IOSR Journal of Research & Method in Education (IOSR-JRME)
e- ISSN: 2320–7388,p-ISSN: 2320–737X Volume 8, Issue 3 Ver. I (May. – June. 2018), PP 44-50
www.iosrjournals.org

The WebQuest Methodology in the Teaching of Chemistry: the Experience of a Teacher and Her High School Students.

Ana Carolina Araújo da Silva
PhD in Education from Universidade Federal de Minas Gerais, Faculty of Education/Department of Education, Universidade Federal de Juiz de Fora, Brazil.
Corresponding Author: Ana Carolina Araújo da Silva; e-mail:anacarolina.silva@ufjf.edu.br

Irene Cristina de Mello
PhD in Education from Universidade de São Paulo, Department of Chemistry, Universidade Federal de Mato Grosso, Brazil.

Abstract: *This article presents a study about the development of virtual learning environments for the teaching of chemistry, which was part of a Masters of Research developed by the corresponding author, titled:* ***The Teaching of Chemistry via the Internet: An Experiment with the WebQuest Methodology****. The main objective of the research was to develop a WebQuest and identify the contribution of this strategy from the perspective of a teacher and her students. The study was identified as a qualitative approach based on the analysis of each of the participants. The object of investigation was the Biofuel WebQuest activity which is theoretically inserted in the educational process to assist students in virtual learning environments with the intention of properly using the information available on the Internet. The results showed that the methodology can effectively contribute to teaching. The activity was oriented and structured in a manner that students involved themselves in the development of a research assignment.*

Keywords: *Learning Environment, Biofuel WebQuest, Teaching of Chemistry.*

Date of Submission: 26-04-2018 Date of acceptance: 16-05-2018

I. Introduction

The great advancement of information and communication technology (ICT) has generated many questions and discussions in the educational field. Many of these questions are related to the possible paths and postures that educators can take when using technological resources in the classroom. Currently, given this diversity which implies multiple forms of using these resources to mediate learning, teachers are faced with doubts and questions regarding the use of such learning tools. One of the questions that we can not ignore and that the researcher herself came across is: how, when and what is the best way to use different technological resources in the classroom?

Our historical context is marked by constant technological changes that affect the modes of being and producing knowledge. Many of these transformations are catalyzed by the use of various resources such as the Internet, cable TV, digital TV, DVD, CD-ROM, software, applications and information cloud storage tools among others. The integration of these media in the education sector is nothing new in the classroom, they can, however, contribute to and stimulate the creation of new teaching, learning and playfulness strategies in the classroom. These new technological resources arose from a societal demand and only became possible and feasible from the consolidation of these changes in this new historical context. In line with the technological resources, comes the pluralization of forms of construction of subjectivities and the promotion of other forms of relationship and the perspective of one's position in society (SIBILIA, 2012).

The society of known information comes to be known as the knowledge society the moment that social networks and the broad democratization of access to information, which is now produced in real time and can be accessed by a wide variety of mobile devices, arises. (MOSÉ, 2013).

The promotion of access to information and the change in the relations established in the transformation of this information in the construction of knowledge, presents a new paradigm that indicates the need to share content. In addition to belonging to the network, it is necessary to share and analyze the data that is available (MOSÉ, 2013).

Indeed, contemporary society characterized by the dynamics of media, which incited the visibility and urged to adopt the most amazing scientific and technological advances quickly, is incompatible with the internalized subjectivity in the previous society with the most prominent changes having been observed in recent years (SIBILIA 2012).

Concerned with the reform of educational spaces and through his research, Bernie Dodge proposed, in 1995, a methodology that reshaped the way teachers and students deal with information. This methodology, known as *WebQuest* (WQ), is a teaching strategy to organize information for the facilitation of learning from an investigative process. Dodge (1995) defines the *WebQuest* as "an oriented investigation in which some or all of the information with which learners interact is originated from Internet resources, optionally supplemented by video conferencing." Dodge's (1995) definition, however, appears to be simplistic in that the emergence and characteristics of a WQ activity are not restricted to that definition, considering the large worldwide development achieved via this method (SILVA, 2006).

The Internet made possible a "new" form of organization, transmission and access to information, which may be used in the preparation of teaching materials such as WQ. The intention in the use of WQ is to guide students to seek and use appropriate information from the Internet, rendering the resources from the Web more adequate. Using this resource without any guidance will result in unproductive searches on the part of the students. From this arises the teacher's role as a mediator to help students search for relevant information on the network. WQ is an educational technology that can be an instrument for meaningful and effective learning. This technology becomes accessible thanks to the ease of access to information via the Internet.

The choice to investigate the *WebQuest* strategy resulted, above all else, as a creation by teachers concerned with finding ways to make good use of the resources available in computer labs and the World Wide Web. This could then be useful and motivating for the public chemistry teachers of Mato Grosso and, therefore, is important to be investigated. In addition, *WebQuest* activities offer the possibility of construction of knowledge in a collaborative process in carrying out a project (ABAR and BARBOSA, 2008). It was in this perspective of knowledge building that we sought to work with a theme that is current and potentially important in the state of Mato Grosso; biodiesel- renewable and biodegradable fuel used in diesel engines and produced from vegetable oils or animal fats. Biodiesel is part of the Brazilian energy matrix relying on the support and incentive of the government. The importance of introducing biodiesel in the Brazilian energy matrix is based on economic, social and environmental factors.

About the *Webquest* methodology

Among the many challenges imposed by the use of the Internet in education, we can mention the problem of how to transform the information found in the large network into knowledge, along with how to integrate this resource into educational projects. *WebQuest* is an activity that enables the use of the potential of Internet resources in the teaching-learning process.

In relation to its etymology, the word *WebQuest* presents us with the sum of two words, *web*, which can mean a network of links, and *quest*, which means questioning, pursuit or search.

Barato (2004) mentions that there is a great interest from masters and doctoral students for *WebQuests* but studies on the subject are faced with a barrier: the lack of bibliographic references. In light of this, to theoretically support the research we sought to gather the most recent information on the subject from articles, books, lectures, dissertations and theses currently available. *WebQuest* is a teaching strategy that aims to perform an activity, a mission to be fulfilled, where certain groups of students are involved in the realization of a project that must extend beyond the space/time of the classroom. The expected result of conducting the WQ is to bring satisfaction to all members of the group, each of which have a part of themselves mirrored in the final product (ABAR and BARBOSA, 2008).

In relation to the duration of the application of this strategy, Dodge (1995) suggests at least two types of *WebQuests*, the short WQ and long WQ, which are defined below:

- **Short WebQuest:** is planned to be developed in the classroom with a minimum duration of one to three classes. At the end of its application the student will have come into contact with a significant amount of information generated by the Internet.
- **Long WebQuest:** is a more elaborate project that can be carried out in the period of a week to a month and/or semester. Its goal is the extension and consolidation of knowledge.

Short and long term WQs are designed to make the best possible use of student and class time. There is no formula for the preparation of a WQ activity or blueprint for its creation and it does not necessarily need a Web page to be linked to it.

To build a WQ activity we need a level of computing skills ranging from basic to intermediate. According to Abar and Barbosa (2008) it can be developed with common software such as *Word*, *PowerPoint* or on paper, since the resources to be used by students are available on the World Wide Web, this being a *sine qua non* for the process.

The teacher who chooses to use WebQuest as a teaching strategy should choose a theme that promotes discussion to allow the approach of different perspectives and favours raising hypotheses, thus giving rise to a variety of interpretations. This is implemented by means of roles or characters that each assumes, allowing the group to offer possibilities of different representations to solve the same problem (ABAR and Barbosa, 2008).

According to the methodology presented by Bernie Dodge (1995) a good WQ should contain six core attributes, namely: introduction, task, process, resources, evaluation and conclusion, which should be distributed in a manner to give a coherent sequence to the work to be proposed, as defined below:

Introduction: The introduction of a *WebQuest* should be developed with the objective of making the subject matter that is to be worked attractive and curious. It should also mobilize the attention of students, providing sufficient motivation for them to be attracted to and encouraged to continue the investigation. In regards to the introduction of a *WebQuest*, Barato (2004) comments on the importance of establishing the objective of the activity to the student, as well as defining their role as a producer of something significant, the result of their knowledge, built through the execution of the task.

Task: The word task evokes an action, what is to be done, and, in a *WebQuest*, should be an action that results in a product that can be executed and obtained by students in the school environment (ABAR and BARBOSA, 2008).

Process: It is in the process that we will describe the type of methodology, i.e., the steps required to perform the task and assist the student in the construction of knowledge. It is also in the process that we must translate the dynamics of the activity - how students should be organized for the activity, i.e., in a group or individually (ABAR and BARBOSA, 2008).

Resources: The resources or sources presented in the *WebQuest* are links provided by the teacher for students to develop their tasks. The nodes (links to related sites) should be analyzed by the teacher with the intention of providing reliable and quality sources available on the network. If the subject matter requires it sources from other media may also be presented.

Evaluation: One of the most important attributes of a *WebQuest*, the evaluation should be presented clearly and with the intention of showing how the result of the tasks performed will be evaluated. The evaluation's principal objective is to make the student give feedback of the main points of the research leading them to detect what should be improved upon in their research throughout the knowledge building process.

Conclusion: The conclusion of a *WebQuest* has to be clear, brief and simple and its purpose must be the closure of the work showing the student the importance of the topic covered in their research, furthermore, it should be a stimulus for them to continue their learning.

To support the development of this teaching resource, several *WebQuest* type activities available on the World Wide Web were researched (SILVA, 2010). The objective was to familiarize and check the various settings and possibilities from other proposals. It is worth noting that we did find any *WebQuests* on the subject matter in question.

It is important to note that although the *WebQuest* strategy offers potential advantages from the educational point of view, there are some precautions that we should take into account when preparing this activity. In preparing the Biofuel *WebQuest* we realized throughout the construction process that overly outlining the attribute process (which is the route that students must follow) could make the activity, in a way, "infeasible." The teacher, therefore, should be aware of these issues when they choose to work with this resource in the classroom.

About the study

For the investigation on the *WebQuest* methodology we developed an activity on the study of biofuels in chemistry teaching designed for senior, afternoon class high school students in the municipality of Várzea Grande / MT (Brasil). The activity was created, evaluated[1] and referred to as Biofuel *WebQuest*.

The Biofuel *WebQuest* was prepared by the corresponding author with permanent monitoring of the teacher (research subject). All components of the activity were discussed by the study group Laboratory of Research and Teaching of Chemisty (LabPEQ), to ensure that the strategy, aside from being adequate, was also easy to perform, thought-provoking and challenging.

[1] The Biofuel WebQuest strategy was evaluated by thirty teachers of basic education in the state of Mato Grosso, regents of disciplines such as biology, chemistry, physics and mathematics. From the evaluation of teachers whose areas of expertise are natural sciences and mathematics we verified that the activity was considered satisfactory, and therefore, the Biofuel WebQuest strategy proposal could be made available online for application with senior high school students.

The *WebQuest* with the biofuel theme was developed through the implementation of a research project with senior high school students. Its goal was to determine the contribution of the activity for the teaching of chemistry. The biofuel theme was chosen due to two major potentials revealed by the state of Mato Grosso, biodiesel and ethanol.

The *WebQuest* activity was visited by students to carry out the task, and also for the development of research using the resources available on the Internet.

After its preparation, the Biofuel *WebQuest* underwent an initial assessment of the study group Laboratory of Research and Teaching of Chemisty (LabPEQ). This procedure was due to the concern that the strategy was adequate, if presented as being easy to perform, thought-provoking and challenging.

II. Results and discussion

The Biofuel *WebQuest* activity was applied specifically in a senior year high school class of 23 students who study in the afternoon period in the municipality of Várzea Grande/MT. Six chemistry classes were used for the implementation of the strategy. All six classes were undertaken in the computer lab as shown in Figure 01.

Figure 01 - Students and teacher in the computer lab

For the analysis of the data and use of the reports, the subjects involved in the research, comprised of one teacher and twenty-three students, were identified as: the teacher and the students as "S1", "S2", "S3" to "S29".

Upon completion of the Biofuel *WebQuest* activities, a semi-structured interview that aimed to analyze the contributions of the activities was held with the students and teacher.

Semi-structured interview: students

In the interview, questions were asked regarding what new knowledge of chemistry they gained through the use of the Biofuel *WebQuest* strategy; their opinion on the activity as well as if they understood the task to be done; if during the research they found the necessary resources to carry out the task; what they would change in the Biofuel *WebQuest* activity; if they needed more time to carry out the activity, what they liked/disliked about the *WebQuest* activity; if they felt motivated during the course of the activity, if they felt the teacher was motivated using *WebQuest*; if they would like the teacher to use another *WebQuest* again; how they would like chemistry classes to take place; and finally, how they would grade the Biofuel *WebQuest*. The criteria for the analysis and the choice of the students' answers were based on motivation, in comparison to the traditional lesson.

When asked about the opinion of the students about the activity one student said, "[...] *it is a different way of learning that is not only focused on the traditional and as such does not leave the student too stressed with the same thing every time, the same content* [...]" (S3).

In regards to traditional classes, Guimarães (2009) mentions that there are many criticisms of traditional teaching, above all else the passive action of the learner who is often treated as a mere listener of the information that the teacher explains. Much of the students' responses criticize traditional classes and thus the teacher must create opportunities for new experiences that allow for more active learning to occur without ignoring their prior knowledge.

In relation to what they would change in the Biofuel *WebQuest* activity students mentioned:

"*Evaluation*" (S1)

"*There could have been more time for us to set up the project*" (S2). Making it very clear that they would need more time carry out the activity

"[...]*in a month, a month and a little bit* [...] *we would set up a better model* [...]" (S2)

When asked about the possible positive and negative aspects in the *WebQuest* activity they mentioned that: "[...] *it was a learning experience, we learned about new sources of energy* [...]" (S6), they least liked "*presenting to the school* [...] "(S4).

Regarding the motivation of the students, they responded that they felt motivated stating that the activity:

"*gets away from the traditional lesson of staying in the classroom just the teacher and the students, in the computer lab we interact with the world* [...] *accessing the Internet*" (S2) and that:

"*We also chose, what we wanted to work on, the profession, the type of energy we would work on*" (S6). It was also asked if they felt that the teacher was motivated, to which they argued that:

"[...] *since she spoke about this project everyone was excited and she also showed excitement* [...]" (S4).

The *WebQuest* can be created with motivational elements that involve the basic structure of investigation, giving learners a role to be played by creating a fictitious personality with which participants will work (DODGE, 1999). During the observations and the statements of the students excitement was evident along with the involvement of students when they used the Biofuel *WebQuest* activity, especially when they read the task and the process and recognized that they should play the part of three different professions: chemist, environmental analyst and economist.

When asked if they would like to perform another *WebQuest* type activity, they all answered "*Yes*" and mentioned that:

"*No one can handle normal classes anymore, chemistry does not become so complicated in our heads. It becomes easier for us to understand*" (S2). When asked how they would like chemistry classes to be, they continued affirming that they wanted "[...] *more practical classes* [...]" (S2). On this issue addressed by students, Giordan (1999), in his article "The Role of Experimentation in Science Education", emphasizes:

[...] *experimentation awakens a strong interest among students of various educational levels* [...]. [...] *In their testimonies, students also tend to assign to experimentation a motivating, playful character essentially linked to the senses*.

The students also gave a grade to the Biofuel *WebQuest* strategy, with the value ranging from 8.0 to 10.0. From the application of the interview we found that the perspective of the students regarding the Biofuel *WebQuest* activity can be classified as satisfactory since they considered the strategy innovative, but would still like their classes to have more experimentation because according to the students the science lab is little explored in the school environment.

Semi-structured interview: teacher

A semi-structured interview was also conducted with the teacher responsible for using the Biofuel *WebQuest* strategy. The objective of the interview was to analyze the role of the activities proposed in the Biofuel *WebQuest* in the teaching of chemistry, from the perspective of the teacher. The same way we proceeded with the students, we started the interview highlighting the importance of the answers and the need for film footage, assuring that the teacher would not be identified.

To analyze the contribution of the Biofuel WebQuest strategy in the teaching of chemistry, the teacher was asked the following questions regarding: the teaching experience; the planning of the activity; the texts available on the Internet; the suggested sites for the research; the teaching time of the strategy; the learning and motivation of students; her own motivation; future changes to the strategy; the difficulties and ease in using the strategy; the pretensions of developing other *WebQuests* for the teaching of chemistry; contributions to the teaching of chemistry; the assignment of a grade to the strategy. The criteria used for the analysis of the interview and the teacher's responses were: planning, motivation, difficulty and possible contributions to the teaching of chemistry.

When asked about the experience, the teacher mentioned that it was of "*great value, the experience brings a deeper knowledge and // which can, over time, bring a broader knowledge provided there is interes*t."

Regarding the planning of the WebQuest activity, the teacher said it was "*well prepared even though we had a deadline according to the activity, it met the needs of the class. So I thought it was good*". Regarding the texts available in the activity she expressed that they "[...] *provided good understanding, and easily accessible // and presented a language* [...] [that was] easier *to understand, therefore yielding good results*". In regards to the suggested sites for the research she mentioned that she already knew some, "*I have had contact with these sites and I have even used some already*", and what she would change in the activity "*I would put more different research groups, more professions, beyond those that were presented*."

For Moretto (2007), planning is to organize actions. This is a simple definition, but it shows the importance of the act of planning, as planning should exist to facilitate the work of both the teacher and the student. Planning should be an organization of ideas and information. According to the response of the teacher she considered the planning adequate for the studied class.

Regarding her motivation and that of the students, the teacher responded, respectively:

"*I felt very motivated, **I intend to use it again***" (**emphasis added**)

"[...] *you moved the classroom to the computer lab, things like that are of their generation and in addition, they knew all the mechanisms of activity. So I found it excellent*."

Kenski (2003) says that the motivational process, however, is not something external that is imposed on people. It is the inner energy that leads us to the realization of our aspirations, even when we do not realize them. In the teacher's response it became clear that the Biofuel *WebQuest* activity is a means that can awaken the student for the teaching of chemistry, once we move the classroom to a computer lab and use the Internet which is already part of the student's experience as a resource and teaching space. When we deal with educational technology, school is an environment that reflects the social and cultural relations experienced by the subjects. In school, therefore, the computer must be a tool for which the students should have easy access just as they do for other resources in the classroom in order for it to be an element capable of guaranteeing power and freedom without constraints.

As is known, the computer arouses the most varied reactions in people. Some adults view it with skepticism, fear and, not infrequently, as a potential enemy. Most young people, however, react differently because they view it with curiousity, naturalness and, frequently, with much enthusiasm. Young people generally have their first contact with the computer through Internet games, bringing to light the normal curiosity about its functioning followed by the search to explore its various possibilities. In this sense, the teaching of chemistry via the *WebQuest* strategy is potentially facilitated, in reference to the interests of students and the motivation for the development of the proposed tasks. Perhaps this helps to explain why the teacher was able to perceive a greater interest in students in classes during the application of this methodology.

The teacher reported on the difficulties and ease of use with the activity in the teaching of chemistry, reporting that the main difficulties were:

"*The number of computers in the computer lab* [...] *is not sufficient to develop the tasks. So they were usually sitting in threes or fours when there could have been one for each*." As for the ease of use she explains "*one that is highlighted is research on the Internet*."

Taking on the use of digital technologies in education by schools requires that such institutions are prepared to make considerable investments in equipment and above all else, are able to facilitate conditions of access and use of these machines (Kenski, 2003). The main difficulty for the execution of the activity presented by the teacher was the infrastructure of the computer lab, but she sidestepped this problem so that her students had access. This arrangement is part of one of the five rules for writing a large *WebQuest* (Dodge 2001).

In relation to the possible educational contribution(s), the teacher reported:

"*Well, first it is the experiences of the students in their daily lives and then the use of knowledge, its construction, second is the **research** where students are not lost on other sites, third is the **union of theory with practice** because we have various contents that are very abstract, so we're breaking apart the traditional and then **working in groups** which the students are very fond of*" (**emphasis added**).

In relation to the work done in groups, Abar and Barbosa (2008) claim it is a way to actualize cooperative learning, since they are moments in which the interaction and collaboration among the members of the group occur through joint actions that guarantee a positive interdependence (no one will succeed unless they all succeed) in addition to individual responsibility. A pedagogical approach, therefore, that values cooperative and collaborative learning depends on teachers and administrators in education, as they should become sensitive to creative and challenging projects.

WebQuest, as an educational tool for teaching, has proven to be an interesting activity since the students are motivated to solve problems and situations and use computers and the Internet. These perspectives are expanded in the search for a more meaningful education of the subject in our time (and HERDD BRANDT, 2008). Abar and Barbosa (2008) state that the successful completion of the *WebQuest* activity depends on the ability to relate concepts and principles, generating new changes within the classroom, being a mechanism for effective learning, providing favorable meaningful, collaborative and cooperative learning, which, according to Dodge (1999), are fundamental pillars of this methodology.

In her responses the teacher said the Biofuel *WebQuest* activity can contribute to the teaching of chemistry, through research, teacher-student interactions, relations of theory with practice and through group work.

Final Considerations

In order to understand the testimony of both the teacher and her students who participated in this work, we sought various readings and reflections arising from the literature used and analysis of application of the *WebQuest*. From this source of information it was possible to see the importance, initially, of a clear understanding of what is "research" and its role in education so that any action which has aims to use information and communication technologies in educational practice can be promoted.

Interviewing the students revealed that the *WebQuest* was "something different" because it provided space for questions, reflections and group discussions. Such practices, properties of *WebQuest* activities, are very different from today's traditional activities in everyday school life.

The teacher, who was the research subject, clarified that the possible contributions that the *WebQuest* activity can bring to the teaching of chemistry are: teacher-student interaction and relations of theory with practice and group work. The Biofuel *WebQuest* can indeed, therefore, contribute to the teaching of chemistry as it requires research, teacher-student interaction, relations of theory with practice and work in groups. Furthermore, we saw the trial arouse a strong interest in students and this should be explored and implemented for the effective advancement of the teaching of science.

From this research we hope to contribute to the understanding of the *WebQuest* activity as part of a process of promoting learning in all areas of knowledge. In the present research, however, we intensified its importance for teaching chemistry, since it has been the subject of few studies and research regarding the use of the *WebQuest* strategy.

References

[1]. ABAR, Celina A.A.P.; BARBOSA, Lisbete M. B. (2008). *WebQuest a challenge for the teacher! A smart solution for Internet usage.* São Paulo: Avercamp.

[2]. BARATO, J. N. (2004). *El Alma de las WebQuest. Quaderns Digitals – Revista Nuebas tecnologias y Sociedad*. Retrieved April 18, 2016, from http://www.quademsdigitais.net

[3]. BOGDAN, Robert; BIKLEN, Sari. (1991). *Qualitative research in education: an introduction to theory and methods*. Portugal: Porto Editora.

[4]. DODGE, Bernie. (1995). WebQuests: A Techinique For Internet – Based Learning *The Distance Educator*, v. 1 (2), 10-13.

[5]. DODGE, Bernie. (2001). Taskonomia: Focus: Five Rules for Writing Great WebQuest, *Learning & Leading with Technology*, v. 28 (8), nº8, 2001

[6]. GIORDAN, Marcelo. (1999). The role of Experimentation in science education. *Química Nova na Escola*, no. 10, November 1999, 43-49.

[7]. GUIMARÃES, Cleidson C. (2009). Experimentation in Chemistry Education: paths and dead end towards meaningful learning. *Química Nova na Escola*, no.3 (31), 198-202.

[8]. KENSKI, Vani Moreira. (2003). *Technology and Face-to-face and Distance Education*. 2.ed. São Paulo: Papirus.

[9]. MORETTO, Vasco Pedro (2007). *Planning: planning education for skills development*. Petrópolis, RJ: Vozes.

[10]. MOSÉ, V. (2013). *School and contemporary challenges.* Rio de Janeiro: Editora Civilização Brasileira.

[11]. SIBILIA, P. (2012). *Nets or Walls. The school in times of dispersion*. Rio de Janeiro: Contraponto.

[12]. SILVA, Marcio Barbosa. *The Spatial Geometry in high school from the WebQuest Activity: analysis of an experiment*. Master thesis. Pontifícia Universidade Católica de São Paulo, São Paulo, 2006.

[13]. SILVA, Ana Carolina Araújo da. *Chemical teaching via internet: an experiment with the methodology of the WebQuest.* Master thesis. Universidade Federal de Mato Grosso, Mato Grosso, 2010.

Ana Carolina Araújo da Silva, Irene Cristina de Mello".The WebQuest Methodology in the Teaching of Chemistry: the Experience of a Teacher and Her High School Students.." IOSR Journal of Research & Method in Education (IOSR-JRME) , vol. 8, no. 3, 2018, pp. 44-50.