A Webquest for Alkali Metals – Guided Information Search, Structuring and Presentation

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Abstract

Pupils of almost all ages increasingly watch videos on the internet with scientific content to complement their regular science class as well as to entertain themselves in their spare time [1,2]. This interest can be used to didactically motivate them to get involved in scientific issues and to promote a critical approach to medial representations. In our contribution, we present a media didactic concept which focuses on a critical reflection of chemistry related representations in the mass media like television or YouTube videos. With the example of the reaction of alkali metals with water, presented by the infotainment group 'Brainiacs' [3], pupils are guided to analyze the course of these reactions, finally identifying the violence of the reactions as a fake. The latter is accomplished by a comparison of the Brainiacs video with a reliable video dealing with the same topic published by scientists of the University of Nottingham [4]. For a methodical understanding of the concept, a WebQuest (WQ) was designed which is presented in some detail. In addition to the critical reflection, the WQ enables pupils to independently gather, structure and evaluate information about properties of alkali metals on selected webpages and in videos. To facilitate communication skills, the results of the WebQuest are presented and discussed in a subsequent panel discussion. Students take on the roles of scientists, infotainment producers, program editors, teachers, adolescents or the audience respectively.

1. Introduction

Popular science broadcasts such as 'Galileo', 'Clever' or the 'Myth Busters' are known to students of almost all ages and are perceived by them with interest [1,2]. A clear and intelligible explanation of everyday phenomena and questions like the origin of magnetism, the dyeing of denim, the function of food additives or the origins of the 'Acid Lake' in the Indonesian Kawah Ijen Volcano are characteristic topics for these programs. An analysis of the audience shows that 16.3 % of the 1.43 million viewers of the program 'Galileo' are between 14 and 19 years old [5]. In addition to these classic television programs, internet videos with scientific contents are also increasingly watched by this age group in their free time and as a support to their class [2]. For instance, the video used in the following teaching example from the British Infotainment Group 'Brainiacs' about the reaction of alkali metals with water has been watched over two million times on the video platform YouTube (01/10/2014) and commented as: '*this really got the point across... I [will] link to this video at Test Boost Inc. to help my students learn about alkali metals*', '*lithium! Burning books! Sounds like chemistry is fun!*' or '*epic video*!' [3].

2. Objectives

The aim of the present project is to take didactical advantage of the pupils' interests in the media and in scientific content in order to motivate them for chemical issues and to promote a critical approach to media representations. To conduct this, we present a concept providing online resources for experiments to schools that would otherwise be impossible to show due to safety reasons, such as the reactions of alkali metals. Consequently, a WebQuest was designed enabling students to independently gather, organize and evaluate information on alkali metals from videos and texts on preselected pages. A guided comparison of the chemical content of various websites shows students how a critical approach of the representation of chemical phenomena in the media can be conducted.

While the chemical and physical properties, *e.g.* density, hardness, reactivity with oxygen, of lithium and sodium can be examined in schools, higher alkali metals are too dangerous to experiment with in the classroom. Often, the properties of these higher alkali metals are shown using literature or internet resources. Numerous search engines provide an easy accessiblity for the wide variety of information on the Internet. For students, this vast amount of information can lead to disorientation, also known as 'Lost in Hyperspace', or information overload. In addition, the information found on the internet is rarely questioned critically. Therefore, WebQuests promote a confident handling of new information and communication media, which nowadays is essential in many areas of everyday life. A didactical reduction of information by limiting and selecting resources for students counteracts the possible disorientation of students.

3. Structure of the Alkali Metals WebQuest

The WebQuest on alkali metals is oriented on the classical structure according to Dodge [6] and therefore composed of the following sections: introduction, task, process, sources, guidelines for presentation and evaluation (Fig. 1).

Figure 1. Screenshot of the WebQuest on alkali metals.

The introduction provides an access to the topic and should enhance the students' motivation to participate. In the following, an overview is given about the WebQuest contents including spectacular reactions of higher alkali metals with water, which cannot be carried out in class for safety reasons. There are four assignments of the WebQuest which are listed in the section 'Tasks'. These tasks help the students to analyse and to evaluate the chemical contents as well as its media portrayal on the given websites. The first two tasks instruct students to search for and compare the properties of alkali metals as well as their reactions by means of internet videos and informational texts. The goal of the first activity is to table physical properties such as density, hardness and melting point of the alkali metals. Then, using the table students should describe trends within the family of alkali metals, *e.g.* the decrease in hardness or the increase in density with ascending atomic number. Integrating these physical trends and their knowledge about the chemical properties of alkali metals, *e.g.* the reaction with water and oxygen, students should be able to explain why these elements are denoted as a 'family'. In the third task, students compare two videos in which the reaction of rubidium with water is shown. One video was published by the infotainment group 'Brainiacs' and the other by scientists of the university of Nottingham. Students receive precise instruction for the analysis of the video such as to pay attention to the amount of reactant in comparison to the violence of the reaction. By this comparison, students should be able to conclude that within the 'Brainiacs' video special effects to increase the intensity of the reaction were used. As a result, the credibility and professionality of the

‘Brainiacs’ suffers through the use of pseudo-technical elements (Fig. 2) and students should recognize that the program follows entertainment purposes.

Figure 2. Image cut-outs from the internet video on the reaction of alkali metals with water by the infotainment group ‘Brainiacs’. Here, the audience is conveyed that the reaction of 2 g of rubidium with water was fierce enough to ‘blow up a bathtub’ (top right). The intention of ‘Brainacs’ to make science exciting and entertaining is displayed by the symbolic burning of a ‘boring science video’ (bottom right) [7].

In the fourth part of the assignment, students draw general conclusions about the possible effects that these types of science representations could have on a (non-critical) audience. Here, possible consequences might be the acquisition of false knowledge leading to an incorrect behavior in everyday situations, a loss of confidence in media or the cause of excessive fear. Based on the information acquired through the tasks, students should plan and perform a panel discussion on the theme ‘Science, Media, Entertainment - What Responsibilities Have the Participants?’. Possible roles students can take in this activity are scientists, infotainment producers, program editors, teachers, adolescents or the audience respectively. The section ‘Process’ provides the students with a structure and organization for their work in groups. These include for example grouping, role assignment, instructions about the order of the tasks and help on how to structure and organize the results. The required materials for the implementation of the WebQuest are provided in the section ‘Sources’. The materials are marked clearly so that students can quickly assign the material to the corresponding task. Furthermore, the WebQuest is designed for both high-performaning and deficiant students or learning groups.

4. Conclusions and Implications for Teaching

The present WebQuest was designed to be used at various stages of alkali metal teaching units and it can also be implemented in different manners. More concretely, the WebQuest unit could be used after having experimentally summarized some chemical and physical properties of lithium and sodium with the help of students. Subsequently, the WebQuest can further be used to introduce the higher alkali metals on a phenomenological level, followed by focusing the theoretical background of the reaction at the particle level. Besides the formulation of chemical equations (*e.g.* reactions of alkali metals with water, oxygen or ethanol), this theoretical background could also comprise an introduction of the mole concept. For a problem-oriented approach, selected elements from the WebQuest, such as the ‘Brainiacs’ video, can be used to pose the question of how much hydrogen is released in the reaction of 2 g of rubidium with water.

Finally, the presented WebQuest offers multifaceted methodological possibilities teaching students to question the authenticity of videos and information, to always critically reflect any information from the media and to differentiate between reliable and unreliable sources.

References

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