

# Argumentative Skills in the Design of Webquests in Environmental Education for Secondary Students

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This manuscript was accepted for publication in *The International Journal of Learning* in November 2011.

**Abstract:** In 2007 the Organic Law on Education was passed by the Spanish parliament. One of the new approaches introduced by this law refers to the term of the achievement of basic competences by pupils. Competences are defined as integral actions to identify, argue and solve problems integrating knowledge of being, doing and knowing. Eight competences were established: Mathematical, linguistic communication, interaction with physical environment, digital competence, social and citizenship, artistic and cultural, learning to learn and personal autonomy and initiative. To reach a balanced fulfilment of these competences a new methodological approach has to be faced by teachers based not on repetition, but in investigation and argumentation of new concepts and ideas. Webquests are methodological tools which enable teachers to develop new kinds of activities and allow students to create new products. They are structured and divided in different stages: introduction, task, process, resources and evaluation. In our study we try to identify methodological patterns used by teachers in the design of webquests: if technology is used as a prompt to induce a new educational approach, or if it is just used to reproduce traditional teaching roles based in mere concept repetition. We search for the inclusion of all patterns leading to facilitate students build their own knowledge: from the inclusion of open questions to group management and new assessment patterns. Data for our study are taken from online web repositories of webquests for environmental education in compulsory secondary education (students aged 12 to 16) in Spain.

**Keywords:** Secondary Education, Webquest, Argumentation

## 1. INTRODUCCION

We are in a moment where society gives special importance at new technologies. The use of Information and Communication Technology (ICT) is present in almost all the fields of everyday life: health, commerce, business, education, communication, etc.

We can find a lot of information on the Internet, but we need a critical attitude to search for information and to select and assess that information.

In education teachers use different ICTs in classroom practice: blogs, wikis, webquests, and treasure hunts. In many cases teachers make their own materials. In the design of these interactive tools the development of the different competences by pupils established in Spanish official curriculum has to be taken into account: Mathematical, linguistic communication, interaction with the physical environment -scientific competence-, digital competence, social and citizenship, artistic and cultural, learning to learn and personal autonomy and initiative.

On our study we will focus in the development of the ability of argumentation, understood as an integral part of scientific competence.

We will try to identify in different webquests (environmental education proposals) for students in secondary Education, the strategies teachers pose to make argumentation.

## **2. ARGUMENTATION IN ENVIRONMENTAL EDUCATION.**

Argumentation can be understood as a kind of linguistic exposition aiming to defend with reasons or arguments a thesis, an idea to be proven. It can also be defined either as the reasoning process to proof or demonstrate a proposition or to convince someone of something we state or deny.

In Science didactic argumentation consists of –or is understood as- reaching claims based in data and warrants (Jimenez Aleixandre, 2010; Toulmin, 1958)

Several authors (see for instance Kuhn, 1992, Kelly, Drucker and Chen, 1998, Duschl and Osborne, 2002) have suggested that science education should pay attention to and promote argumentation as one of the dimensions of learning science, and of the enculturation in the scientific discourse. Argumentation can also be described as a process of making public or external processes that are private, such as reasoning or thinking. We cannot enter the students' minds, but as Kuhn (1992) indicates, argumentative dialogue externalizes argumentative reasoning.

Argumentative reasoning is relevant for Science education, as one of the aims of scientific research is statement generation and justification, and actions leading to the understanding of nature (Jiménez, Bugallo and Duschl, 2000) So, Science teaching should give the opportunity to develop, among others, the ability to reason and argument (Jiménez, 1998; Sardá and Sanmartí, 2000)

This is recognized in the Spanish Curriculum for Secondary Education in Scientific Competence: “This competence makes it possible to identify questions or problems and obtain conclusions based in data, in order to understand and take decisions about physical world and about changes made in environment by human activity (...)” (D.O.G., 2007)

Including the ability of argumentation in the aims of Science education means, among other things taking into account that making science is also posing and discussing ideas, assessing alternatives, choosing among different explanations and widening the vision of science learning. To summarize, it can be said that the aim is students' participation in science discourse. In classes with traditional methodology, there is hardly ever

participation, as pupils are scarcely given the opportunity to solve tasks or assess alternatives. It is important to design activities which help pupils “speak science”, to take part in scientific culture, knowledge production and circulation. (Jiménez Aleixandre and Díaz de Bustamante, 2003).

The main aim of environmental education is related to socio-environmentally committed citizens’ education, with a reflexive and critical ability enabling them to analyze their surrounding world, assess received information, be conscious of self and others’ actions, and skillful to maintain argued opinions in decision-taking processes (Marco- Stiefel, 2000).

A learning process favoring the development of abilities, such as argumentation, is positively valued in environmental education as it could lead to understanding the complexity of environment and its problems, and act properly in it as well. It is necessary its activation in order to understand news, discuss a decision, defend a position, carry out an action, persuade some authors and to show different concepts, processes and behavior perspectives both on intrapersonal and interpersonal levels (Campaner and De Longhi, 2007)

From environmental education the development of argumentative or the ability to assess the importance of data and evidence to make reasoned judgements and to take decisions is then expected. In this way we are contributing on one hand to build as more complex, critical and committed with the environment thought and on the other hand to the ability of “speak science” through a shared language and code (Lemke, 1997).

### **3. ENVIRONMENTAL EDUCATION WEBQUESTS**

Environmental education offers good opportunities to promote argumentation, due to the complexity of the problems under study (Jiménez Aleixandre, López Rodríguez and Erduran, 2005; Jiménez Aleixandre, Pereiro Muñoz and Aznar Cuadrado, 2000)

Teachers have different methodological strategies and tools to develop curriculum contents -in our case the development of the argumentative ability about environmental topics. One of the tools which allow teachers face curricular subjects having into account new methodological requirements in Information and Computing Technologies are webquests.

According to Dodge (1995; 1998a; 1998b; 2001; 2002; 2007) and March (2000; 2004), we understand that webquests should be investigation oriented activities where part or all of the information students interact with comes from the Internet. These kinds of activities use a cooperative methodology, where each group member’s contributions are fundamental for the posed problem-resolution as each of the group members has a part of the information necessary for learning (González Fernández and García Ruíz, 2007). It also facilitates discussion, reflection, and argumentation, as knowledge generating actions (Aznar and González, 2010).

As we have already pointed out, environmental education topics are adequate to enable pupils in decision-taking processes. Thus, in our study we have analysed 43 webquests dealing with environmental education contents in different levels of Secondary Education hosted in a repository PHPWebquest.

Each module (introduction, task, process, evaluation and conclusion) was analysed in terms of what kind of activities has been designed in order to enable argumentation.

#### 4. ARGUMENTATION IN ENVIRONMENTAL EDUCATION WEBQUESTS.

There is a wide variety of topics with a great degree of complexity in the different webquests taken as sample. As it is shown in Table 1, the greater amount refer to biodiversity in the planet or to certain ecosystems near to pupils environment (like Huamantanga forest in Peru or Sierra de Segura in Spain), and to the defense and care of natural resources. We also found a great number of webquests referred to environment pollution either through water, air or solid waste. Another block of contents refers to climate change or global warming, we have also included in this block related webquests dealing with greenhouse effect or the hole in the Ozone layer.

**Table 1.** Environmental Education webquests for Secondary Education in the repository PHPwebquest

Webquest Topic	Number	Percentage
Biodiversity: ecosystems, environment care/defense.	15	34.9 %
Pollution: water, air or solid waste.	14	32.6 %
Climate change: global warming, greenhouse effect, hole in Ozone layer.	11	25.6 %
Cycles: water and CO <sub>2</sub>	3	6.9 %
<b>TOTAL</b>	43	

The modules webquests are divided in are: introduction, task, process, evaluation and conclusion. We will analyse in detail each of these modules.

##### 4.1. Introduction

In the introduction a short, general presentation of the problem to study is given. Some webquests show a very simplified way if related to the complexity of the environmental issue. Environmental issues show great complexity and in many of the analysed webquests they are introduced in a very simple way, distorting the vision of the problem.

In this module teachers (designers of the tool) play the role of informant, in very few cases (4.7%) poses questions motivating students to investigate and deepen in the topic (W02I: *Are we conscious of these effects? Do we know how can we act?* W14I: *What important ecosystems are there in our country?Where are they?*). Questions leading to decision-taking are not posed.

#### 4.2. Task

The task poses the product to perform and how conclusions have to be handed out. Products demanded in the different webquests are varied, although information search to answer questions, report and PowerPoint presentations elaboration are the most required ones. In the following Table analysed tasks are shown:

**Table 2.** Products Secondary Education students have to perform in environmental education webquests.

Product	Percentage
Answer a questionnaire	31.5 %
Report elaboration	18.4 %
Power Point presentation	15.8 %
Concept map	8 %
Comparative charts	5.3 %
Real case resolution	5.3 %
Models	5.3 %
Project/campaign	2.6 %
Triptic	2.6 %
Magazine	2.6 %
Posters	2.6 %

All the questionnaires in these webquests do only request information which can be obtained from the resource list provided by teachers (for example, W19T: *How is water pollution produced?*; W28T: *What is biodiversity?*; W02T: *Which are the origins of climate change?*). In these cases there is little information processing, we could say that these can be solved with copy and paste which will be shown in PowerPoint presentations and final reports (W02T: *The task to perform will be a report elaboration about climate change. You have to include what is climate change, its origins and its consequences in our country*)

Few of these tasks require reflection about resources or elaboration of a product implying decision-taking with argumentative processes. The argumentative ability is developed, for instance, through activities where options have to be chosen justifying such selection (W06T: *Which of the terms: "climate change" or "greenhouse effect" fits better as a title for the research project? Why?*) or giving reasons to convince others of our decisions (for example, W06T: *Design a project to counter this evil in our planet Earth and the living beings in it, write a letter and a model putting forward a solution. Create a slogan and a logo for the project;* W11T: *(...) each group dialogue and make requested notes in order to later try to convince others that environment should be*

*respected and cared for and give a global vision of how the world would be in a thousand years if we keep on behaving like this)*

#### 4.3. Process

In this area, teachers have to explain how the task has to be performed - what steps or phases have to be taken into account. The resources pupils need in order to accomplish the task are also given. These resources can be found on the Internet or in other source of information.

All the analysed webquests set small-group task to perform (two to five members each). Only 8% of them require individual work for some items of the task (for example, W06P: *Individual work: systematize the topic using organizers: concept maps. Make your presentation using slides*) or an information search of the resources given (for example, W18P: *Two- hour individual homework to search digital newspapers*)

Posed group activities can be differentiated into two sectors. One of them refers to information analysis activities, or, in terms of argumentation, data analysis. These activities would be, for instance, search for information on the Internet (for example, W11P: *surf the Internet web pages you consider convenient*; W32P: *visit the links you can find in the resources section*), read and analyze selected texts (for example, W08P: *Make five person groups to read and analyze the given text*), watch documentaries (W37P: *watch the video "Treatment Plant"*; W03P: *Watch suggested videos*), or attend theoretical explanations.

The other group of activities would comprise debates (for example, W02P: *A class debate will be carried out discussing possible actions to help diminish the effect of climate change*) and role play (for example, W11P: *You are a member of a political party and you will represent your nation. You should discuss and take notes about the measures you will carry out in your nation*). Though not in an explicit way, these activities give students the chance of explaining different points of view about a certain environmental issue. These techniques make students give warrants to persuade or convince their partners to justify claims reached by the whole group.

This second group of activities –debates and role play- complements the first one (data analysis activities) in the development of argumentative abilities.

#### 4.4. Evaluation

Teachers design the model to value students' product. Webquests give the chance to make an authentic evaluation understood as Mueller (2006) explains -as a kind of evaluation where students are asked to fulfill real-world tasks demonstrating significant application of basic knowledge and competences. Authentic evaluation is focused on the verification of students' abilities in the production of well-finished, complete and based in good arguments answers, in good performances or in good products. This kind of evaluation makes it important the use of valuing rubrics. Rubrics are used when a valuing of the product or process quality is needed with multiple dimensions which have specific weight, according to the teacher, in the final result (Moskal, 2000).

Only a small percentage (26,3%) of webquests about environmental education use rubrics. Most of them (73,7%) show in a generic way what issues are going to be taken

into account to value students' work (for example, W08E: *Group organization and performance. Presentation of group report according to given schema. Report defense, materials and prevention measures*; W33E: *The following aspects will be assessed: if the information is clear and fit to the required issues. If you extract main concepts. If you manage the programme to make presentations. If work is clean and ordered. Interest and participation in tasks.*)

Rubrics in the analysed webquests show different aspects of product quality. Most of them do not mark students' productions clearly (see Table 3)

**Table 3:** Example of rubric of evaluation (W03E)

Kind of evaluation	A	B	C	D
Group work				
Spelling				
Presentation within deadline				
Each member's role				

Or taking into account criteria not related to argumentation (see Table 4)

**Table 4.** Example of rubric of evaluation (W33E)

CATEGORY	EXCELLENT	GOOD LEVEL	ACCEPTABLE	POOR
<b>Punctuation</b>	No spelling or grammar mistakes.	Three or less spelling/punctuation mistakes	Four spelling/grammar mistakes	More than four spelling and grammar mistakes
<b>Organization</b>	Well organized using titles and lists to group related material	Used titles and lists to organize, but main topic organization is weak.	Most of the content is logically organized.	Not clear or logical organization. Only a lot of facts.
<b>Content</b>	Covers topics deeply with details and examples. Excellent knowledge of the topic.	Includes basic knowledge of the topic. Content appears to be good.	Includes key information about the topic, but commits 1-2 mistakes.	Minimum content and has many mistakes in the facts.
<b>Originality</b>	The product shows originality. Creative ideas.	The product shows certain originality. The work shows use of new ideas.	Use of other people's ideas (giving them credit) but there is scarce evidence of original ideas.	Use of other people's ideas, but giving no credit to them.

Only one of the analysed rubrics (2.6%) makes clear reference in one of the items to the achievement of argumentative competence (W15E: *Work group: The task was performed cooperatively, sharing functions and tasks in a balanced way. Vocabulary*

*used: Precision in environmental terminology used and in proposes ideas as well. Learned contents: Contents are solid, clear and precise enough. Information quality: Different sources of opinion are integrated, comparing points of view and factors in opinions given)*

#### 4.5. Conclusión

Conclusions can be grouped into two categories.

Most of the webquests (95%), just summarize the issues developed (for example, W15C: *In an ecosystem living and non-living beings are present interrelating to accomplish every day actions. In some ecosystems it is necessary to stop cutting trees to preserve other living beings. Man pollutes the environment with some everyday-activities and this affects the health of living beings. If we pollute the environment, living beings from different ecosystems could disappear or extinguish*)

Only 5.3% of the revised conclusions go further, leading to influence into the environment or keep on investigating (for example, W06C: *Climate change could have severe consequences, human beings know about this issue, but has given scarce importance to it. You are now well informed in order to be conscious of the problem on our planet, and can take part in the change by transferring information to your neighbors, friends and other people. The task has just begun, and many of the effects of climate change have manifested. We have to take part now, as we have not done it before due to ignorance. Let's react and act*).

### 5. FINAL CONSIDERATIONS.

The concern in favoring argumentation in Science classrooms is not new. For more than two decades, there has been consensus in that the ability of understanding and formulating scientific arguments is a key aspect both in scientific knowledge creation and people's literacy.

We agree with Márquez Bargalló and Prat (2010) when they state that a science pupil should not be a student with a paper or book with truths to learn. Each person, each student has to face papers or surrounding information as a researcher, to be able to justify facts and argument ideas and actions in a reasoned way.

The use of environmental issues in the classroom gives the opportunity to foster beliefs and opinions in pupils, sometimes scarcely scientifically justified. In these cases the development of abilities such as argumentation is necessary in order to understand the complexity of environment and consequently act.

In order to develop this scientific competence it is important to design activities which help students "speak science". Webquests are tools which make pupils' group work easier using evidence or data to reach conclusions, with interchange of ideas, reasoned discussion, reflection and justification -argumentation.

Teachers should explain this competence more in both in work strategies and in evaluation rubrics as well.

We should keep on progressing, teachers and pupils, in the ability to understand and make scientific arguments, to transfer them to a more environmentally committed way.

We hope further investigations would be able to fulfill the lacks found in these interactive tools in order to reach the development of the argumentative competence.

### **Acknowledgments**

Work supported by the Spanish Ministry of Science and Innovation, code EDU2009-13890-C02-01

This manuscript was accepted for publication in *The International Journal of Learning* in November 2011.

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