

INTERACTIVE RESOURCES IN SECONDARY EDUCATION: DESIGN AND APPLICATION.

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Abstract: One of the aims of Secondary teachers is to get students to reach basic competencies, which are defined as the ability to put into practice, in an integrated way and in different contexts and situations, the acquired knowledge, abilities and personal attitudes. One of these basic competencies is referred to the treatment of information and digital competence, that is, effective use of technology. So, not only correct use of technology will be assessed in this competence, but the intelligent use of information as well: searching analyzing, selecting according to certain criteria and reconstructing it through technologies. This model of work is a way of applying ICT to school settings. And this means that teachers should manage the knowledge and development of interactive tools and innovative strategies which improve pupils' learning process.

Keywords: Secondary Education, Methodological Strategies, Interactive Tools

1. CONTEXT OF INVESTIGATION

The priority of society is to prepare the future citizens to successfully deal with the huge amount of information they get via Information and Communication Technologies' (ICT's).

This fact demands the development of skills to process the information as well as digital competences to search, assess, organize and use the information from different resources with varied contents (Comisión Europea, 2001).

Within this context, one of the aims of secondary education teachers in Spain is to develop basic skills in students. Such basic skills are defined as the ability to put into practice the acquired knowledge, abilities and personal attitudes in different contexts and situations, in an integrated way. One of these basic skills concerns information processing and digital competences, i.e. the effective use of technology. Therefore, not only the management of technology will be assessed but the intelligent use of information too: how to search, analyze and select it according to certain criteria and reconstruct it using different technologies. This pattern of work is a way of implementing ICT's in the school environment.

This competence –included in the secondary education curriculum, raises the need for the students to be able to clearly define a topic or task, select the proper terms, establish a searching strategy that includes different sources of information, analyze the data collected in order to assess their importance, quality and convenience, and then turn the

information into knowledge. This implies that the teacher knows and develops the interactive tools and the innovative strategies that make this learning process easier to the students (Ala-Mutka, Punie, Redecker, 2008; Gay and Grosz-Ngate 1994).

Internet has improved the information availability and has developed new models to solve information problems, redefining the existing ones in order to integrate information critically and constructively, i.e. the intelligent use of information. Six of these models are defined in the chart below.

MODELS OF INFORMATION PROBLEM-SOLVING					
GAVILÁN Development of information management skills (Colombia).	OSLA Information studies: Kindergarten-Grade 12 (Canada)	Kuhlthau Information searching (USA)	(Big6) Eisenberg/Berkowitz Information problem-solving (USA)	Irving Information management skills (UK)	Stripling/Pitts Research process (USA)
1. DEFINITION OF THE INFORMATION PROBLEM a. Ask the initial question. b. Analyze the initial question. c. Construct a research plan. d. Ask secondary questions. e. Assessment of step 1.	1st STAGE: Get ready to research 1. Define 2. Explore 3. Identify 4. Relate	1. Start 2. Select a topic 3. Explore (search information on the topic). 4. Formulate a theory or a specific topic.	1. Task definition. - Define the problem - Identify the needs 2. Information-searching strategies - Establish a range of resources - Prioritize the resources.	1. Set out/analyze the information needs. 2. Identify/evaluate the potential sources.	1. Choose a broad topic. 2. Get a global perspective on the topic. 3. Limit the topic. 4. Develop the theory/Establish the objective. 5. Ask questions to channel the research. 6. Plan the research and the production.
2. INFORMATION SEARCHING AND EVALUATION a. Identify and select the information sources. b. Access the selected sources. c. Evaluate the sources and the information they offer. d. Assessment of step 2.	2nd STAGE: Access to resources 5. Locate 6. Select 7. Compile 8. Collaborate.	5. Compile (gather information on the topic).	3. Location and access. - Locate the resources. - Find the information in the resources.	3. Locate the individual resources 4. Examine, select, and reject individual resources.	7. Find, analyze and evaluate the sources.
3. ANALYSIS OF THE INFORMATION. a. Choose the most suitable information. b. Read,	3rd STAGE: Information processing 9. Analyze/evaluate 10. Prove	6. Present, organize, outline, summarize, and write.	4. Use of information - Commit oneself, read, see, listen, etc. - Extract relevant	5. Question/use the individual resources 6. Register/store the	8. Assess the evidences, take notes, and compile the bibliography. 9. Draw

understand, compare and evaluate the selected information. c. Preliminary conclusions. d. Assessment of Step 3.	11. Select 12. Synthesize		information. 5. Synthesis. - organize the information from different sources. - Create and present.	information. 7. Interpret, analyze, synthesize, and evaluate the information	conclusions, organize the information into a diagram.
4. INFORMATION SYNTHESIS AND USE a. Draw a general conclusion. b. Elaborate a specific product. c. Communicate the results. d. Assessment of step 4.	4th STAGE: Transfer of learning 13. Revise 14. Present 15. Reflect 16. Transfer	7. Evaluate the process and the outcome.	6. Evaluation - Judge the product. - Judge the process	8. Shape, present and communicate the information. 9. Assessment of the task.	10. Create and present the final product. 11. Material for reflection: is the document satisfactory?

Source: <http://www.eduteka.org/pdfdir/ModelosCMI.php>

With regard to ICT's, our conception is based on Gisbert (1996); González Soto, (1998); and Cabero (2001), among others. We understand ICT's as a wide range of services, applications and technologies using different kinds of equipment and computer programs, usually transmitted through telecommunications –they spread quickly in all fields of our society, without exception.

Adell's definition (1998) is also interesting. He considers ICT's as "the set of devices, tools, platforms and channels for information management, access treatment and distribution based on digital coding and on the use of electronics and optics in communications" (Adell, 1998: 4).

The most distinctive features of ICT's are synthesized by Cabero (2001) who groups them as follows: immateriality, interactivity, instantaneity, innovation, digitization, penetration in all fields, automation, interconnectivity, diversity, storage capacity, and image and sound quality. These features attach special importance to ICT's as regards the potentiality of the system and –such as in the case of Internet, make ICT's be considered as qualitatively different from previous technological innovations, since they can integrate other systems, such as image and sound for instance.

Based on this experience, ICT's are considered as resources that enable the introduction of new didactic approaches leading to innovation and improvement in the educational environment (Roig-Vila, 2003a, 2003b). We also agree with Cabero (2002) when he refers to a number of ideas that should guide the use of media from a didactic, non-technical perspective, and when he states that the use of a medium will depend on the aims to be achieved and the aims that justify such use, based on the needs of the communication process. In short, bearing in mind that the main aim of teaching is to make our pupils learn, producing learning in our pupils, the medium is understood as an element favoring the interaction in the teaching-learning process.

Likewise, we must bear in mind the connection between the medium to be introduced and the other components of the didactic process (Cabero, 2002).

With regard to the didactic-academic perspective, we understand the use of ICT's within the study of media in the curriculum, since only from the curriculum the analysis of relevance and the clarification of design criteria and specific strategies of use make sense (Cabero, 1993; Castaño, 1994; Duarte, 1998). The didactic act using the Internet will need a deep pedagogical change in the way its different components are understood (Marcelo, 2000; Smeets, 2005; Ward and Parr, 2010).

2. JUSTIFICATION OF THE EXPERIENCE

The aim of this experience is the use of the webquest methodology as a strategy in the process of building knowledge in Secondary Education students. Webquests allow integrating constructivist learning principles, task-based learning methodology, and web surfing in order to develop the curriculum with a group of students in an ordinary classroom (Adell, 2004).

Bearing in mind the cognitive development, Murphy (1997) summarized the principles of the design of teaching-learning environments and activities that come up from the set of philosophical, epistemological, psychological and pedagogical ideas we call constructivism. Based on different authors, Murphy suggests the following points, which we completely agree with in the production of interactive materials that make the development of a constructivist structure easier:

- Several perspectives and representations of the facts, concepts, principles, and procedures must be presented, and the students should be encouraged to take them into account.
- The learning objectives and goals should be established in a process of negotiation in which the students and the teacher take part.
- Teachers play the role of guides, instructors, tutors and facilitators of the cognitive scaffolding.
- Students should be provided with activities, opportunities, tools and environments favoring metacognition, self-analysis, regulation of their own behavior, reflection and self-awareness.
- Students play a leading role in learning control.
- The learning situations, the environments, the skills to be achieved and the contents and tasks to be developed must be relevant, realistic, authentic, and must reflect the natural complexities of the "real world".
- Primary data sources must be used in order to guarantee the authenticity and the complexity of the real world.
- Knowledge building rather than knowledge reproduction must be encouraged. Knowledge building takes place through the negotiation, the collaboration and the experience of the team members.
- The learning building process has to take into account the students' previous knowledge, beliefs and attitudes.
- Problem solving, high-level cognitive skills and comprehension should be emphasized.
- Errors and mistakes are opportunities for the teacher; they allow teachers to know students' previous knowledge.

- Exploration is one of the favorite approaches to encourage students to seek knowledge independently and to manage the achievement of their goals.
- Students should be given the opportunity to act as apprentices in tasks, skills and the acquisition of increasingly complex knowledge.
- Collaborative and cooperative learning should be encouraged in order to expose students to alternative points of view.
- Students should be provided with cognitive scaffolding so as they can develop skills beyond their present abilities.
- The evaluation is real and integrated in learning.

Our webquest was outlined as follows:

- Definition of the problem, information searching and selection
- Critical analysis of the information
- Information synthesis, assessment and extrapolation

This methodology was selected due to several reasons. One of them is its suitability to deeply develop –from a personal point of view, ICT-based educational material, programs and resources related to our daily work that -at the same time, could be useful to other teachers. Another reason is that it enables us to connect and integrate ICT's with the curriculum of Secondary Education students. It also gives us the chance of making available materials through which we can observe the learning results and make a theoretical analysis leading to keep on searching and progressing. The webquest is a strategy that takes the students' time into account, based on the use of information rather than on information searching, and gives teachers the possibility of carrying out a real assessment in order to verify the students' skills. It also allows students to know what they are expected to know and thus control their own learning. This methodology enables us to create small learning communities where the responsibility of learning is shared; learning is no longer an individual matter, but a team work (cooperative learning).

3. DESCRIPTION OF THE EXPERIENCE

The experience was carried out in a school with 650 pupils in total from nursery education to Secondary Education. More specifically, the work with interactive tools was developed in 3rd year of Secondary Education in the Biology and Geology subjects. There were 25 students in the class: 10 boys 15 girls.

Once informed about the experience, all of them accepted to actively take part in the work and in the results.

Nutrition was chosen as the topic of our webquest since we noticed that some students were changing their eating habits because of the proximity of summer.

3.1. Design

According to Dodge (1995; 1998; 1999) and March (1998; 2000), we understand that a webquest must be a research-oriented activity where part of or the whole information students interact with comes from the Internet. And we also agree with Adell (2003),

who sees a webquest as an activity that allows students to develop a high-level thinking process. It is a matter of doing something with the information: synthesize, analyze, understand, judge, transform and value, among others.

The design of our webquest was based on the above considerations and we followed the attributes or modules marked as essential by Dodge (1995; 1998; 1999):

3.1.1. Introduction.

This section provides with the data that justify the need for a balanced diet to achieve a good development and a good school performance.

3.1.2. Task.

This section specifies the objectives and the contents developed in this activity, and it describes a real situation of a female teenager consulting a panel of experts in order to understand some aspects related to the functioning of the different systems and organs that take part in nutrition.

3.1.3. Process

This section describes in detail the steps to carry out the task. Such steps must be the scaffolding or guide to achieve the final goal. Therefore, this section also includes the resources that can be used, e.g. a selection of interesting links with relevant information, books and magazines recommended, experts' assessments, etc.

In our case, we must create a committee to advise the teenager. With this purpose, the students will have to carry out the following tasks:

- 1°. Create work groups.
- 2°. Assign the roles: each member of the group will be an expert in one organ or system related to nutrition.
- 3°. Search information: each member becomes an expert in his/her topic.
- 4°. Share the information that has been found and discuss the involvement of each organ or system in nutrition and, consequently, in health.
- 5°. Write a report: the report must integrate the information referred to the nutrition process, pros and cons of the teenager's eating habits and an example of a balanced diet for her.

3.1.4. Assessment

We considered a real assessment through an evaluation rubric, since we think that an assessment of product quality (final report) is necessary due to its multiple dimensions with different weights.

There are some useful references as regards the design and use of evaluation rubrics on the Internet (Brookhart, 1999; Chicago Public Schools, 1999; ERIC/AE, 2000; Moskall, 2000a and 2000b; Schrock 2000).

Our final report evaluates the presentation, the scientific level and depth, the structuring of contents, and the documenting and reasoning on the conclusions.

3.1.5. Conclusion

In our webquest every student is also asked to evaluate or reflect on this pattern of work through an individual questionnaire on the difficulties found in the task and in the group work, on the change of eating habits, and on the skills developed in this activity.

3.2. Timing

The activity was developed as follows:

- In the first session, we presented the activity and explained what a webquest is as well as its parts, the objectives pursued, the task to be carried out (together with the protocol to do so), where to search the information, and how to evaluate the production. The work groups were trained and advised to explore the different sections of the webquest being well aware of the information provided, before planning the work.
- The following sessions (2nd to 5th) were devoted to information searching, selection and processing, as well as to writing the final report under the teacher's supervision and guide.
- In the final session (6th), the students put the results of the different work groups forward, which gave rise to a debate among the students thus enriching their view on the topic. The students asked for further information on nutrition habits suitable for different pathologies.

As a supplementary activity, an expert in nutrition gave a lecture presenting the guidelines on eating habits for schoolchildren. The students filled a card with the most relevant information of the lecture.

4. METHOD

In order to analyze the experience, the students' work was studied, analyzing the contents based on each group's final report as well as on the assessment questionnaires so as to know the pros and cons of this methodology.

Our purpose was to get information through cognitive and emotional sources on the reactions of the interviewees to the use of learning strategies in the classroom. The research was focused on the subjective experiences of those who were exposed to such situation (Merton, Fiske and Kendall, 1990).

The research has, then, a qualitative, transversal and descriptive methodological approach in order to interpret the phenomena according to the meanings people offer (Denzin and Lincoln, 1994; Rodríguez Gómez, Gil Flores and Jiménez García, 1999). Based on Latorre and González (1987), we try that this qualitative research prioritizes the understanding and interpretation of the facts from the point of view of those involved. We work with qualitative data generating explanatory theories whenever possible.

In order to summarize and structure the contributions rising from the analysis of the works and those provided by the interviewees, we followed the typical stages of qualitative analysis of texts (reduction of the original database, link reconstruction and outcome comparison).

As McCracken (1988) explains, in this kind of researches it is not a matter of generalizing but glimpsing the complex character, organization and logics of culture.

5. RESULTS

In order to make the results easier understood, they were organized into categories defining a topic. Therefore, in this section we show the data obtained in the study according to the selected categories, including different significant extracts of the compiled stories as well as of the analysis of the contents of the works.

5.1. Motivation

One of the categories analyzed refers to the students' motivation for this kind of methodology. We may state that the students participated in this activity enthusiastically, since the use of ICT's is always a motivating tool. The use of cooperative learning as one of the pillars of the activity was also gratifying for the students, since it favors peer learning. Most questionnaires showed that there was *"great communication among all the members of the group"* and that *"all helped to improve the task with advices and suggestions"*.

The topic chosen was attractive for them as well, since it is one of their everyday concerns. Many students confirm in the questionnaire filled in at the end of the webquest activity that they will keep on searching and putting the guidelines agreed by the group into practice, since they are aware that diet affects their quality of life and their school performance. *"What we eat not only affects the digestive and excretory systems, but it also provokes a reaction and certain consequences in the body."* *"People usually eat too much fast food to save time in their meal breaks or for personal reasons. It is also true that there are seasons when recommendations on eating habits are better followed, especially in the months just before summer, when most people try to eliminate their excess kilos in a too short period of time. In my opinion, we should change this habit of doing everything "in the last minute" and try to change –with the help of an expert if necessary, our eating habits in order to have a little healthier life"*.

5.2. School Performance

The analysis of the reports prepared by the different groups show that there are some deficiencies in information processing and computer skills, since there are many students that lack confidence in the use of computers or they simply reproduce extracts of information instead of processing it to solve the problem or the suggested task, or they have difficulties in searching information in the internet. Despite all these limitations in the use of ICT's, 72% of the students that took part in the webquest earned good grades in the corresponding subject. This evaluation was based on the final report of each group of experts taking the scientific depth, the structuring of contents, the documents

provided, the reasoning on the conclusions and the adaptation or extrapolation of study results to real life into account.

5.3. Evaluation of the activity

We can draw positive aspects from the individual assessment questionnaires such as increased motivation of the students and increased responsibility with a view to the group, improved team work and awareness of healthy lifestyles. *“At first, I was quite afraid of working with people I usually don’t work with, but in the end I believe that we all participated in the work actively”*. *“I’m aware now that eating well is good to our health not just a matter of being more or less fat”*.

The students pointed out the following negative aspects: the lack of time to go deeper into the topic, and the lack of skills when selecting reliable sources. *“If I had more time I would probably have gone further searching more information in other books and in more webpages and webquests”*.

5.4. Advantages

All things considered, we may summarize the possibilities offered by the implementation of this digital tool as follows:

- The students’ motivation for learning is increased, since activities of this kind are an innovation in the school routine. *“We can work together more easily. We discuss and take notes on the computer, without needing to read the textbook or listening to the teacher. We do more things in the same time”*.
- Webquests are activities that make the approach to real life easier, due to the real means used and to the topics that can be dealt with, which must be complex, rich, real and relevant to the students. In our case, the selected topic was useful to eradicate wrong beliefs about diets and to make students aware of the importance of healthy lifestyles. *“I learned that following a diet is not a matter of just eating vegetables and fat-free food; they are also necessary for the proper functioning of our metabolism”*.
- We work with a task-based methodology. Webquests are small learning projects where the student elaborates his/her own knowledge and the teacher acts as a guide providing the necessary scaffolding. Webquests are useful to develop research and investigation skills.
- Webquests facilitate the cooperative learning; in these group activities, where each member has a different role and becomes an expert in a topic, the information each member has on such topic is essential in order to attain the final objective of the assigned task –in short, to achieve learning. In these cooperative work groups, discussion, reflection and reasoning are encouraged as knowledge-creating actions. As some students involved point out: *“They require to exchange opinions, to come to an agreement and to be more responsible before the group”* i.e., they learn how to work in a team.
- Webquests develop a constructivist structure in the teaching-learning process, since as the student builds his/her own knowledge starting from the research carried out and the processing of the information found. It is therefore necessary to develop analysis, synthesis and information assessment processes. *“To carry out the work, we first had to search the information and then select what was useful and what was not”*.

- Webquests enable us to make a real evaluation, since the task ordered to the students in this webquest belongs to the real world and they are asked to apply the information obtained to make up a healthy diet.

5.5. Difficulties

- One of the difficulties mostly pointed out in the individual questionnaires was the time needed to become organized within the group as well as to plan and develop the task, which was longer than initially expected. *“I would like to have more time because some years ago I became aware of the importance of eating habits to have a healthy life”*. Some students felt lost at the beginning because it was the first time they faced such an activity.
- Another difficulty had to do with the use of the software and handling the information. There was a variety of personal situations; whereas some students had serious difficulties in the management of ICT’s, others –somehow more “experienced”, were overwhelmed by so much information and did not know what information to select, and the most outstanding students had difficulties in applying the theoretical contents to the real situation (extrapolation of knowledge). *“Some things were difficult, such as relating it to the small cake, or selecting information for certain parts of the work”*.
- Most students also pointed out difficulties when structuring the task and working together. Although they are used to working in groups, the dynamics of such work often consists in just doing each one his/her respective part and then putting it together with the parts of the other members of the group. *“We distributed the work with no problem at all and then each one did his/her part. Later, we put all the parts together and commented on it. There was a lack of sharing”*. They are not used to this kind of methodology. They are still unaware of being a work team where the contribution by each member is essential for learning.

6. DISCUSSION

Cultural changes are today more than ever linked to ICT’s. Therefore, the concept of education and the role of the different agents involved in these new educational paradigms should be redefined. Lifelong learning needs new patterns and new intervention guidelines arousing innovative and effective suggestions. We may say that new boundaries in the acquisition and management of information are opened. Here, learning linked to expertise skills becomes important, especially –in our case, as regards information processing and digital competence. Interactive tools are thus more and more present in these new educational paradigms. One of these tools that seem to be effective is webquests. Several characteristics make webquests a recommended resource in teaching Secondary Education (Baraba, 2002; Blanco, de la Fuente and Dimitriadis, 2000).

The most outstanding aspects in the use of webquests are the following:

1) Approach to the real world.

Both the topic suggested to the students and the means used should be related to the students’ interests in order they can be significant and the expected conceptual and behavioral change can be made.

- 2) Increased motivation of the students.
This is in part connected with aspect 1) above. The topic chosen should be sufficiently complex and rich, real and relevant to the students. And the methodology used should get them involved in the task so as the fact of being capable of developing high-level thinking processes is satisfactory to the students.
- 3) Cooperative learning
This kind of learning makes each person responsible for a part of it. Each student's work depends on the group and makes them use high-level cognitive skills. We agree with March (1998) when he says that this process prioritizes the transformation of the information into knowledge.
- 4) Task-based learning methodology
Webquests are small learning projects where the student elaborates his/her own knowledge and the teacher acts as a guide providing the necessary scaffolding. Webquests are useful to develop research and investigation skills.
- 5) Possibility of an authentic assessment
We agree with Mueller (2006) when he understands the authentic assessment as a kind of evaluation where students are required to develop real life tasks that show the significant application of basic competences and knowledge. This kind of evaluation is, in addition, oriented towards assessment methodologies that are as close as possible to real life experiences. Therefore, the authentic assessment is aimed at checking the students' skills in the production of complete answers based on good reasoning or in the elaboration of works. Traditional tests usually only ask the students to select or write correct answers regardless the reasoning or grounds their answers are based on. Actually, they scarcely have the opportunity to revise and check their answers neither in a multiple-choice test nor in essay questions (Wiggins, 1991). The authentic assessment in webquests is mainly focused on the quality of the work created by the students. Evaluation rubrics are very interesting in this kind of assessment. Rubrics are used when the assessment of the quality of a product or process with multiple dimensions and differential weights are necessary in the final result at the discretion of the teacher (Moskal, 2000a). Furthermore, the rubrics used in webquests are useful to guide the student in the elaboration of the final work.
- 6) Development of a constructivist structure in the teaching-learning process.
The teaching-learning process is posed in this constructivist focused secondary education experience as the only valid working pattern, along with cooperative learning techniques. Outcome analysis foster some of the prior hypotheses such as the peer help value (scaffolding), the increase of knowledge and the change in attitude in the topic or pupils' bigger interest in getting involved in a complex real world task

We must bear in mind that the school population we are dealing with is immersed in new technologies, technological media being an indispensable reality in their everyday life. However, despite this familiarity, in some cases the command of such technology is limited. We need educational tools that link the environment where students live with the achievement of skills, interactive tools that enable to develop analysis, synthesis and assessment processes of the information obtained from the net on matters that are

significant to the students. We believe webquests can be an effective tool to generate learning and to contribute meaning to school tasks and teaching practice.

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