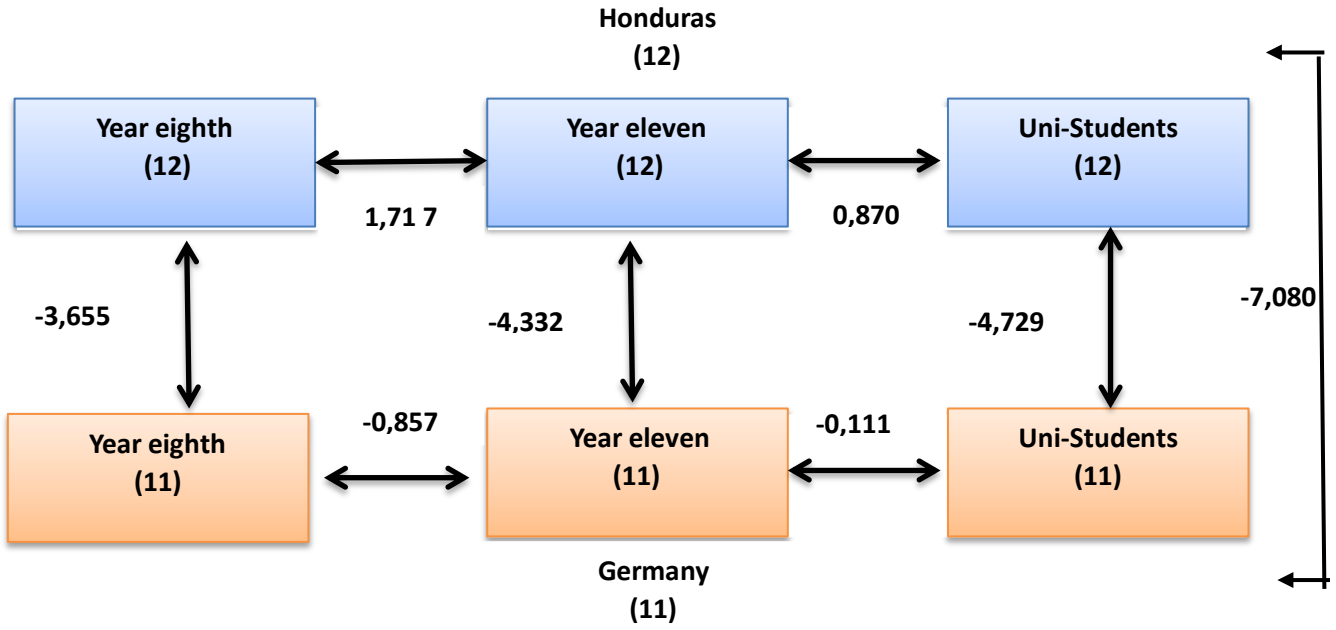


Diagram 5- 12 Honduras and Germany, level of responsibility

Within the German groups no statistical differences were found among them. When comparing the regions, it was found that the three Honduran groups reported having a higher level of responsibility regarding environmental problems and the efficient use of energy.

By comparing the regions as entire groups it was found that the Honduran respondents have a higher level of responsibility than the German respondents.

5.10.5 Honduras and Germany, Level of exposure to information

Diagram 5-13 shows the results of comparing the six participating groups with each other in the category level of exposure to information.

With the Honduran groups, when the three groups were compared with other in their level of exposure to information regarding environmental problems and the efficient use of energy, it was found that the groups are not distinguished in this category.

With the German groups, it was found that the year eleven school children have a higher level of exposure to information when they are compared to the year eight secondary school children. While the university students do not differ from the year eleven group but have a higher level of exposure to information than the year eight group.

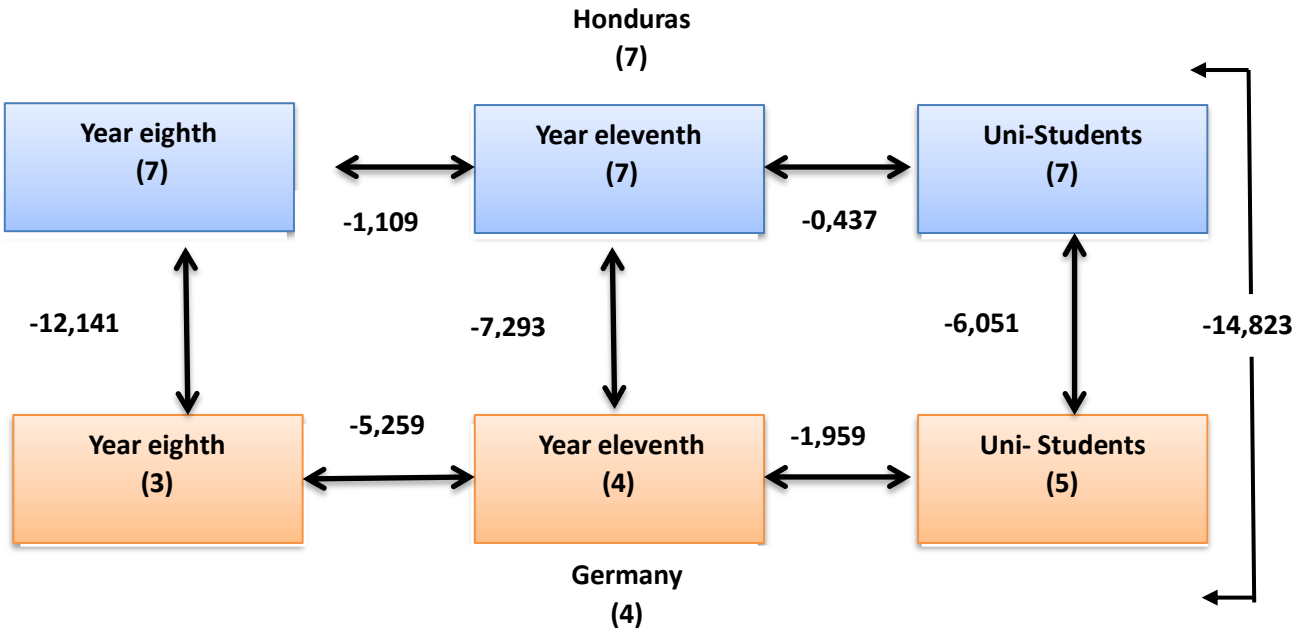


Diagram 5- 13 Honduras and Germany, level of exposure to information

By comparing the regions, the three Honduran groups reported having a higher level of exposure to information when they were compared to their German peers.

When the two regions were compared as entire groups, the results of the Wilcoxon-Mann-Whitney-Test and the median of both groups leads us to conclude that the Honduran respondents reported having a higher level of exposure to information regarding environmental problems and the efficient use of energy than the Germans.

5.10.6 Honduras and Germany, Level of importance of the topic energy saving

On Diagram 5-14 are shown the results of comparing the six participating groups in the category level of importance of the topic energy saving.

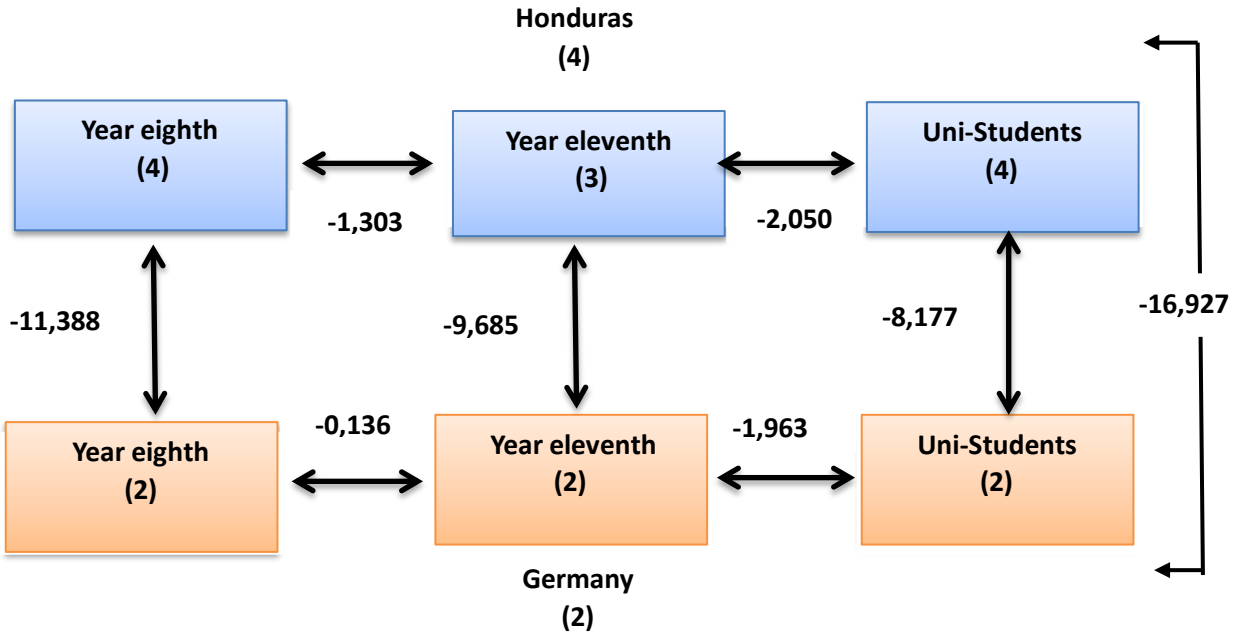


Diagram 5- 14 Honduras and Germany, level of importance of the topic "energy saving"

As it can be seen on the diagram the secondary school children from Honduras were found not to be distinguished in the category level of importance of the topic energy efficiency. While the university students have a higher score than the year eleven group, they were found not to be distinguished from the year eight group in the level of importance given to the topic.

Among the German groups no statistical difference was found with the secondary school children, while the university students were found to have higher scores than the year eleven group, they are not distinguished from the year eight group in the level of importance given to the topic energy saving.

By comparing the regions, the three Honduran groups scored higher in the category level of importance to the topic energy saving. By comparing the regions as entire groups the same results were found, the Honduran respondents reported a higher score in the category level of importance of the topic energy saving.

5.10.7 Honduras and Germany, Level of willing to know more about energy efficiency

Diagram 5-15 shows the results of the Wilcoxon signed-rank test and the median of the six participating groups in the category level of willing to know more about energy efficiency. With the Honduran groups, the university students are willing to know more about energy efficiency when they are compared to the year eleven secondary school children. While both Honduran groups of secondary school children are found not to be not distinguished in the category level of willing to know more about energy efficiency.

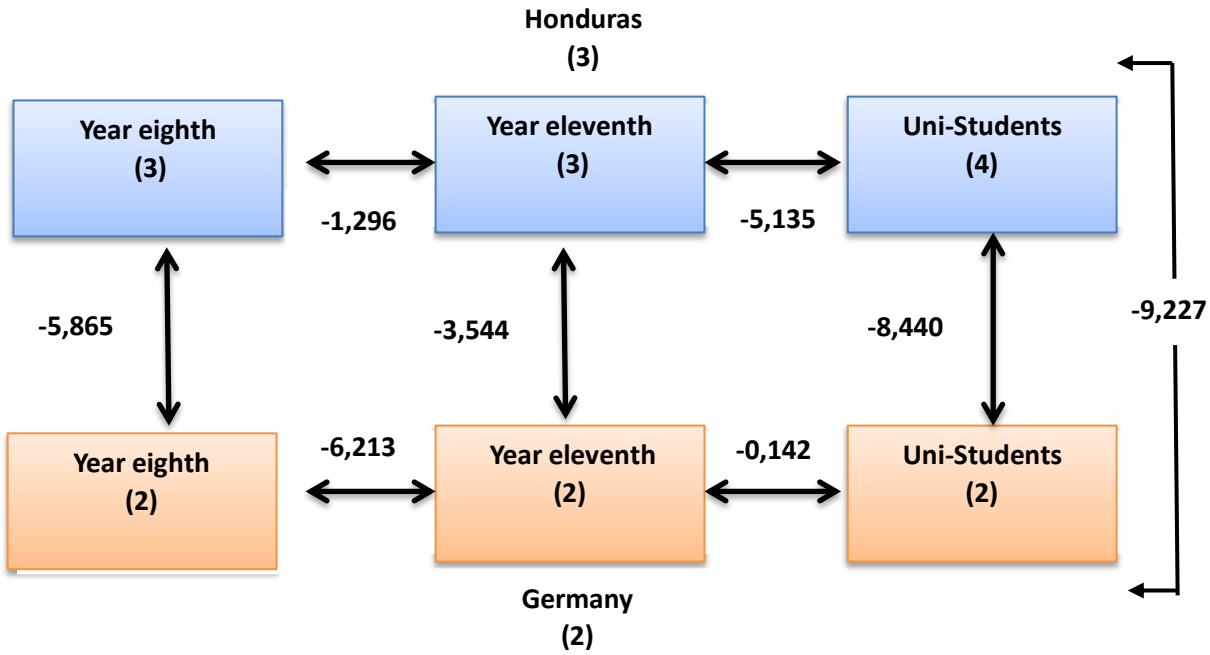


Diagram 5- 15 Honduras and Germany, level of willing to know more about energy efficiency

Among the German school children, the year eleven group reported being willing to know more about energy efficiency, while the university students were found not to be distinguished from the year eleven group, but they reported a higher score than the year eight group.

The test results on Diagram 5-15 leads us to conclude that the three Honduran groups are willing to know more about energy efficiency when they are compared to their German peers. By comparing the regions as entire groups, the Honduran respondents are willing to know more about energy efficiency than the German respondents.

5.10.8 Honduras and Germany, Correlation among the 7 categories

On diagram 5-16 are shown the correlation among the 7 categories. The blue arrow means a correlation in more than one Honduran group, an orange arrow means a correlation in more than one German group.

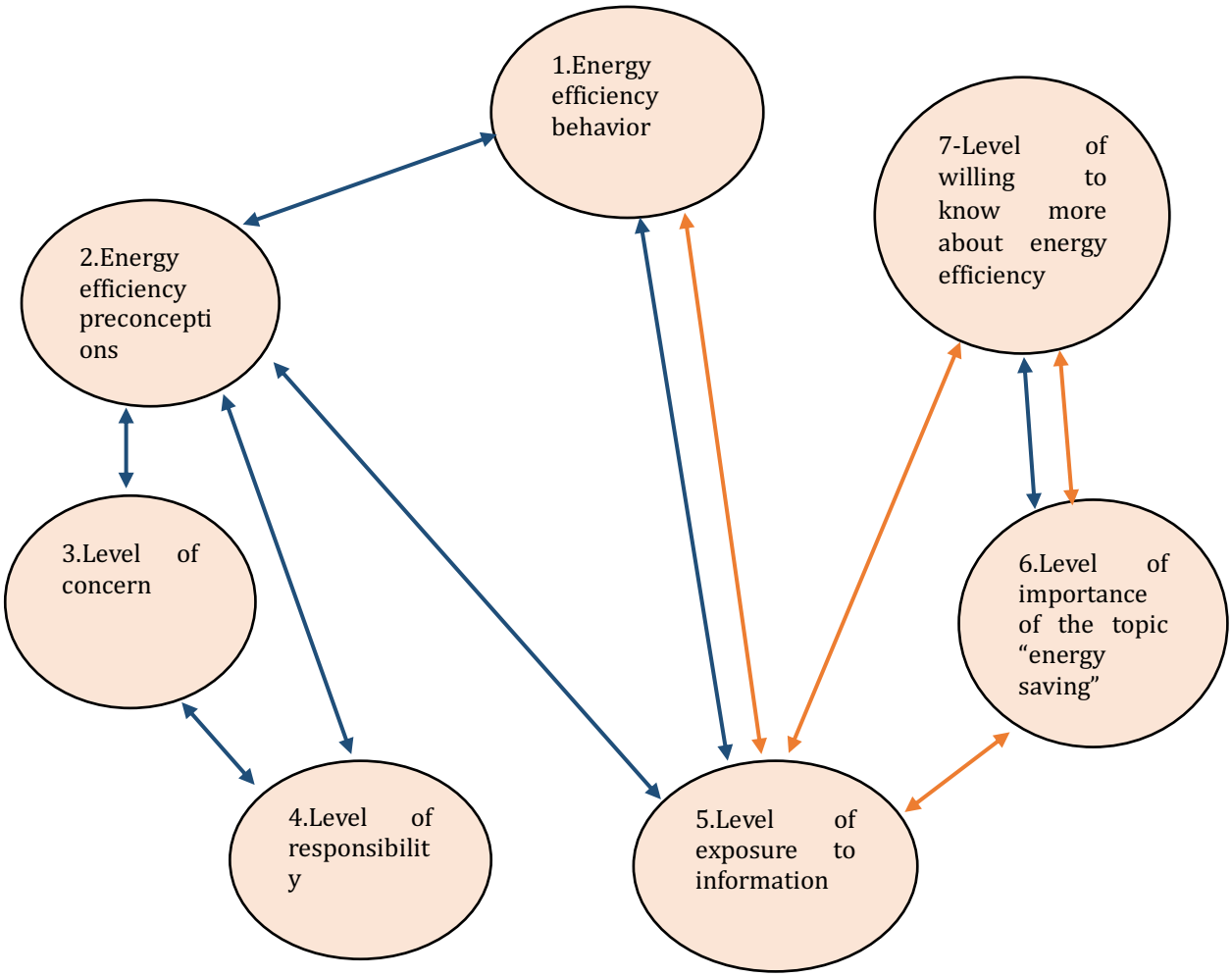


Diagram 5- 16 Honduras and Germany, Correlation between the 7 categories

As it can be seen on the diagram, in more than one Honduran group the category energy efficiency preconceptions was found to be correlated to the level of concern, level of responsibility and level of exposure to information. The efficient use of energy is correlated to the level of exposure to information and energy efficiency preconceptions. The level of concern and the level of responsibility are also correlated in the Honduran data.

In more than one German group the level of exposure to information was found to be correlated to energy efficiency behavior, the level of willing to know more about energy efficiency, and the level of importance of the topic energy saving.

In both countries, the level of willing to know more about energy efficiency was found to be correlated to the importance given to the topic energy saving. In the results of both countries, energy efficiency behavior was found to be correlated to the level of exposure to information.

The level of responsibility and the level of exposure to information are not directly correlated, neither are energy efficiency behavior and the level of willing to know more about energy efficiency.

5.10.9 Honduras and Germany, Association with energy efficiency

In Table 5-42 the results of comparing the six participating groups in their association with energy efficiency are shown. In the table are shown the results of comparing the groups, taking into account the country where the study took place, that is, each level of education is compared to their peers from the other country, year eight Honduras were compared to year eight Germans, year eleven Honduras to year eleven Germans and the Honduran university students to the German university students. When it is said that a group is higher than another it only means that the group is higher than the other group with same level of education, but it does not mean that the group ranked a term in first place or that the group is higher than the other five participating groups.

For example, with the term renounce, when comparing both groups of year eight secondary school children, the groups were found to be distinguished. On seeing the rankings made by both groups it was found that the German group reported a score higher in the term renounce than the Honduran group, so it can be concluded that the year eight secondary school children from Germany associate energy efficiency to renounce stronger than the year eight secondary school children from Honduras. The result does not mean that renounce is in first place in the German group's ranking, or that the year eight secondary school children from Germany reported a higher score than the other five participating groups. The results only mean that the year eight secondary school children from Germany reported a higher score with renounce than the year eight secondary school children from Honduras.

The color blue in Table 5-42 means that the Honduran group reported a higher score with the term, the color orange means that the German group reported a score higher with the term and the color green means that the groups were found not to be distinguished.

	Terms	8-H, 8-G	11-H, 11-G	UNI-H, UNI-G
Association with energy efficiency	Save money			
	Environmental protection			
	Electricity			
	Renounce			
	Uncomfortableness			

Table 5- 42 Honduras and Germany, association question, association with energy efficiency

As it can be seen in Table 5-42, the three Honduran groups associate energy efficiency with save money more than their German peers. While the three German groups make a stronger association between energy efficiency and environmental protection.

The German university students and the year eight secondary school children made a stronger association between energy efficiency and electricity, while the German secondary school children associate more strongly energy efficiency with renounce than their Honduran peers. With the association between energy efficiency and uncomfortableness, the groups were found not to be distinguished.

5.10.10 Honduras and Germany, Sources of information

In Table 5-43 are shown the results of comparing the six participating groups in their sources of information. As in the previous section, the color blue means that the Honduran reported a higher score with the term, the color orange means that the German group reported a higher score with the term and the color green means that the groups were found not to be distinguished.

As it can be seen in Table 5-43, the three Honduran groups reported using books more frequently to obtain information on environmental problems, while the two groups of secondary school children from Germany reported using internet more frequently.

Sources of information

Sources	8-H, 8-G	11-H, 11-G	UNI-H,UNI-G
Books			
Family			
Friends			
Internet			
In classes at school			

Table 5- 43 Honduras and Germany, association question, sources of information

Family as a source of information was found to be used more frequently by the university students from Germany, while the university students from Honduras reported getting information more frequently in classes at school. The year eleven secondary school children from Germany also gets information more frequently in classes at school than their Honduran peers.

By using friends as a source of information, it was found that the year eight secondary school children from Honduras use more frequently friends as a source of information when they were compared to the year eight secondary school children from Germany.

5.10.11 Honduras and Germany, Reasons to make efficient use of energy

Due to the levels of education of the secondary school children and the university students from both countries, the survey of the university students from both countries was different in some question from the survey of the secondary school children. As it was explained in the results of the pilot study, some question from the students' survey were found to be not useful in the secondary school survey. In this association question in particular, two of the five options given are different in the university students survey. These two option appear in the first two rows of Table 5-44, at the beginning of the option it is pointed out that the option corresponds to the university students. As in the other association question, the comparison is made only among the groups with the same level of education in each country.

As it can be seen in Table 5-44, the two groups of secondary school children from Honduras reported being more influenced by their parents in making efficient use of energy than their German peers, while the two groups of German school children would make efficient use of energy because it is good for the environment and to save money.

	Reasons	8-H, 8-G	11-H, 11-G	UNI-H,UNI-G
Reasons to make efficient use of energy	Because my parents say I have to (UNI) I am responsible For environmental protection			
	It is good for the environment (UNI) For the future of the earth			
	To save money			
	Because it is a popular topic			
	Because it was said at school			

Table 5- 44 Honduras and Germany, association question, reasons to make efficient use of energy

With the year eight secondary school children, the Honduran would make efficient use of energy because it was said to do so at school, while with the year eleven groups in both countries, the Germans would make efficient use of energy because it is a popular topic. Among the university students from both countries, no statistically significant difference was found in their reasons for making efficient use of energy.

5.10.12 Honduras and Germany, Reasons why people do not make efficient use of energy

In Table 5-45 are shown the results of comparing the participating groups in the reasons why people do not make efficient use of energy.

The three Honduran groups differ from the German groups in ranking the first given reason. The three Honduran groups are of the opinion that people do not know how to make efficient use of energy because they do not know how to do so. Two Honduran groups also said that people have very little environmental awareness, while two of the German groups differ from their Honduran peers and have ranked higher it is uncomfortable use the energy efficiently as the reason.

	Reasons	8-H,8-G	11-H,11-G	UNI-H,UNI-G
Reasons why people do not make efficient use of energy efficient	People do not know how to make an efficient use of energy.			
	People have a very little environmental awareness			
	It is uncomfortable to use energy efficiently			
	Costs a lot of money			
	People have a very little interest in the issue of energy efficiency			

Table 5- 45 Honduras and Germany, association question, reasons why people do not make efficient use of energy

The German year eight group have ranked higher people have very little interest in the topic energy efficiency as the reason.

The three groups were found not to be distinguished in ranking costs a lot of money as a reason not make efficient use of energy.

Differences and similitudes were found by comparing the groups, these are discussed in the next chapter.

One category of analysis (waste of energy) and one association question (which Light sources consume less energy) were taken out of the present results, they information provided from them was found to be unsuitable for the research.

6. DISCUSSION

In the previous chapter the topic of energy efficiency and its strong link to climate change as well as its mitigation strategies were discussed. It was also argued that there is a lack of information on the topic of energy efficiency in science education, in the teaching methods of physics and in school books. The information is limited to the industrial sector and the efficient use of energy is shown in most advertising as “saving energy”. Different strategies in saving energy can be seen in national and international publicity in the educational sector. In Germany in particular the topic is limited to building modernization to create “eco-schools” or seen in isolated programs or campaigns at schools which intend to inform children how to save energy. In Honduras the topic of save energy is also popular with isolated governmental campaigns targeted at the entire population, mainly focused on informing the population in how to save energy.

As it was explained in chapter two, the relation between energy efficiency and science instruction is almost zero in educational programs, particularly in Germany and in Honduras where the study took place. The present investigation is a comparative study which may serve as a basis to introduce energy efficiency into science instruction, framed on the model of educational reconstruction in the study where it found out the preconceptions, attitudes, interests and motivations of the respondents regarding energy efficiency. In the findings the participating groups were compared which each other taking into account three different levels of education and two different cultural contexts. The comparisons between groups have given us the opportunity to conclude whether culture backgrounds and the different levels of education might influence preconceptions, attitudes, interests and motivations of the respondents regarding the efficient use of energy but also whether the efficient use of energy differs in two different cultural contexts and three different levels of education.

The results of the investigation suggest the influence of cultural backgrounds on the respondents' attitudes but also suggest similarities within the two targeted countries, indicating that some common features exist between the respondents' preconceptions and their cultural background.

Six of the seven categories seem to be context-dependent, that is, the groups of respondents from two different regions were found to be distinguishable in six of the seven categories of analysis; only the category energy efficiency preconceptions appear to be universal for the two regions. Among the secondary school children, the school children from Germany and Honduras do not differ in their preconceptions about energy efficiency neither within each country nor among each region, but they were found to be distinguishable in their efficient use of energy on a regional level. The university students from both countries are the only ones not distinguishable in their efficient use of energy,

In diagram 6-1 are shown the results of comparing the six groups in the category energy efficiency behavior.

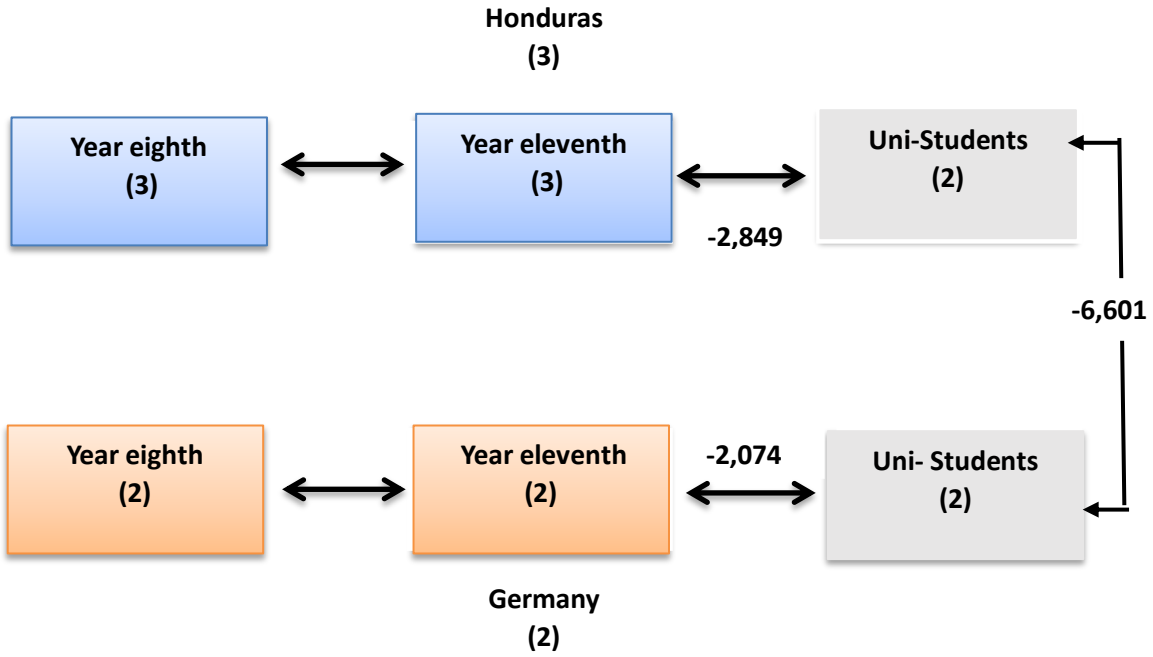


Diagram 6- 1 Honduras and Germany, energy efficiency behavior

The gray color means the groups are not distinguishable with respect to their energy efficiency behavior the four targeted groups of secondary school children were found to be distinguished in their efficient use of energy on a regional level and within the two different levels of education in Honduras and in Germany. The university students from both countries on the other hand cannot be distinguished in their efficient use of energy. In this regards it is important to discuss some findings from the results of the university students from both regions.

Both groups of university students are distinguishable in some categories while they cannot be distinguished in others. For example, on a regional level the hypothesis that the Uni-Students from both countries are distinguishable by ranking their reasons to make efficient use of energy was rejected. The level of concern about environmental problems is also a category not distinguishable within both groups. But in the preconceptions about energy efficiency, the level of responsibility, the level of exposure to information, the level of importance of energy saving and the level of willing to know more about the topic, the Honduran Uni-Students reported a higher score.

The results show that the Uni-Students from Honduras make the strongest connection between energy efficiency and save money, while the German university students make the strongest connection between environmental protection and energy efficiency and find it more uncomfortable to make efficient use of energy.

The data of the Honduran university students shows a positive correlation between the efficient use of energy and the level of importance of the topic, while with the German university students the correlation is found between the efficient use of energy, the level of exposure to information and the level of engagement as future teachers.

From the findings it can be said that the efficient use of energy of the Uni-Students from both countries is constricted to cultural backgrounds and to two different socioeconomical situations. It seems that the Germans have developed an environmental awareness based on information about climate problems and environmental protection. The efficient use of energy of the German Uni-Students is also correlated to the level of engagement as future teachers in taken actions to mitigate climate problems and to make efficient use of energy, so we can conclude that if they make efficient use of energy they are also willing to teach their future students at school how to make efficient use of energy and are also willing to take part in activities that are intended to promote environmental protection. The Honduran Uni-Students on the other hand associate the topic with save money and renounce and their efficient use of energy is correlated to the level of importance of the topic. Part of the explanation might be that this level of importance of the topic of energy efficiency comes from the need to save money in a country were energy is expensive and the efficient use of energy might be seen as an alternative to save money, but to make efficient use of energy means for

them that they have to renounce somethings. Although the Uni-Students from Honduras reported to have a higher level of engagement as future teachers, no relation between the level of engagement and the efficient use of energy of the Honduran Uni-Students was found.

Both groups of university students might be aware of climate problems, and the importance of making efficient use of energy. Both groups would also be willing to take part in solving the problem by participating in activities to mitigate climate problems, but both groups do not differ in their efficient use of energy. On the other hand, the four groups of school children are distinguishable in their efficient use of energy on a regional level and within the two different levels of education. The participants' age might be part of the explanation; the Uni-Students normally live alone in Germany and in Honduras they probably do not live alone but they have more freedom to do their as they wish. Both groups of Uni-Students have the information and the topic is important for them but that is not enough to get a higher score in energy efficiency. That is, even though the topic is important for them and they know how to make efficient use of energy, that is not enough to make efficient use of energy. Part of the explanation can be that because of their age they have more freedom to decide whether to be energy efficient or not, and the influence of family seems to be not that important in this decision as it might be with the school children. A possible recommendation in this regard might be that the topic energy efficient has to be taught at school and not at university because of the age of the students; school children might be more open to new habits and require less effort to establish these new habits as a practice.

Teaching the topic at school seems to be more appropriate than teaching the topic at university. Although preconceptions about the efficient use of energy seem to not influence the energy efficiency behavior of school children, energy efficiency behavior changes within school in Honduras and in Germany. On a regional level, in both countries a relation between the efficient use of energy and the level of exposure to information was found. We can say that the topic has to be taught at school but including children's perspectives toward the topic, trying to involves family and the children's surroundings, motivating the student at the same time to read more about the topic and to take part in the activities that involve environmental protection.

Regarding the school children of both countries, as it was mentioned previously, the four targeted groups are distinguishable in their energy efficiency behavior; in this category the two Honduran groups achieved a higher score. Although the four groups differ in their energy efficiency behavior none of the four groups are distinguishable in their preconceptions about the efficient use of energy. The Honduran secondary school children got a higher score in level of responsibility, level of exposure to information, level of importance of the topic energy efficiency and the level of willing to know more about energy efficiency. While in the category level of concern only the year eleven groups are distinguishable in this category, with the German group achieving a higher score. These differences between both regions could come from the two different cultural backgrounds of the respondents.

The two groups of Honduran secondary school children make a stronger relation between energy efficiency and saving money, while the German groups associate the topic with environmental protection. As it was mentioned previously, the university students from Honduras also associate energy efficiency with save money more than the Germans and part of the explanations for this association might be the socioeconomic situation of each country. Honduras is a poor country and the cost of energy is expensive so in Honduras the efficient use of energy could be a good way to save money, while in Germany this does not seem to be associated with the efficient use of energy. Cultural differences seem to be present in ranking the reasons to make efficient use of energy, although for the Honduran school children energy efficiency is more related to save money than for their German counterparts. When both groups were asked about the reasons to make efficient use of energy, to save money is more important for the Germans than for the Hondurans, while for the Hondurans because their parents say they have to is more important. These motivations appear to be constrained by personal experiences. In Honduras it is common that parents influence their children's opinions, where conflicts between children and parents are not on an equal to equal basis, as in Germany. As stated in chapter 3, in German families, parents do not over-stress their influence as adults and a hierarchy within a family is not as common as it is in Honduras.

The opinions of the secondary school children about other people's reasons to make efficient use of energy also differ within the two regions. For the three Honduran groups, people do not make efficient use of energy because they do not know how to do so, while for two of the

three German groups people do not make efficient use of energy because it is uncomfortable and because they have very little environmental awareness. It seems that the Honduran respondents are trying to justify people's actions more than the German respondents, finding acceptable explanations for their reasons to not make efficient use of energy, while the Germans seem to accept their own reasons more readily. These opinions could have different explanations, but the study is limited to comparing the efficient use of energy in two different cultural contexts and to make some presuppositions. To find some suitable explanations for some differences a future investigation is needed, for example, a study in another cultural context or in private schools or in other regions of Germany.

The Honduran school children can be considered as higher scorers in the category energy efficiency. By analyzing the results of the four groups of children some speculation about these finding can be made. The Hondurans seem to be more influenced by family members and by personal beliefs coming from their context to make efficient use of energy; among the Honduran secondary school children was also found a correlation between the efficient use of energy and the level of exposure to information. But this correlation was also found in both groups of secondary school children from Germany; it means that for the groups the more exposure the secondary school children have to information about the efficient use of energy, the higher is their efficient use of energy. This exposure to information means providing information about the efficient use of energy at home and at school, and to encourage the students to inform themselves about climate problems and the efficient use of energy.

Among the German secondary school children in particular, the level of importance and the level of willing to know more about the topic were found to be related to the level of exposure to information, which suggests that in Germany exposure to information leads the students to give more importance to the topic and to be willing to know more about it. Although the Honduran secondary school children reported higher scores in the category level of importance of the topic energy efficiency, this level of important does not necessary come from exposure to information, as in Germany.

A relation between the level of importance of the topic energy efficiency and the level of exposure to information about energy efficiency was not found among the groups of Honduran school children. From the results of the association question, the first reason for

the Honduran children to make efficient use of energy is because their parent say they have to. We could say that the level of importance of the topic for the Honduran respondents could come from their parents; they possibly see the topic as important because their parents say they have to save energy in order to save money, not because the topic is genuinely important for them. The results suggest that their efficient use of energy might be influenced by cultural background, it also suggests that the topic of energy efficiency is an interdisciplinary and multidisciplinary problem where knowledge about the efficient use of energy is not enough to make efficient use of energy. From the results of the six groups, preconceptions about energy efficiency seem to lead to energy efficiency behavior.

The Honduran groups

The study showed that the efficient use of energy differs within regions and within age groups. but an older age does not necessary mean higher energy efficient behavior, instead within the Honduran groups the university students were not the highest scorers. Within the school children in Honduras the groups are not distinguishable in six of the seven categories of analysis, while by comparing them with the university students, when they were distinguishable in a particular category the university students scored higher (excluding energy efficiency behavior).

In table 6-1 is shown a comparison made between the three Honduran groups, taking into account the three different levels of education in the seven categories of analysis.

Category	**8-11**	**11 -UNI**	**8- UNI**
1.-Energy efficiency behavior	↑	↓	
2.- Preconceptions about energy efficiency		↑	↑
3.- Level of concern		↑	↑
4.- Level of responsibility			↑
5.- Level of exposure to information			
6.- Level of importance of the topic “energy saving”		↑	
7.- Level of willing to know more about energy efficiency		↑	↑

Table 6- 1 Honduras, comparison by category

An arrow pointing up means that the “older group” score higher in the category, an arrow pointing down means that the “younger group” score higher in the category.

It seems that the higher score is linked with an older age, except in energy efficiency behavior. There also seems to be a “grown” [33] from school to university. Although preconceptions about the efficient use of energy increases from school to university, the efficient use of energy of the Honduran groups increases at school but decrease from school to university. We can again see that a higher score in the category preconceptions about the efficient use of energy does not lead to higher energy efficiency behavior.

The three groups are not distinguishable in the category level of exposure to information; it seems that the level of exposure to information does not change either within school nor from school to university. The study shows that the Honduran school children slightly differ in their associations with energy efficiency as in their sources of information, while among the school children and the university students the difference is higher. Part of the explanation might be that within the Honduran groups' “the grown” does not occur at school but it does happen from school to university.

Although there is a change in maturity or mental age from school to university within the Honduran groups, this not means higher energy efficiency behavior. The efficient use of energy increases within school but decreases again from school to university. Part of the explanation can be that the school children make efficient use of energy not because they really want to, but because their parents want them to, so when they go to university they might have more freedom to do as they wish. The findings also show that the university students from Honduras make a stronger relation between the efficient use of energy with environmental problems and with renounce when they were compared to the secondary school children. It might be that the university students used energy efficiently when they were younger when forced by their parents to save money at home and this relation between renounce and energy efficiency might come from this obligation. This relation between the

[33]“Grown” means for us in this conclusion, that the group of respondents shows a development within a level of education, that is, the categories increase within each level of education, this could be the results of a higher mental maturity.

efficient use of energy seen as an obligation might be the reason why the efficient use of energy decreases from school to university.

Within the Honduran groups, the year eleven one achieved the highest scores in the category energy efficiency behavior. From the results of the association questions some presuppositions for this behavior can be made. For this group, the term most associated with energy efficiency is save money, but their principal reason to make efficient use of energy is not to save money but because their parents say they have to do so; this is more important for them than to save money. This group of children gets its information about climate problems from books in first place and from family in second place. A factor to point out from this information is the influence of parents and family on this group of children; perhaps because the Honduran year eleven children are in their teenager years, their parents can still influence their behavior. Category

The German groups

In table 6-2 is shown the comparison among the three German groups in the 7 categories of analysis.

	8-11	**11- UNI**	**8-UNI**
1.- Energy efficiency behavior	↓	↑	
2.- Preconceptions about energy efficiency	↑		
3.- Level of concern			↑
4.- Level of responsibility			
5.- Level of exposure to information	↑	↑	↑
6.- Level of importance of the topic "energy saving"			
7.- Level of willing to know more about energy efficiency	↑		↑

Table 6- 2 Germany, comparison by category

An arrow pointing up means a higher score in the category, an arrow pointing out down means that the category gets a lower score with an increase in age. The green color means no change in the category.

From the findings it can be seen that energy efficiency behavior decreases at school and increases back once again whe n the children go to university, but increasing back does not mean a higher score in the category, instead, as it can be seen in the diagram, the year eight school children and the university students are not distinguishable in their energy efficiency behavior. Preconceptions about the efficient use of energy does not change either at school nor from school to university; the same happens with the level of responsibility. The level of concern about environmental problems, the level of exposure to information and the level of willing to know more about energy efficiency increases with the age at school but does not increase from school to university. The level of importance of the topic energy efficiency is the only category that does not change at school but increases from school to university.

It seems that the topic becomes more important when the German school children go to university, making them use energy more efficiently, although preconceptions about the efficient use of energy have not changed.

The investigation shows that among the German groups the secondary school children are the ones who associate energy efficiency with renounce more strongly. The influence of family and friends seems to be more present at the lowest and at the highest level of education in Germany. The year eleven group instead seems to be not influenced either by family members nor by friends in their motivations to make efficient use of energy. Among the German groups the higher the age the stronger is the association between energy efficiency and ecological factors. It seems that their associations between energy efficiency and environmental problems are linked to a higher age.

In the three German groups a relation was found between the efficient use of energy, the level of exposure to information, the level of importance given to the topic and the level of willing to know more about energy efficiency. Part of the explanation for this relation could be that they make efficient use of energy because the topic is indeed important for them; this importance of the topic is correlated to the information that they get at home, at school and searching themselves, and this probably makes them want to know more about energy efficiency. As it was mentioned previously, the topic becomes more important when they go to university; this level of importance is correlated to the exposure to information that they get at school, which increases while at school but not from school to university.

Suggestions for the development of science instruction

The discussion of introducing energy efficiency into science instruction is based on the lack of information about the efficient use of energy in educational programs, particularly in Germany and in Honduras where the study took place, but is also based on the criteria to assess the preconceptions of interdisciplinary topics like energy efficiency to introduce these into science instructions. It should be noted that the efficient use of energy is constricted to cultural contexts; these cultural contexts and the age of the participants seem to contextualize the importance to make efficient use of energy and the motivations to do so.

Although the development of energy efficient behavior seems to not come from preconceptions about the efficient use of energy, exposure to information about the topic involves essentially efficient use of energy in the six participating groups. Being exposed to information about energy efficiency involves not only knowledge about the efficient use of energy but also the participation of family, school and the students themselves, that is to say, the development of energy efficiency behavior has to be contextualized, looking at students' interests, attitudes and motivations toward the efficient use of energy. The development of science instruction for the efficient use of energy has not only to include the educational perspective of what the students have to know to make efficient use of energy but also the students' perspectives of why they are doing it and what benefits come from it. These benefits have to come from the students' perspectives which, as the study showed, might vary with cultural context and with age.

The structural form of energy efficiency makes the topic both interdisciplinary and multidisciplinary. The findings suggest that energy efficiency involves several dimensions: ecological, the teaching methods of physics, economic and social, that is to say, the development of teaching strategies concern not only the teaching methods of physics perspective but also the ecological, economic and social perspectives. Furthermore, as it was mentioned previously, these perspective have to be also contextualized, that is, the thinking behind these teaching strategies has to lead to the students reflecting about the ecological and social consequences that involves the efficient use of energy. The awareness of the importance to make efficient use of energy has to comes from students' perspectives linked to the exposure to information at home and at school, that is, the parents and family members

have to be part of the learning process. In chapter three the importance of students' perspectives in science instruction was discussed. The results in chapter five show that in multidisciplinary topics like energy efficiency these perspectives have to include different dimensions, that is to say, to introduce energy efficiency into science instruction, teaching strategies and the selection of materials has to included not only the cognitive domain but also the affective domain. In the affective domain students' interests, motivations and attitudes toward the topic are involved, but a previous assessment of these affective characteristics is essential to contextualize science instruction to lead to the development of energy efficiency behavior.

It is important in the learning process that students become aware of their global responsibility, one that involves the efficient use of energy. Although science instruction has to be contextualized, looking at students' perspectives, it is important to make cross-cultural links so the students can assess their own interests, attitudes and motivations toward energy efficiency across cultural border. This might lead to a greater perception about their own perspectives. The target is not only for students to recognize and examine their own perspectives but also to think about them and evaluate them looking at them in different contexts.

The efficient use of energy is a global issue and the development of science instruction for energy efficiency in a developed country like Germany has to include learning strategies that provides a larger scope, so the students can compare their own perspectives with students from poor countries like Honduras. As the study shows, the Hondurans and the Germans are distinguishable in six of the seven categories of analysis, as well as in their associations and motivations toward the efficient use of energy. These different perspectives have to be involved in the development of science instruction for energy efficiency to lead the students to develop global responsibility, looking at the ecological, economic and social consequences that comes from it.

Suggestions for further study

In this section some suggestions for further study were discussed, mentioning the regions where the investigation took place, the socioeconomic situation in both countries and the topic of research.

The data collection was made by using a questionnaire, which was contextualized by looking at two different countries, different ages and two different languages. Issues about different socioeconomic characteristics and different climates should be considered. The questionnaire was contextualized in Germany, a country that has four seasons a year, and Honduras, a tropical country. The questionnaire was also contextualized by looking at the socioeconomic situation in each country. The students answered the questions related to their weather conditions, for example, questions about the use of air conditioners and ventilators or questions about the use of heating. The students' answers were also analyzed on their socioeconomic background. This is an issue to be considered for a further investigation in a country with different climate and socioeconomic characteristics from Germany or Honduras.

The results of the study could be different in another country in Europe, for example, in France, Spain or Italy. The culture in a different European country and a different socioeconomic situation could give us different results. Another continent, like Asia or Africa, with two different cultural contexts could also be a field to explore. By making a comparison between an African country and a Latin American country with similar weather conditions and similar economic situations some questions could arise, for example. is the topic of energy efficiency important for the secondary school children in Africa? Can the African children and the Latin American children be distinguished in their efficient use of energy, taking into account their different cultures but also their similar economic situations? Do the participants differ in their preconceptions about the efficient use of energy? Are the students in Africa aware of current climate problems? Does this awareness differ taking into account their cultural backgrounds? Is the efficient use of energy important for them or which motivations could they have to make efficient use of energy?

A comparison between two European countries could be also al field to explore. Are the results by comparing two European countries with similar socioeconomic situations different? Do the participants from two wealthy countries differ in their efficient use of energy? Do the participants differ in their preconceptions, motivations and interests toward the efficient use of energy? Do the participants from two wealthy European countries differ in their level of concerns about environmental problems and the efficient use of energy?

Another comparison could be between a wealthy Asian country and a wealthy European country. Are the results different by comparing two wealthy countries from two different continents and two different cultures? Do the participants from two wealthy countries but two different cultures differ in their efficient use of energy? Do they differ in their preconceptions? Can they be distinguished in their motivations toward making efficient use of energy? The same questions could be made by comparing two European countries but with two different socioeconomic situations, like France and Greece, for example, or Germany and Portugal.

The present study analyzed the preconceptions, attitudes, interests and motivations of students towards energy efficiency but also assessed the efficient use of energy of the respondents. Framed in the model of educational reconstruction and the thematic structure of science, in the research is shown the multidisciplinary and multidisciplinary character of energy efficiency, as well as the importance to include these features in science instruction. The study was targeted in one region in Germany and in the two largest cities in Honduras. In the study only students from public schools participated. There is still a larger field to research, for instance, the results could be different in different regions in Germany, in different levels of education or in private schools in Honduras. The opinions of the teachers could also be a field to explore.

The study is not intended to name a group of respondents as bad or good in their efficient use of energy. The study is intended to find out whether the efficient use of energy differs in two different cultural contexts and different levels of education. The intention is also to find out from a cross-cultural perspective the motivations, attitudes, interests and preconceptions toward energy efficiency. From our perspective, this comparison is meaningful for the

development of science instruction, teaching strategies and learning environment toward energy efficiency.

In the study the importance of energy efficiency as a local and global issue and the importance of educational measurement to introduce the topic at school was discussed. It also showed that the participants of two different countries are distinguishable in six of the seven categories of analysis as well as in their associations and motivations toward the efficient use of energy. But the study was limited to two countries. There is still a large field to explore in further studies, for instance, by using the same questionnaire in Spanish and making comparisons between two Latin American countries, or by taking into account another language it could be possible to make a comparison between two African countries or between two Asian countries. The results could be different by changing the cultural contexts and the socioeconomic situations in which the respondents are located.

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Frankfurt, den 21.10.2019

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Appendices

EvaSys	Encuesta para Educación Básica y Media en Honduras	Electric Paper
Universität Flensburg	Paula Paz	
Projekte	Encuesta para Educación Básica y Media	

Bitte so markieren: ☐ ☒ ☐ ☐ ☐ Bitte verwenden Sie einen Kugelschreiber oder nicht zu starken Filzstift. Dieser Fragebogen wird maschinell erfasst.

Korrektur: ☐ ■ ☐ ☒ ☐ Bitte beachten Sie im Interesse einer optimalen Datenerfassung die links gegebenen Hinweise beim Ausfüllen.

1. Marca con una X la respuesta que concuerde con tus hábitos.

		Siempre	Frecuentemente	Algunas veces	Raras veces	Nunca
1.1	(Si tienes o si tuvieras una lampara en tu escritorio), Cuando estas sentado en tu escritorio y debes ausentarte por poco tiempo¿apagas la lampara en tu escritorio?	☐	☐	☐	☐	☐
1.2	Si tienes (o si tuvieras una ducha),¿apagas el agua de la ducha mientras te enjabonas?	☐	☐	☐	☐	☐
1.3	¿Apagas el radio y el televisor cuando no los estas utilizando?	☐	☐	☐	☐	☐
1.4	¿Se mantienen conectados los aparatos eléctricos en tu casa cuando no están siendo utilizados?	☐	☐	☐	☐	☐
1.5	¿Qué tan seguido descongelan la refrigeradora en tu casa?	☐	☐	☐	☐	☐
1.6	¿Se habla en tu casa sobre el tema del ahorro de la energía?	☐	☐	☐	☐	☐
1.7	¿Te han enseñado el tema de la eficiencia energética en la escuela?	☐	☐	☐	☐	☐
1.8	¿Te gusta leer artículos relacionados con el cuidado al medio ambiente?	☐	☐	☐	☐	☐
1.9	¿Te bañas con agua helada?	☐	☐	☐	☐	☐
1.10	¿Si tienes (o si tuvieras) aire acondicionado en tu casa prefieres ponerte una ropa más fresca en lugar de subirle el aire acondicionado?	☐	☐	☐	☐	☐
1.11	¿Si tienes (o si tuvieras) aire acondicionado en tu casa le bajas la intensidad por las noches?	☐	☐	☐	☐	☐

2. Marca con una X la respuesta que concuerde con tu opinión.

		Totalmente de acuerdo	De acuerdo	En desacuerdo	Totalmente en desacuerdo
2.1	El cambio climático es el reto global más grande.	☐	☐	☐	☐
2.2	El uso eficiente de la energía es una decisión libre e individual.	☐	☐	☐	☐
2.3	Al analizar detenidamente los problemas climáticos la situación con el clima esta mejorando.	☐	☐	☐	☐
2.4	La Ciencia y la Industria pueden por sí solos solucionar "el problema de la energía".	☐	☐	☐	☐
2.5	Es preocupante que las fuentes fósiles de energía sean limitadas y que estén llegando a su final.	☐	☐	☐	☐
2.6	El uso ineficiente de la energía es la principal causa del cambio climático.	☐	☐	☐	☐
2.7	El hombre aún puede detener el cambio climático.	☐	☐	☐	☐
2.8	En Honduras el gobierno debería aplicar nuevas medidas en los hogares en relación al uso eficiente de la energía, por ejemplo con focos ahorradores o eco-fogones.	☐	☐	☐	☐
2.9	Los estándares de vida de los países industrializados pueden seguir creciendo aunque esto signifique que gasten más energía que ahora.	☐	☐	☐	☐
2.10	Es muy importante desconectar completamente los aparatos eléctricos,por ejemplo el radio o el televisor al terminar de utilizarlos.	☐	☐	☐	☐
2.11	Es muy importante apagar la luz cada vez que se sale de una habitación.	☐	☐	☐	☐
2.12	Es necesario bañarse con agua caliente para quedar más limpio.	☐	☐	☐	☐
2.13	Si una habitación tiene un sistema de aire acondicionado es necesario mantener las puertas y ventanas de esa habitación cerradas mientras el aire acondicionado este encendido.	☐	☐	☐	☐

3. Marca con una X cada una de las respuestas en orden de importancia.

Ordena las siguientes palabras en orden de importancia para vos ¿Qué palabra tiene mayor relación para vos con el tema de la eficiencia energética? Marca como número 1 la palabra que para vos tiene la mayor relación y como número 5 la que tenga la menor relación. A cada una de las palabras dadas le corresponde un número diferente del 1 al 5.

		1	2	3	4	5
3.1	Ahorrar	☐	☐	☐	☐	☐
3.2	Protección ambiental	☐	☐	☐	☐	☐
3.3	Electricidad	☐	☐	☐	☐	☐
3.4	Renunciar	☐	☐	☐	☐	☐
3.5	Incomodidad	☐	☐	☐	☐	☐

¿Qué importancia tiene para vos el tema del ahorro de energía? En la escala del 1 al 5; número 1 significa muy importante y el número 5 significa menos importante.

		1	2	3	4	5
3.6	¿Qué importancia tiene para vos el tema del ahorro de energía?	☐	☐	☐	☐	☐

¿Cuál de las siguientes fuentes de luz necesita más energía para producir el mismo brillo? Marca con el número 1 la que en tu opinión necesita la mayor energía y con el número 5 la que necesita menor energía. A cada opción le corresponde un número diferente del 1 al 5.

		1	2	3	4	5
3.7	LED	☐	☐	☐	☐	☐
3.8	Lámpara fluorescente	☐	☐	☐	☐	☐
3.9	Bombillos ahorradores	☐	☐	☐	☐	☐
3.10	Lámpara incandescentes	☐	☐	☐	☐	☐
3.11	Halógenas	☐	☐	☐	☐	☐

Ordena la siguiente lista según tu fuente de Información ¿Cuál es tu principal fuente de Información en temas relacionados con la protección al medio ambiente? Marca como número 1 tu principal fuente de información y con el número 5 tu ultima fuente de información. A cada opción le corresponde un número diferente del 1 al 5.

		1	2	3	4	5
3.12	Libros	☐	☐	☐	☐	☐
3.13	Tu familia	☐	☐	☐	☐	☐
3.14	Amigos	☐	☐	☐	☐	☐
3.15	Internet	☐	☐	☐	☐	☐
3.16	En clases, en la Escuela	☐	☐	☐	☐	☐

3. Marca con una X cada una de las respuestas en orden de importancia. [Fortsetzung]

Ordena la siguiente lista en orden de importancia para vos. ¿Cuál crees que es la principal causa del desperdicio de energía en los hogares hondureños? El número 1 significa la causa más importante y el número 5 significa la causa menos importante. A cada opción le corresponde un número diferente del 1 al 5.

	1	2	3	4	5
3.17 La gente no sabe como hacer uso eficiente de la energía	☐	☐	☐	☐	☐
3.18 La gente tiene muy poca conciencia ambiental	☐	☐	☐	☐	☐
3.19 Es incomodo usar la energía de forma eficiente	☐	☐	☐	☐	☐
3.20 Cuesta mucho dinero	☐	☐	☐	☐	☐
3.21 La gente tiene muy poco interés en el tema de la eficiencia energética	☐	☐	☐	☐	☐

Ordena la siguiente lista según tus motivos personales en la escala del 1 al 5 ¿Por qué usarías eficientemente la energía? Número 1 significa tu primer motivo y número 5 significa tu ultimo motivo. A cada opción le corresponde un número diferente del 1 al 5.

	1	2	3	4	5
3.22 Porque mis padres dicen que hay que hacerlo.	☐	☐	☐	☐	☐
3.23 Es bueno para el medio ambiente.	☐	☐	☐	☐	☐
3.24 Por ahorrar dinero.	☐	☐	☐	☐	☐
3.25 Porque actualmente es un tema popular.	☐	☐	☐	☐	☐
3.26 Porque en la escuela dicen que hay que hacerlo.	☐	☐	☐	☐	☐

4. Marca con una X la respuesta que expresa tu opinión.

4.1 ¿Te gustaría saber más sobre el tema de la eficiencia energética?

☐ Si muchísimo más ☐ Si mucho más ☐ Algo más
☐ Un poco más ☐ No nada más

Muchas gracias por tu colaboración.

EvaSys	Encuesta para los estudiantes universitarios en Honduras.	Electric Paper

Universität Flensburg	Paula Paz	
Projekte	Eficiencia Energética	

Bitte so markieren: ☐ ☒ ☐ ☐ ☐ Bitte verwenden Sie einen Kugelschreiber oder nicht zu starken Filzstift. Dieser Fragebogen wird maschinell erfasst.

Korrektur: ☐ ■ ☐ ☒ ☐ Bitte beachten Sie im Interesse einer optimalen Datenerfassung die links gegebenen Hinweise beim Ausfüllen.

1. Marque con una X la respuesta que concuerde con sus hábitos.

		Siempre	Frecuentemente	Algunas veces	Raras veces	Nunca
1.1	(Si tiene o si tuviera una lampara en su escritorio), Cuando esta sentado en su escritorio y debe ausentarse por poco tiempo¿apaga la lampara en su escritorio?	☐	☐	☐	☐	☐
1.2	Si tiene (o si tuviera una ducha),¿apaga el agua de la ducha mientras se enjabona?	☐	☐	☐	☐	☐
1.3	¿Apaga el radio y el televisor cuando no los esta utilizando?	☐	☐	☐	☐	☐
1.4	¿Se mantienen conectados los aparatos eléctricos en su casa cuando no están siendo utilizados?	☐	☐	☐	☐	☐
1.5	¿Qué tan seguido descongelan la refrigeradora en su casa?	☐	☐	☐	☐	☐
1.6	¿Se habla en su casa sobre el tema del ahorro de la energía?	☐	☐	☐	☐	☐
1.7	¿Le enseñaron el tema de la eficiencia energética en la escuela?	☐	☐	☐	☐	☐
1.8	¿Le gusta leer artículos relacionados con el cuidado al medio ambiente?	☐	☐	☐	☐	☐
1.9	¿Se baña con agua helada?	☐	☐	☐	☐	☐
1.10	¿Si tiene (o si tuviera) aire acondicionado en su casa prefiere ponerse una ropa más fresca en lugar de subirle el aire acondicionado?	☐	☐	☐	☐	☐
1.11	¿Si tiene (o si tuviera) aire acondicionado en su casa le baja la intensidad por las noches?	☐	☐	☐	☐	☐
1.12	¿Se desperdicia la Energía en la Universidad?	☐	☐	☐	☐	☐
1.13	¿Desperdicia energía en su casa?	☐	☐	☐	☐	☐
1.14	¿Se comprometería como profesor a hacer actividades pedagógicas en su hogar y en su centro de trabajo con el objetivo de incentivar el uso eficiente de la energía ?	☐	☐	☐	☐	☐

2. Marque con una X la respuesta que concuerde con su opinión.

		Totalmente de acuerdo	De acuerdo	En desacuerdo	Totalmente en desacuerdo
2.1	El cambio climático es el reto global más grande.	☐	☐	☐	☐
2.2	El uso eficiente de la energía es una decisión libre e individual.	☐	☐	☐	☐
2.3	Al analizar detenidamente los problemas climáticos la situación con el clima esta mejorando.	☐	☐	☐	☐
2.4	La Ciencia y la Industria pueden por sí solos solucionar "el problema de la energía".	☐	☐	☐	☐
2.5	Es preocupante que las fuentes fósiles de energía sean limitadas y que estén llegando a su final.	☐	☐	☐	☐
2.6	El uso ineficiente de la energía es la principal causa del cambio climático.	☐	☐	☐	☐
2.7	El hombre aún puede detener el cambio climático.	☐	☐	☐	☐
2.8	En Honduras el gobierno debería aplicar nuevas medidas en los hogares en relación al uso eficiente de la energía, por ejemplo con focos ahorradores o eco-fogones.	☐	☐	☐	☐
2.9	Los estándares de vida de los países industrializados pueden seguir creciendo aunque esto signifique que gasten más energía que ahora.	☐	☐	☐	☐
2.10	Es muy importante desconectar completamente los aparatos eléctricos,por ejemplo el radio o el televisor al terminar de utilizarlos.	☐	☐	☐	☐
2.11	Es muy importante apagar la luz cada vez que se sale de una habitación.	☐	☐	☐	☐
2.12	Es necesario bañarse con agua caliente para quedar más limpio.	☐	☐	☐	☐
2.13	Si una habitación tiene un sistema de aire acondicionado es necesario mantener las puertas y ventanas de esa habitación cerradas.	☐	☐	☐	☐

3. Marque con una X en orden de importancia cada una de las opciones dadas.

Ordene las siguientes palabras en orden de importancia para usted ¿Qué palabra tiene mayor relación para usted con el tema de la eficiencia energética? Marque como número 1 la palabra que para usted tiene la mayor relación y como número 5 la que tenga la menor relación. A cada una de las palabras dadas le corresponde un número diferente del 1 al 5.

		1	2	3	4	5
3.1	Ahorrar	☐	☐	☐	☐	☐
3.2	Protección ambiental	☐	☐	☐	☐	☐
3.3	Electricidad	☐	☐	☐	☐	☐
3.4	Renunciar	☐	☐	☐	☐	☐
3.5	Incomodidad	☐	☐	☐	☐	☐

¿Qué importancia tiene para usted el tema del ahorro de energía? En la escala del 1 al 5; número 1 significa muy importante y el número 5 significa menos importante.

		1	2	3	4	5
3.6	¿Qué importancia tiene para usted el tema del ahorro de energía?	☐	☐	☐	☐	☐

¿Cuál de las siguientes fuentes de luz necesita más energía para producir el mismo brillo? Marque con el número 1 la que en su opinión necesita la mayor energía y con el número 5 la que necesita menor energía.A cada opción le corresponde un número diferente del 1 al 5.

		1	2	3	4	5
3.7	LED	☐	☐	☐	☐	☐
3.8	Lámpara fluorescente	☐	☐	☐	☐	☐
3.9	Bombillos ahorradores	☐	☐	☐	☐	☐
3.10	Lámpara incandescentes	☐	☐	☐	☐	☐
3.11	Halógenas	☐	☐	☐	☐	☐

Ordene la siguiente lista según su fuente de Información ¿Cuál es su principal fuente de Información en temas relacionados con la protección al medio ambiente? Marque como número 1 su principal fuente de información y con el número 5 su ultima fuente de información. A cada opción le corresponde un número diferente del 1 al 5.

		1	2	3	4	5
3.12	Libros	☐	☐	☐	☐	☐
3.13	Tu familia	☐	☐	☐	☐	☐
3.14	Amigos	☐	☐	☐	☐	☐
3.15	Internet	☐	☐	☐	☐	☐
3.16	En clases, en la Escuela	☐	☐	☐	☐	☐

3. Marque con una X en orden de importancia cada una de las opciones dadas. [Fortsetzung]

Ordene la siguiente lista en orden de importancia para usted. ¿Cuál cree que es la principal causa del desperdicio de energía en los hogares hondureños? El número 1 significa la causa más importante y el número 5 significa la causa menos importante. A cada opción le corresponde un número diferente del 1 al 5.

	1	2	3	4	5
3.17 La gente no sabe como hacer uso eficiente de la energía	☐	☐	☐	☐	☐
3.18 La gente tiene muy poca conciencia ambiental	☐	☐	☐	☐	☐
3.19 Es incomodo usar la energía de forma eficiente	☐	☐	☐	☐	☐
3.20 Cuesta mucho dinero	☐	☐	☐	☐	☐
3.21 La gente tiene muy poco interés en el tema de la eficiencia energética	☐	☐	☐	☐	☐

Ordene la siguiente lista según sus motivos personales en la escala del 1 al 5 ¿Por qué usaría eficientemente la energía? Número 1 significa su primer motivo y número 5 significa su ultimo motivo. A cada opción le corresponde un número diferente del 1 al 5.

	1	2	3	4	5
3.22 Porque soy responsable de cuidar el medio ambiente.	☐	☐	☐	☐	☐
3.23 Por el futuro de la tierra.	☐	☐	☐	☐	☐
3.24 Por ahorrar dinero.	☐	☐	☐	☐	☐
3.25 Porque actualmente es un tema popular.	☐	☐	☐	☐	☐
3.26 Nada me motiva a usar eficientemente la energía.	☐	☐	☐	☐	☐

4. Marque con una X la respuesta que expresa su opinión.

4.1 ¿Le gustaría saber más sobre el tema de la eficiencia energética?

☐ Si muchísimo más ☐ Si mucho más ☐ Algo más
☐ Un poco más ☐ No nada más

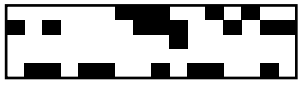
Muchas gracias por su colaboración.

Bitte so markieren: ☐ ☒ ☐ ☐ ☐ Bitte verwenden Sie einen Kugelschreiber oder nicht zu starken Filzstift. Dieser Fragebogen wird maschinell erfasst.

Korrektur: ☐ ■ ☐ ☒ ☐ Bitte beachten Sie im Interesse einer optimalen Datenerfassung die links gegebenen Hinweise beim Ausfüllen.

1. Welche Verhaltensweisen treffen auf dich zu?

		Ja immer	häufig	manchmal	selten	nie
1.1	Wenn du gerade am Schreibtisch sitzt und dann kurz weggehen musst,machst du das Licht am Schreibtisch aus?	☐	☐	☐	☐	☐
1.2	Schaltest du das Wasser in der Dusche aus,während du dich einseifst?	☐	☐	☐	☐	☐
1.3	Schaltest du das Radio und den Fernseher aus,wenn du es nicht benutzt?	☐	☐	☐	☐	☐
1.4	Bleiben die Elektrogeräte bei dir zuhause im Stand-by-Modus, wenn sie nicht im Gebrauch sind?	☐	☐	☐	☐	☐
1.5	Taut ihr ab und an euren Gefrierschrank bzw. das Eisfach ab?	☐	☐	☐	☐	☐
1.6	Wird das Thema Energieeffizienz bei dir zuhause gesprochen?	☐	☐	☐	☐	☐
1.7	Wird das Thema Energieeffizienz in deiner Schule behandelt?	☐	☐	☐	☐	☐
1.8	Liest du gerne ökologische Artikel?	☐	☐	☐	☐	☐
1.9	Wäscht du deine Hände mit kalten Wasser?	☐	☐	☐	☐	☐
1.10	Bevor du die Heizung hochdrehst ziehst du dir lieber einen Pullover anstelle eines Shirts an.	☐	☐	☐	☐	☐
1.11	Regelst du die Heizung runter in der Nacht?	☐	☐	☐	☐	☐



2. Wie ist deine Meinung dazu? Bitte nur einmal ankreuzen.

		Stimme sehr zu	Stimme eher zu	Lehne eher ab	Lehne sehr ab
2.1	Klimawandel ist die größte globale Herausforderung.	☐	☐	☐	☐
2.2	Energieeffizientes Handeln ist eine individuelle und freiwillige Entscheidung.	☐	☐	☐	☐
2.3	Genau betrachtet verbessert sich die Umwelt doch schon.	☐	☐	☐	☐
2.4	Wissenschaft und Technik können allein die „Energieprobleme“ lösen.	☐	☐	☐	☐
2.5	Es ist besorgniserregend, dass die fossilen Energiequellen begrenzt sind und immer mehr davon immer kürzerer Zeit verbraucht werden.	☐	☐	☐	☐
2.6	Ineffiziente Nutzung der Energie ist die wichtigste Ursache des Klimawandels.	☐	☐	☐	☐
2.7	Man kann den Klimawandel noch stoppen.	☐	☐	☐	☐
2.8	In Deutschland sollten verschiedene Energieeffizienzmaßnahmen in Bezug auf Privatpersonen auch erzwungen werden, z.B. Gebäudesanierung, Heizungsmodernisierung.	☐	☐	☐	☐
2.9	Sollen die Schwellenländer ihren Lebensstandard weiter steigern dürfen, auch wenn sie hierfür mehr Energie benötigen?	☐	☐	☐	☐
2.10	Es ist sinnvoll, Geräte wie z. B. Fernseher oder Musikanlagen nach Gebrauch komplett auszuschalten.	☐	☐	☐	☐
2.11	Es ist sinnvoll jedes Mal beim Verlassen eines Zimmers das Licht auszumachen.	☐	☐	☐	☐
2.12	Um saubere Hände zu bekommen, braucht man unbedingt warmes Wasser.	☐	☐	☐	☐
2.13	Während des Lüftens eines Zimmers sollten die Heizkörper darin ausgedreht werden.	☐	☐	☐	☐

3. Markierst du bitte in der Reihenfolge ihrer Bedeutung

Bitte ordne die folgende Liste nach ihrer Wichtigkeit.
Mit welchem Wort kannst du den Begriff „Energieeffizienz“ am ehesten oder am besten verbinden? Ordne den Grad der Verbindung zu. Stufe 1 hat die stärkste Verbindung, Stufe 5 hat die schwächste Verbindung. (Alle Begriffe haben eine Verbindung, wir wollen von dir den Grad der Verbindung wissen - du musst eine schwächste Verbindung angeben)

		Extrem verbunden	sehr verbunden	ein wenig verbunden	nicht sehr verbunden	gar nicht verbunden
3.1	Geldsparen	☐	☐	☐	☐	☐
3.2	Umweltschutz	☐	☐	☐	☐	☐
3.3	Elektrizität	☐	☐	☐	☐	☐
3.4	Verzicht	☐	☐	☐	☐	☐
3.5	Unbequemlichkeit	☐	☐	☐	☐	☐

Gib bitte an, welche Bedeutung das Thema Energiesparen für dich hat. Stufe 1 hat die stärkste Wichtigkeit, Stufe 5 hat die schwächste Wichtigkeit.

		Extrem Wichtig	Sehr Wichtig	wichtig	nicht wichtig	überhaupt nicht wichtig
3.6	Wie wichtig ist das Thema Energiesparen für dich?	☐	☐	☐	☐	☐

Gib bitte an, welche der folgenden Lichtquellen deine Meinung nach am meisten bzw. am wenigsten Energie bei gleicher Helligkeit umsetzt. 1 ist die Lichtquelle, die am meisten Energie benötigt, 4 ist die Lichtquelle, die am wenigsten Energie benötigt.

		1	2	3	4	5
3.7	LED	☐	☐	☐	☐	☐
3.8	Leuchtstoffröhre	☐	☐	☐	☐	☐
3.9	Glühlampe	☐	☐	☐	☐	☐
3.10	Energiesparlampe	☐	☐	☐	☐	☐
3.11	Halogenlampe	☐	☐	☐	☐	☐

3. Markierst du bitte in der Reihenfolge ihrer Bedeutung [Fortsetzung]

Bitte ordne die folgende Liste nach ihrer Bedeutung als Informationsquelle
Welche sind deine Hauptinformationsquellen für Umweltthemen ? Ordne den Grad der Informationsquelle zu. Stufe 1 ist die erste Informationsquelle, Stufe 5 ist die schwächste Informationsquelle. (Alle Begriffe haben eine Verbindung, wir wollen von dir den Grad der Verbindung wissen - du musst eine schwächste Verbindung angeben).

	1	2	3	4	5
3.12 Bücher	☐	☐	☐	☐	☐
3.13 Eltern	☐	☐	☐	☐	☐
3.14 Freunde	☐	☐	☐	☐	☐
3.15 Internet	☐	☐	☐	☐	☐
3.16 Schule	☐	☐	☐	☐	☐

Bitte ordne die folgende Liste nach ihrer Wichtigkeit.
Was ist deiner Meinung nach die wichtigste Ursache für die Verschwendung der Energie im privaten Haushalten? Ordne den Grad der Verbindung zu. Stufe 1 hat die stärkste Verbindung, Stufe 5 hat die schwächste Verbindung. (Alle Begriffe haben eine Verbindung, wir wollen von dir den Grad der Verbindung wissen.

	1	2	3	4	5
3.17 Die Leute wissen nicht, wie man die Energie effizienter nutzten kann.	☐	☐	☐	☐	☐
3.18 Die Leute haben zu wenig Umweltbewusstsein	☐	☐	☐	☐	☐
3.19 Es ist umbequem die Energie effizienter nutzen.	☐	☐	☐	☐	☐
3.20 Es Kostet zu viel Geld	☐	☐	☐	☐	☐
3.21 Die Leute haben zu Wenig Interesse am Thema Energieeffizienz	☐	☐	☐	☐	☐

Verteile fünf Stufen der Attraktivität. Stufe 1 bedeutet sehr attraktiv, Stufe 5 bedeutet am wenigsten attraktiv. Jede Stufe kann nur genau einmal vergeben werden. (Alle Begriffe haben eine Verbindung, wir wollen von dir den Grad der Verbindung wissen - du musst eine schwächste Verbindung angeben)
Warum würdest du die Energie effizienter nutzen?

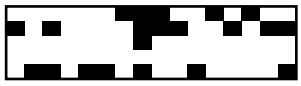
	1	2	3	4	5
3.22 Weil meine Eltern es so sagen	☐	☐	☐	☐	☐
3.23 Es ist gut für die Umwelt	☐	☐	☐	☐	☐
3.24 Weil es Geld spart	☐	☐	☐	☐	☐
3.25 Weil es ein populäres Thema ist.	☐	☐	☐	☐	☐
3.26 Weil in der Schule gesagt wird	☐	☐	☐	☐	☐

4. Zu jeder Vorgabe eine Antwortziffer ankreuzen.

4.1 Möchtest du mehr über das Thema Energieeffizienz wissen?

☐ Ja sehr viel mehr ☐ Ja viel mehr ☐ Ein bißchen mehr
☐ Eher nicht mehr ☐ Nein

Vielen Dank



EvaSys	Fragebogen Studenten Schleswig Holstein	Electric Paper

Universität Flensburg [Paula Paz]

Projekte Energieeffizienz

Bitte so markieren: ☐ ☒ ☐ ☐ ☐ Bitte verwenden Sie einen Kugelschreiber oder nicht zu starken Filzstift. Dieser Fragebogen wird maschinell erfasst.

Korrektur: ☐ ■ ☐ ☒ ☐ Bitte beachten Sie im Interesse einer optimalen Datenerfassung die links gegebenen Hinweise beim Ausfüllen.

1. Welche Verhaltensweisen treffen auf dich zu?

		Ja immer	häufig	manchmal	selten	nie
1.1	Wenn du gerade am Schreibtisch sitzt und dann kurz weggehen musst,machst du das Licht am Schreibtisch aus?	☐	☐	☐	☐	☐
1.2	Schaltest du das Wasser in der Dusche aus,während du dich einseifst?	☐	☐	☐	☐	☐
1.3	Schaltest du das Radio und den Fernseher aus,wenn du es nicht benutzt?	☐	☐	☐	☐	☐
1.4	Bleiben die Elektrogeräte bei dir zuhause im Stand-by-Modus, wenn sie nicht im Gebrauch sind?	☐	☐	☐	☐	☐
1.5	Taut ihr euren Gefrierschrank bzw. das Eisfach ab?	☐	☐	☐	☐	☐
1.6	Wird das Thema Energiesparen bei dir zu Hause gesprochen?	☐	☐	☐	☐	☐
1.7	Wurde das Thema Energieeffizienz während deiner Schulzeit behandelt?	☐	☐	☐	☐	☐
1.8	Liest du gerne ökologische Artikel?	☐	☐	☐	☐	☐
1.9	Wäscht du deine Hände mit kalten Wasser?	☐	☐	☐	☐	☐
1.10	Bevor du die Heizung hochdrehst ziehst du dir lieber einen Pullover anstelle eines Shirts an.	☐	☐	☐	☐	☐
1.11	Regelst du die Heizung runter in der Nacht?	☐	☐	☐	☐	☐
1.12	Wird in der Uni die Energie verschwendet?	☐	☐	☐	☐	☐
1.13	Verschwendet du zuhause Energie?	☐	☐	☐	☐	☐
1.14	Würdest du dich als Lehrer engagieren um pädagogische Aktivitäten für den effizienten Einsatz von Energie zuhause und in der Schule zu ermöglichen?	☐	☐	☐	☐	☐

2. Wie ist deine Meinung dazu? Bitte nur einmal ankreuzen.

		Stimme sehr zu	Stimme eher zu	Lehne eher ab	Lehne sehr ab
2.1	Klimawandel ist die größte globale Herausforderung.	☐	☐	☐	☐
2.2	Energieeffizientes Handeln ist eine individuelle und freiwillige Entscheidung.	☐	☐	☐	☐
2.3	Genau betrachtet verbessert sich die Umwelt doch schon.	☐	☐	☐	☐
2.4	Wissenschaft und Technik können allein die „Energieprobleme“ lösen.	☐	☐	☐	☐
2.5	Es ist besorgniserregend, dass die fossilen Energiequellen begrenzt sind und immer mehr davon immer kürzerer Zeit verbraucht werden.	☐	☐	☐	☐
2.6	Ineffiziente Nutzung der Energie ist die wichtigste Ursache des Klimawandels.	☐	☐	☐	☐
2.7	Man kann den Klimawandel noch stoppen.	☐	☐	☐	☐
2.8	In Deutschland sollten verschiedene Energieeffizienzmaßnahmen in Bezug auf Privatpersonen auch erzwungen werden, z.B. Gebäudesanierung, Heizungsmodernisierung.	☐	☐	☐	☐
2.9	Sollen die Schwellenländer ihren Lebensstandard weiter steigern dürfen, auch wenn sie hierfür mehr Energie benötigen?	☐	☐	☐	☐
2.10	Es ist sinnvoll, Geräte wie z. B. Fernseher oder Musikanlagen nach Gebrauch komplett auszuschalten.	☐	☐	☐	☐
2.11	Es ist sinnvoll jedes Mal beim Verlassen eines Zimmers das Licht auszumachen.	☐	☐	☐	☐
2.12	Um saubere Hände zu bekommen, braucht man unbedingt warmes Wasser.	☐	☐	☐	☐
2.13	Während des Lüftens eines Zimmers sollten die Heizkörper darin ausgedreht werden.	☐	☐	☐	☐

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3.3	Elektrizität	☐	☐	☐	☐	☐
3.4	Verzicht	☐	☐	☐	☐	☐
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		Extrem Wichtig	Sehr Wichtig	wichtig	nicht wichtig	überhaupt nicht wichtig
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3.8	Leuchtstoffröhre	☐	☐	☐	☐	☐
3.9	Glühlampe	☐	☐	☐	☐	☐
3.10	Energiesparlampe	☐	☐	☐	☐	☐
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	1	2	3	4	5
3.12 Bücher	☐	☐	☐	☐	☐
3.13 Familie	☐	☐	☐	☐	☐
3.14 Freunde	☐	☐	☐	☐	☐
3.15 Internet	☐	☐	☐	☐	☐
3.16 Schule	☐	☐	☐	☐	☐

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3.20 Es Kostet zu viel Geld.	☐	☐	☐	☐	☐
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Warum würdest du die Energie effizienter nutzen?

	1	2	3	4	5
3.22 Ich bin verantwortlich für den Umweltschutz.	☐	☐	☐	☐	☐
3.23 Für die Zukunft der Erde.	☐	☐	☐	☐	☐
3.24 Weil es Geld spart.	☐	☐	☐	☐	☐
3.25 Weil es ein populäres Thema ist.	☐	☐	☐	☐	☐
3.26 Nichts motiviert mich, Energie effizienter zu nutzen.	☐	☐	☐	☐	☐

4. Zu jeder Vorgabe eine Antwortziffer ankreuzen.

4.1 Möchtest du mehr über das Thema Energieeffizienz wissen?

☐ Ja sehr viel mehr ☐ Ja viel mehr ☐ Ein bißchen mehr
☐ Eher nicht ☐ Nein

Vielen Dank