

Barbara Michałek-Piernik

barbara_mp@wp.pl

Regional Center for Improving Teachers' Professional Skills in Bielsko-Biala

ORCID iD: 0000-0002-5590-9751

COMMUNICATION BETWEEN A CHEMISTRY TEACHER AND ELEMENTARY SCHOOL STUDENTS WITH THE USE OF A SUBJECT-DEDICATED WEBSITE

*The one real object of education is to
have a man in the condition of continually asking questions.*

Mandell Creighton

Introduction

Education of the so-called network society has fundamentally influenced the way people communicate. We are participants in the construction of a new civilization, which brings a new lifestyle in which information and communication technologies are cognitive fields that support human learning and teaching (Sysło, 2002, p. 172). Knowing them is today an indispensable part of everyone's life, especially that they function as integrated interactive media (Monet, 1999, p. 8). Internet – a model interactive medium – has become an important and comfortable social space of a modern student, enabling them to reach multi-format information in the form of text, sound, graphics, animation, video; all these become for students a valuable source of inspiration, exploration and discoveries.

In the subject literature, we often find statements that in the context of these transformations, it is justified to speak about new principles of social life.

Today, information technologies are closely connected with the concept of multimedia education. They are identified with methods and techniques of communication in the area of creating, storing, selecting, transmitting and sharing information. They determine the pace and level of development and have a significant impact on structural and social changes, which is largely determined by the speed of sending, searching and processing information. They influence the individual's activity and way of thinking by improving the techniques of collecting, processing and generating information – they change the social structure and create the information society. (Skibska, 2014, p. 380)

Multimedia, being a tool for mutual communication, has been considered a “system of scientifically justified recommendations for teaching practice [...], modern education technology has become [...] – applied didactics, which is based on general didactics, closely related to detailed (subject-related) methods as well as [...] to a multimedia information system” (Bednarek, 2006, p. 92).

The revaluations taking place in our culture cause the domination of the culture of the word to cease in favour of the image culture. In the case of people communicating only on the textual level, on the one hand, we have to deal with the impoverishment of their interaction, but on the other – with the strengthening of concentration on the transmitted text. Although the Internet is not replacing direct communication, it maximizes it.

Changes in a student's behaviour are the effect of the progressing social transformations, which means that if teachers want to be able to follow their students, they must become more active in the virtual space. In the era of progressive computerization of the society, it seems reasonable that each teacher runs a website. Therefore, subject-dedicated websites are established, and entire portals are created to exchange experiences, materials, teaching aids, as well as publications, studies and class scenarios.

“Multimedia is a means of acquiring knowledge and skills through various activities, in accordance with the theory of multilateral education – intellectual, practical and emotional, which we identify with different types of learning – through noticing and solving problems, acting and experiencing” (Skibska, 2014, p. 382). Multimedia educational programs launch many information tracks in the form of static and dynamic images, and all this is to serve both: the transfer of information and communication with students. Teachers can be closer to their students, in their natural environment, but

must use new media and use students' natural skills in moving around the digital world. Students use the popular YouTube channel to watch videos with chemical experiments, which they often discuss with each other; they also make attempts to investigate their course and experiment outside the school. Also for the teacher, YouTube is an attractive teaching support medium that provides a wide base of videos. Therefore, the teacher uses facts because they know that from the pedagogical point of view, with appropriate treatments, they can positively influence the improvement of the student's higher cognitive processes, i.e. analysis, synthesis and evaluation, which are necessary for teaching a given subject.

To encourage students to become interested in a new field of science, the author of the article used communication with students via the Internet as a tool supporting and motivating this process. Even though in its current version, the website serves only as a source of information, students visit it willingly. However, it is intended to be so extensive that it becomes a widely understood modern educational tool.

To make this possible, working on the concept of expanding the website, the author decided to check whether her plans coincide with students' expectations, mainly in the content-related aspect and planned technical facilities of the service. Furthermore, she also wanted to check whether the effort put into running the website translates into the motivation of students to deepen their knowledge in the field of chemistry.

The assumption on which the project has been built is to create a platform related to one subject, having one administrator – a chemistry teacher who uses it to motivate students to learn about chemistry. In accordance with the assumption, students are the recipients, but ultimately also co-authors of the website content. Depending on the administrator's decision, individual students, their groups or task teams may be able to publish content in specific categories.

The developing online system that motivates students to gain knowledge in the field of chemistry in an elementary school aims to:

- a) create a knowledge base in the following areas: a database of chemical experiments along with necessary instruments (in accordance with the new curriculum and the requirements defining the detailed scope of knowledge and skills), hypertext reference database and a database of downloadable files in the form of visualizations and animations;
- b) train distance work skills;

- c) expand the area of contact with the teacher by publishing the contents and possibility of communicating with them via the Internet (discussion forum or e-mail).

It is planned that the website will be divided into parts that are compatible with the chemistry material distribution in grades 7 and 8 of an elementary school, in accordance with the new core curriculum for general education in chemistry at the second stage of education, in force from the school year 2017/2018. According to the recommendations for its implementation “in teaching chemistry at the stage of elementary school, it is important to find time to carry out chemical experiments. In order to make education in the field of chemistry as effective as possible, classes should be conducted in not too big groups (division into groups) in classrooms equipped with necessary equipment and chemical reagents” (<https://www.ore.edu.pl/wp-content/uploads/2017/05/chemia.-pp-z-komentarzem.-szkola-podstawowa.pdf> [accessed: 19.10.2018]).

Chemistry teachers know the guidelines for the implementation of the chemistry curriculum, but do not decide on the size of classes or dividing students into laboratory groups. They have also limited impact on equipping the chemistry classroom with proper instruments and reagents. Therefore, they decide to organize the didactic process in such a way that students can experiment on their own during classes (and not just watch the course of selected experiments on the YouTube channel). The project's goal is to provide individual students (each student at least once per semester), by selecting the appropriate experiment card from the experiment database or developing their own experiment instructions, with the opportunity to present their homework during chemistry class on the class forum. The students' elaborated materials would also be posted on the website, thanks to which the base of experiments, which can be downloaded by other peer students or next year students, would systematically expand.

It has been assumed that in the main part of the website is a list of further lesson topics associated with the sets of chemical experiments – to download and use. In addition, in order to show the presence of chemistry in the environment, the teacher, while conducting or assigning experiments should use substances familiar to students from everyday life (e.g. vinegar, flour, sugar, salt, oil, paraffin). The intention of the author of the project is to provide students with joyful and safe play while learning and to create a situation and a habit of asking questions (inquiries). “The assumption of the core

curriculum is not to emphasize the importance of the performed experiment, but rather of its use for the purpose of an in-depth analysis of the processes that accompany it” (<https://www.ore.edu.pl/wp-content/uploads/2017/05/chemia.-pp-z-komentarzem.-szkola-podstawowa.pdf> [accessed: 19.10.2018]).

The basic communication platform between the teacher and students is to be a discussion forum and e-mail; it has been also intended to introduce an automatic notification system for new content.

The main objective of the author of the project is to make this website an element of pedagogical practice.

Computer technology should become a set of cognitive tools, and the school should create conditions for students to acquire knowledge and skills needed to solve problems using methods and techniques derived from computer science, including logical and algorithmic thinking, programming, use of computer applications, searching and using information from various sources, using a computer and basic digital devices [...]. (<https://www.ore.edu.pl/wp-content/uploads/2017/05/chemia.-pp-z-komentarzem.-szkola-podstawowa.pdf> [accessed: 19.10.2018])

Description of the conducted research

In a situation where a chemistry teacher is looking for an optimal way of communicating with students, encouraging them to explore chemistry-related issues – and the Internet creates such a chance – there is a need to conduct a research in the field of pedagogy, check whether the planned development of the website, including didactic means in the form of visualizations and animations and the experiment database together with the necessary instruments, will improve the students’ higher cognitive processes.

The following research problems were formulated:

1. Whether and to what extent the planned development of the website corresponds to the expectations of students in terms of its content and planned technical facilities?
2. Whether and to what extent the teacher’s communication with students through the subject-dedicated website is appreciated by students and motivates them to explore their chemical knowledge?

A diagnostic survey method, a technique for gathering information consisting in completing a questionnaire, was selected for the study. The choice of the

survey technique was dictated by the following conditions: the quantitative nature of the research carried out and the fact that, unlike the interview technique, this method allows the respondents to remain anonymous. This is important because the questionnaire also deals with the teacher's activities, which could result in providing false answers to keep the teacher satisfied. The author of the study made an effort to make the questionnaire as simple and transparent as possible, covering all the problems that interest her. The majority of asked questions were closed-ended questions.

The study was conducted in 2018. The surveyed population are students of an elementary school located on the outskirts of the city. 62 students participated in the research, almost equally big groups of boys (49.4%) and girls (51.6%)

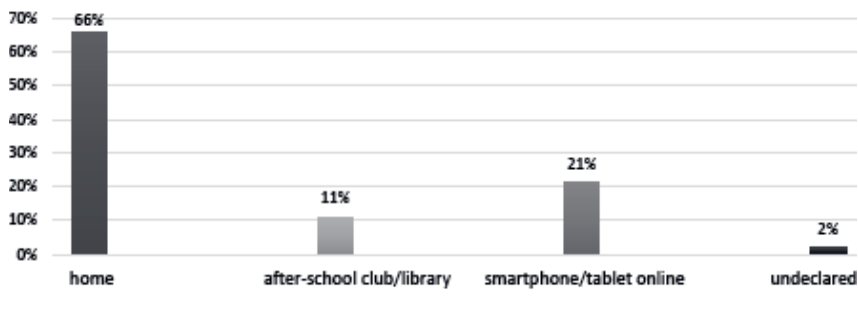


Figure 1.

Place of the Internet use (in %).

Source: the author's own research.

On the basis of the questionnaire it was found (graph 1) that 66% of the students use the Internet at home, 11% of the respondents use it at the after-school club/library, 21% of the students use it on a regular basis via a smartphone/tablet; whereas 2% of the respondents did not declare their place of using the Internet. None of the respondents indicated friends' homes/Internet cafes as a place of using the Internet.

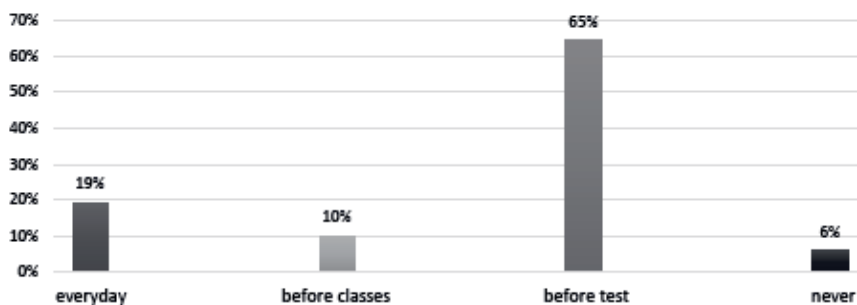


Figure 2.

The frequency of visits to the subject-dedicated website.

Source: the author's own research.

The website address is known to 95% of the respondents, and only 5% of the respondents do not know this address. Each day (graph 2), the website is visited by 19% of the students, 10% of the respondents visit it before classes, while 65% of the respondents declare to visit the chemistry-oriented website before each test. Meanwhile, 6% of the students do not visit it at all, stating that they prefer spending time differently (e.g. through other forms of using the Internet).

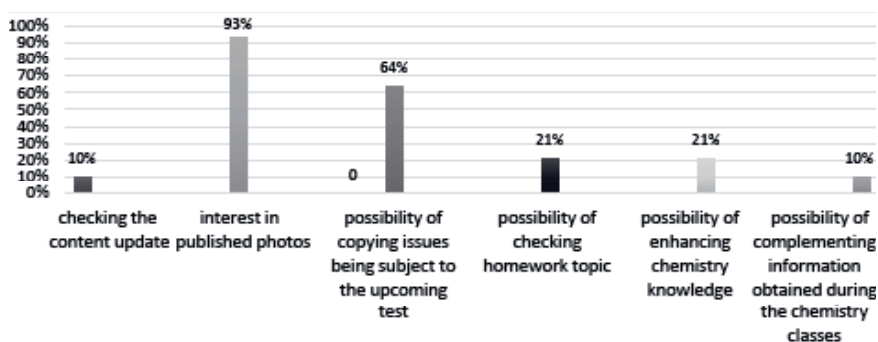


Figure 3.

The purpose of visits to the subject-dedicated website.

Source: the author's own research.

Checking if there is new content on the website is declared by 10% of the respondents (graph 3), and 93% of the students enter it because they are interested in the posted pictures. Among the respondents, 64% of the students consider the possibility of copying issues that are subject to the upcoming test the reason to visit the website, whereas for 21% of the students the homework subject is the reason for entering the website. In this way, 21% of the surveyed students broaden their knowledge, and 10% see the possibility of completing the information gained during the classes (values do not amount to 100% due to the possibility of choosing more than one answer).

For 95% of the respondents, the subject-dedicated website is motivation to explore chemical issues (the level of declaration: rather yes – 74% of the respondents, definitely yes – 19% of the respondents). The website is not considered to motivate to explore chemical issues by 6% of the surveyed students.

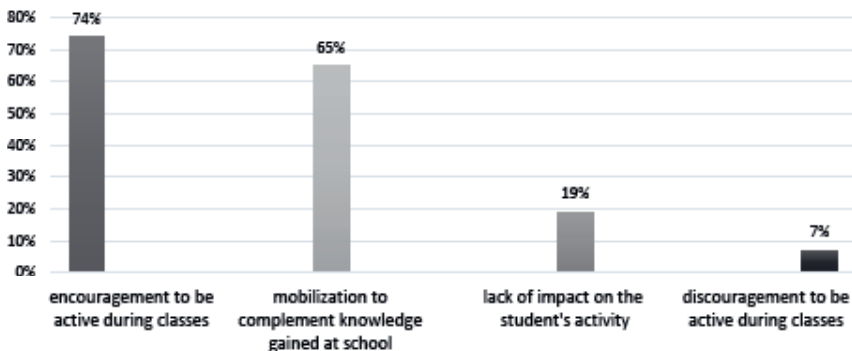


Figure 4.

The effect of visits to the subject-related website.

Source: the author's own research.

74% of the respondents treat information posted on the website as an incentive to be active during the chemistry classes (graph 4), and for 65% of the students, it is also an incentive to broaden the knowledge in the field of chemistry obtained at school. Meanwhile, according to 19% of the respondents posted information does not affect their activity during the classes, and 7% of the respondents declare that they are discouraged to be active during the classes.

At this point, the possibility to communicate with the teacher via the Internet is declared by 54.84% of the respondents. Whereas, 45.16% of the surveyed students admit not to use this option of communication with the teacher.

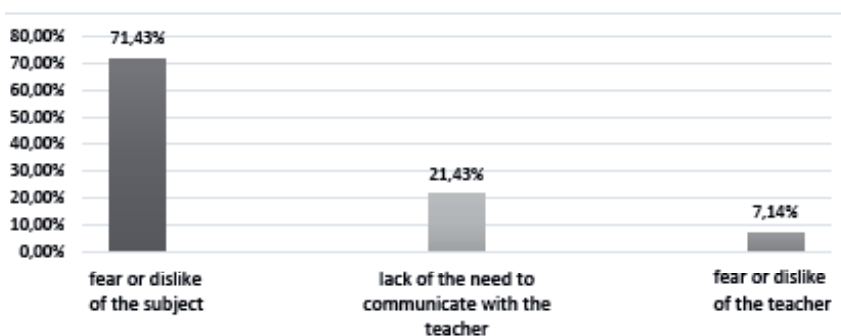


Figure 5.

The reasons for the lack of Internet communication with the teacher.

Source: the author's own research.

Among the surveyed students who did not communicate with the teacher via the Internet, 71.43% declared fear or dislike felt toward the subject the reason for not visiting the website (Graph 5). No need to communicate with the teacher declares 21.43%, and the dislike and fear of the teacher are revealed by 7.14% of the respondents.

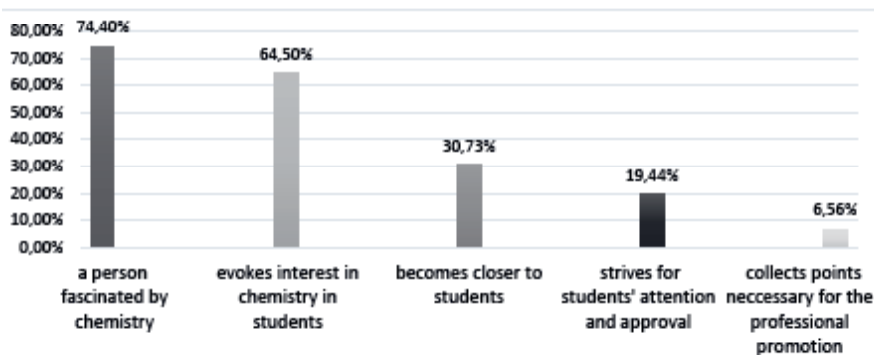


Figure 6.

Students' opinions about the teacher communicating electronically with them.

Source: the author's own research.

The students, when asked about what they think about the teacher who communicates with them via the subject-dedicated website and e-mail (graph 6), answered that she is a person who is fascinated by chemistry (74.40%) and tries to arouse interest in the taught subject in her students (64.50%). In the students' opinion, the teacher is closer to them because they use the same means of communication – 30.73% of the respondents. For 19.44% of the surveyed students, the teacher communicates in this way, because she tries to get their attention and approval, and 6.56% of the respondents think that the website has been created by the teacher only to collect points necessary for her professional promotion.

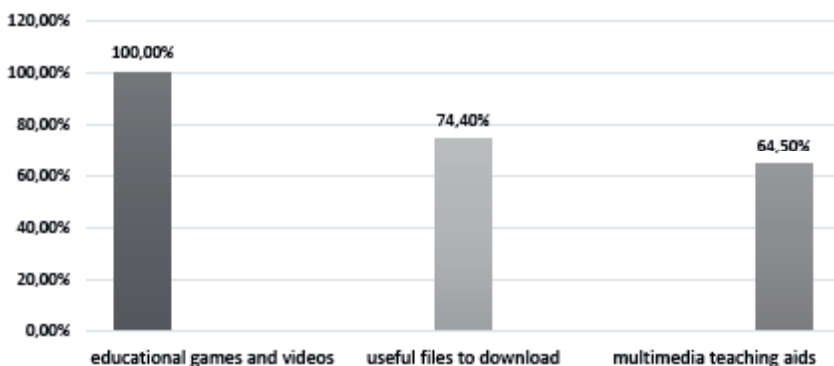


Figure 7.

The most important elements of the website according to the students.

Source: the author's own research.

During the study, the students also indicated the elements that should be included in the website (graph 7): 100% of the respondents pointed to educational games and videos, 74.40% – download files, including chemical experiments to prepare for chemistry classes along with the necessary instruments, 64.50% – didactic means in the form of visualizations and animations, as well as links redirecting to valuable pages devoted to selected issues in chemistry. Among other elements that should be included in this website, students mentioned: a discussion forum, the ability to complete a homework task and establishing of a database of users of the online system supporting learning chemistry.

Based on the conducted surveys, there have been formulated conclusions which, due to the small research group, refer only to it and cannot be generalized:

1. The students' expectations regarding the subject-related content of the website and the planned technical facilities are in line with the assumptions adopted by the teacher. Teaching supported by the website triggers positive emotions in students and stimulates them to show their own initiative. The students expressed their willingness to get involved in the creation of the website and indicated the media by which it should be expanded (multimedia, multimedia presentations, videos, simulations and educational games). Regardless of the reasons and frequency of using this website, students perceive it as a useful source of knowledge and postulate that it should include a downloadable set of experiment cards along with a list of necessary instruments so that they can prepare their experiment presentation and discuss it in the classroom with their classmates.
2. Students appreciate the opportunity to contact the teacher outside the school walls, it is important to them because the teacher seems to be more easily accessible – mainly through the use of the same communication tool. The fact that the student like their teacher also translates into greater interest in the subject and the willingness to meet the requirements, which is why the students emphasize that it is important that the teacher contacts them via e-mail and online forum.

Conclusion

Plato argued that writing destroys the direct dialogue between the student and the teacher, which should be the foundation of education. Disputing with Plato, one can point to the fact that not the verbal exchange of information, but the form of this exchange determines educational values. As sometimes the teacher present in the classroom may be more pedagogically away from a teaching teacher than the designer who leads online group work. "A modern student lives on the border between the real and virtual world. A digital teacher, noticing both these worlds, uses them in everyday work to conduct classes in an interesting way" (Nowicka & Dziekańska, 2018, p. 56).

Depending on the pedagogical theory that is closer to the teacher, computer technologies can be introduced into education in two ways. The first of these, when the teacher is inclined toward the behavioural psychology, is only a change of tools and the treatment of computer technology as a new element enriching a set of instruments to support the teaching process; the pedagogical

process itself remains unchanged in this case. Teaching is then understood as a pedagogically conditioned process of information transmission, and present in it educational technologies are its transmission tools. On the other hand, the introduction of computer technology can change the pedagogical process qualitatively, provided that the teachers adopt the constructivist approach and understand pedagogy as a process of creating conditions for learners enabling them a targeted, active and social building of knowledge.

Therefore, the success of the integration of computer technology with pedagogical practice depends mainly on giving technology a transformational character and on the perception of technology as an agent of educational changes. Computer technologies should become a set of cognitive tools and should not be treated only as tools for the collection, storage and transmission of information. (http://edu.pjwstk.edu.pl/wyklady/ele/scb/2_Teoria_elearningu.htm [accessed: 19.10.2018])

Therefore, it seems necessary for teachers to use the latest achievements of neurodidactics, a didactic sub-discipline defined as “teaching and learning in a way that is friendly to the human brain” (Maigret, 2012, p. 415–426). Students are able to process only the content they understand, and the essence of learning is not to remember information but to transform it into useful knowledge. “The most important is to determine the criteria for the selection of educational material so that to optimally stimulate the brain activity of learners. As the great goal of education is not knowledge, but action [...]” (Maigret, 2012, p. 223). “Knowledge, therefore, cannot be transferred, acquired or obtained – it must be built on the basis of previous knowledge and new experiences and, finally, it must be socially negotiated” (http://edu.pjwstk.edu.pl/wyklady/ele/scb/2_Teoria_elearningu.htm [accessed: 19.10.2018]).

Chemistry is not among the popular subjects at school and many students fear it. Since an important function in its teaching, as a natural science subject, is a chemical experiment, it is worth expanding the didactic instruments in this direction, and this is possible thanks to Internet communication. The experience gained by the author seems to confirm that computer technologies can be an ally in building knowledge.

References

- Bednarek, J. (2006). *Multimedia w kształceniu*. Warszawa: Wydawnictwo Naukowe PWN.
- Maigret, E. (2012). *Socjologia komunikacji i mediów*, trans. I. Piechnik. Warszawa: Wydawnictwo Oficyna Naukowa.
- Monet, D. (1999). *Multimedia*, trans. P. Latko. Katowice: Wydawnictwo Książnica.
- Gruszczyński, L.A. (2002). *Elementy metod i technik badań socjologicznych*. Tychy: Śląskie Wydawnictwa Naukowe Wyższej Szkoły Zarządzania i Nauk Społecznych.
- Nowak, S. (1985). *Metodologia badań społecznych*. Warszawa: Państwowe Wydawnictwo Naukowe.
- Nowicka, M. & Dziekańska, J. (eds.). (2018). *Cyfrowy Tubylec w szkole – diagnozy i otwarcie*, t. 1. *Współczesny uczeń a dydaktyka 2.0*. Toruń: Wydawnictwo Adam Marszałek.
- Nachmias, D. & Frankfort-Nachmias, Ch. (2001). *Metody badawcze w naukach społecznych*, trans. E. Hornowska. Poznań: Zysk i S-ka.
- Pilch, T. & Bauman, T. (eds.). (2001). *Zasady badań pedagogicznych. Strategie ilościowe i jakościowe*. Warszawa: Żak.
- Skibska, J. (2014). Nowoczesne technologie multimedialne w edukacji dziecka w młodszym wieku szkolnym. In: D. Morańska & K. Wójcik (eds.), *Multimedialny wymiar edukacji* (p. 379–390). Dąbrowa Górnicza: Wydawnictwo Naukowe WSB.
- Sztumski, J. (1999). *Wstęp do metod i technik badań społecznych*. Katowice: Wydawnictwo Śląsk.
- Sysło, M. (2002). Multimedia w edukacji. In: *Media a edukacja w obrębie integracji. IV Międzynarodowa Konferencja, Poznań, 20–23 kwietnia 2002. Program i tezy*. Poznań: Wydawnictwo eMPI2.

Legal acts

- The Act of December 22, 2015 on the Integrated Qualification System (Journal of Laws of the Republic of Poland of 2016, item 64).
- Regulation of the Minister of National Education of 14 February 2017 on the core curriculum for pre-school education and the core curriculum for general education in primary schools, incl. for pupils with moderate and severe intellectual disability, and for general education in first-grade sectoral vocational schools, general education in special schools preparing for employment, and general education in post-secondary schools (Journal of Laws of the Republic of Poland of 2017, item. 356).
- Regulation of the Minister of National Education of 28 March 2017 on the outlined timetables in public schools (Journal of Laws of the Republic of Poland of 2017, item 703).

Online articles

http://edu.pjwstk.edu.pl/wyklady/ele/scb/2_Teoria_elearningu.htm.

<http://www.kopernik.org.pl/news/n/zapowiedz-pracowni-przewrotu-kopernikanskiego-o-nowym-przedswieziciu-edukacyjnym-centrum-na/>.

<https://www.ore.edu.pl/wp-content/uploads/2017/05/chemia.-pp-z-komentarzem.-szkola-podstawowa>.

COMMUNICATION BETWEEN CHEMISTRY TEACHER AND PRIMARY SCHOOL STUDENTS USING THE SUBJECT WEBSITE

Summary: Author of the text is looking for the optimum way of communication with the students which motivates them to explore chemical issues and break the reluctance to the subject. As a tool that supports chemistry teaching wants to use the Internet. The research was of a cognitive nature and the method was a survey.

The purpose of the article is to show:

- 1) optimum way of communication chemistry teacher with the students of primary school which affecting the improvement of the student's cognitive processes,
- 2) students expectation about substantive content of the subject website and other technical facilities,
- 3) opportunities to build knowledge through interactive media which are natural and attractive for the student in his digital world.

Keywords: communication, interactive media, cognitive processes, building knowledge, teacher, students

KOMUNIKACJA MIĘDZY NAUCZYCIELEM CHEMII A UCZNIAMI SZKOŁY PODSTAWOWEJ ZA POMOCĄ PRZEDMIOTOWEJ STRONY WWW

Streszczenie: Autorka tekstu poszukuje optymalnego sposobu komunikacji z uczniami, który miałby zmobilizować uczniów do zgłębiania zagadnień chemicznych i przełamać ich niechęć do przedmiotu. Jako narzędzie wspierające naukę chemii chce wykorzystać Internet. Badania miały charakter poznawczy, a do ich przeprowadzenia wybrano technikę ankiety.

Celem przedmiotowego artykułu jest przybliżenie:

- 1) optymalnego sposobu komunikacji nauczyciela chemii z uczniami szkoły podstawowej wpływającego na usprawnienie wyższych procesów poznawczych ucznia,

- 2) postulatów uczniów co do merytorycznej zawartości przedmiotowej strony www oraz oczekiwań uczniów dotyczących udogodnień technicznych,
- 3) możliwości budowania wiedzy poprzez media interaktywne, które są naturalne i atrakcyjne dla ucznia w jego cyfrowym świecie.

Słowa kluczowe: komunikacja, media interaktywne, procesy poznawcze, budowanie wiedzy, nauczyciel, uczniowie