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STUDENTS' SEARCH FOR VISUAL SCIENTIFIC INFORMATION: SITUATION ANALYSIS

Renata Bilbokaitė
Šiauliai University, Lithuania
E-mail: renata.bilbokaite@inbox.lt

Abstract

The modern visualization is created to help in education processes and it is oriented to the evaluation of knowledge. It is very important for science education to have perfectly prepared aids that could show invisible phenomena and could foster deeper motivation. This research encloses that students like to use internet for their purposes. The most important purpose is to use search for visualizations because students have aspiration for deeper knowledge. Also, results enclose negative aspects in this field. Students do not search for visual information in the internet because they feel lack of need; there are bad conditions in the classroom. The last reason could be identified as highlighted prominence of pedagogues' role. All this could improve that students who have low interest to search in the internet could be called as unmotivated.
Key words: *internet, students, visualization.*

Introduction

In the past years students have become very interested in computers. It is evident in a fast spread of computer games so popular in the adolescence period. There is also a tendency to use various teaching-learning programs. The most interesting tool for students is the Internet because they can find any information needed at the right moment. Research shows that scientists are exploring the use of the Internet for educational purposes, especially in the area of science education (Barab, 2006; Yang, Heh, 2007; Sorensen et al., 2007; Lamanauskas, Vilkonis, 2007). From a scientific pointy of view, results of various research prove (Wang, Reeves, 2007; Mistier-Jackson, Songer, 2000) that computer based visualization, used in science disciplines, highlights motivation especially if visualization is linked with the Internet. The mentioned preposition supports an opinion that visualization using the Internet in the science education process could be helpful developing students' knowledge.

It is widely discussed and acknowledged that science disciplines are difficult for secondary school students. This assumption is based on arguments that students do not understand concepts (Black, Lucas, 1993; Driver, Leach, Millar, Scott, 1996; Fisher, 1983; Larrabee, Stein, Barman, 2006), molecular conjunctions are not clear for some of them, others have misconceptions about cell division (Kindfield

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1994; Yip, 1998). These facts condition a situation that students dislike learning science; they do not try to find out the reasons of their misunderstanding. Students' disfavor science as they do not understand that science is the background of knowledge. ICT, the Internet and computers serve as tools and methods in this situation and stimulate students' interest in science education. Computer based visualization may help them understand difficult phenomena, visual representation is clearer than a static one provided in textbooks (Burewicz, Miranowicz, 2002; Penn et al., 2007). Scientists argue that computer based visualization activates learning motivation (Wu, Shah, 2004; Cook, 2006; Bilbokaitė, 2008; Nieswandt, Shanahan, 2008), it also helps to concentrate attention (Velázquez-Marcano et al., 2004) and to memorize things for a longer period of time (Cook, 2006). Relying on an opinion that students are interested in computers and the Internet, we could raise an assumption that students' motivation and understanding could be enhanced if these tools are used in the science education process. The Internet may be used to give lessons, student homework assignments may also include Internet search. Students could search for various types of visualization on the Internet and use this additional information in the learning process. There is not enough information about this phenomenon, especially in the Lithuanian context, research is also lacking. Moreover, we do not know students' opinion about their use of the Internet in their daily life and doing homework assignments. Data could focus on the existing situation and that could help to formulate a following step of research in this area. All this allows us to formulate the following ***problem question***: *Do students search for additional visual information on the Internet with the aim to clarify misunderstood science topics?*

Research object **–** Internet search for concept visualization.

The aim of the research is to find out whether students search for additional visual information on the Internet with the aim to get clearer scientific information.

Research Methodology

Theoretical background

The research is based on an opinion that visualization using the Internet could help students understand objects and phenomena that have no visual representation in textbooks, make the learning process easier, decrease gaps in knowledge and deepen knowledge. In the context of a holistic paradigm, students' interaction with a computer could prepare them for life-long learning, individual learning and facilitate implementation of this aim.

Mental model theory. Johnson-Laird (1983) maintains that people have an internal representation of things they come into contact with in their life. Mental models link practice and different knowledge in various spheres. Wrongly constructed mental models are the main problem. A schoolchild, who lacks perception, wrongly perceives observable objects, constructs more or less distorted visual mental models of them. It means that wrong mental models are formed in consciousness.

L. M. Veker's (1976) model of *genetic structural intellect*. According to Veker, an individual gains experience which is very important for other skills in the learning process. Visual thinking is essential developing an ability to perceive information and think in concepts. It means that visual thinking is the basis of concept thinking. It is especially meaningful in science education because almost all phenomena are related to imagination and mental models in schoolchildren's minds. An assumption can be made that in the future visual aids could help build up original constructs necessary to understand visual and verbal information.

The research refers to *the theory of dual code* (Hodes, 1994). It says that visual and verbal information are interrelated in some aspects. Both types of information are connected with consciousness and this conditions circumstantial perception of an object – a child realizes the visual part of the object and links verbal information about it with the form of the concept. A visual system enhances knowledge perception which includes spatial abilities, visual perception, encoding and transformation.

Research organization and participants

It was important to identify the situation of students' searching for scientific visualizations in the internet. These findings could be helpful for future research with a bigger sample. The research instrument, a questionnaire with open-ended questions was designed. The questionnaire was used as a research instrument and distributed to grade 9 and grade 10 schoolchildren. All schoolchildren were from Šiauliai (Lithuania). There were 209 schoolchildren (92 schoolchildren from grade 9, 107 – from grade 10) in the sample. The respondents were about 14–17 years of age (2 schoolchildren – 14 years old, 73 schoolchildren – 15 years old, 111 schoolchildren –16 years old and 23 schoolchildren – 17 years old). The respondents' distribution by gender: 72 girls and 45 boys of grade 10, 45 girls and 47 boys of grade 9.

Random sampling was chosen when schoolchildren in grades 9 and 10 had a possibility to participate in the research. The respondents were adolescents by the developmental psychology (*Viner, Christie, 2005*) thus they were able to evaluate the circumstances and a situation at school. This leads to an assumption that schoolchildren decided individually and written the right answer to reflect a real situation with responsibility. The second reason why schoolchildren of this age group were targeted is a science education program. All schoolchildren in grade 9 and grade 10 already had experience in using science concepts and could be sure about what they know well and what is still unclear.

Research methods

Survey (open ended questionnaire), content analysis.

Results of Research

Only one category (Table 1), that can be called "positive", was found as it highlights an assumption about a positive evaluation of the situation.

Table 1. The search for visualization in the Internet

Category	Number of categories	Subcategory	Number of subcategories	Proposition
Aspiration for deeper knowledge	**39**	*Endeavor for knowledge*	34	For better learning; I want to understand deeper, it really helps me; that I could be cleverer that others; when I do not understand the theme I am searching for visualization in the internet; I am doing it when I want to learn and still do not understand theme; because I want to learn better and to get good mark; there are lot of unknown words; if the theme is difficult I am looking for material and for visualization because I want to understand quickly; if it is unclear for me; when I do not see what I am learning about, when things are invisible.
		Motivation	5	It is interesting and I want to learn better; it is interesting how everything looks like; the themes are very interesting for me; I want to deepen my knowledge; I am searching for more visualization because it is curious; more interesting to learn.
The lack of need	**43**	*The lack of motivation*	27	It is not interesting; I am not interested in that; I am lazy; does not interesting because I do not understand; absolutely dry material; this information does not important for me; molecules are not interesting; atoms, bones and all other phenomena are not unexciting; I use only books; mostly science is boring.
		Makes a shift with books	12	Mostly everything is illustrated in the books; I can read a book, it is enough for me; all information about phenomena I am getting from the book; everything is in the books; all material is in the books.

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Prominence of a pedagogue's role	**29**	*Teacher explains*	23	Teacher explains enough; the biology is too difficult because of concepts but teachers very good explain the chemistry and physics; teachers explain clearly; teachers do not give difficult things to find in the internet because they are explaining everything.
		Functions of pedagogues	11	In my way of thinking the school must give all difficult information; no one searches for information in this modern world, everything must be given during the lesson; teacher must explain more clearly; teacher should explain; pedagogue must transmit all information.
		There is no order	6	Teacher do not require; I am searching if teacher asked to write something; teacher does not ask for this
Bad conditions	**29**	*Lack of visual information*	22	Not always I can find visualization in the internet; mostly the searching in the internet is wasting of time, so, why I should look for information if I know that I will not find visualized objects in the net; I do not know the good addresses where I can really find the information; I am looking but I sometimes do not find; there is not enough information in the net.
		Lack of time	7	I have no time for sitting near computer; I am very busy, I have no time; very often I have no time; I have time only for lessons and home works.

The category "*aspiration for deeper knowledge*" shows that many students search for visual information on the Internet because they want to deepen their knowledge. The sub-category "*endeavor for knowledge*" explains the aspect of last mentioned category pointing at students' need to perceive, understand and learn more about difficult phenomena that have not been understood by usual environmental tools. Students are critical about themselves as well as competent enough to identify misunderstood issues. Misconception conditions low evaluation in a discipline and students aiming to avoid this situation tend to search for information that could explain difficult topics more clearly. The sub-category "*motivation*" means that some students have a broadly expressed need for knowledge in nature science and use the Internet to gain full-scale information. Answers clearly show that, firstly, students are interested in self-dependent learning; secondly, these students can use technology with competence and, thirdly, they try to help themselves without interacting with adults. The number of propositions in this category shows that a minority of students make up a group of those who search for visualization on the Internet because their aspiration to deepen knowledge dominates.

The category "*lack of need*" shows that many students do not have a need to look for visual information on the Internet. The sub-category "*lack of motivation*" explains the last mentioned category; a majority of respondents do not have motivation to search for information. A low level of motivation and motivation facilitation in secondary schools are an urgent problem in modern education because students tend to gain knowledge very quickly and without any efforts. This aim slows down the efficiency of the educational process. Data also show that many students find enough information in textbooks (the sub-category "*make a shift with books"*); this is the reason why students do not look for visualizations on the Internet. These students do not have a need for additional learning or for understanding of everything therefore they do not want to study more. Learners who do not have strong motivation tend to learn using ordinary tools; computers and the Internet are the tools for free time and pleasure in their life.

The category "*prominence of a pedagogue's role*" shows that students follow an old paradigm, which gives prominence to teachers' responsibility for students' knowledge. This shows that post-modern culture and progress in technology have changed students' relationships with their teachers very little. The sub-category "*teacher explains*" means that students are satisfied with the knowledge passed over by the teacher in the classroom. This knowledge is oriented to practical work; it is rather easy to do laboratory work applying general knowledge. The sub-category "*functions of pedagogues*" shows that students tend to pass over all responsibility for the quality of their knowledge to teachers. It is a conscious avoidance of responsibility and some form of social attitude supported by many parents who are of an opinion that teachers must be always responsible for their students' understanding. The fewer requirements are set forth, the better results are; the most important thing is that exact information was passed over in the classroom so that it could be used in practical work. The last mentioned subcategory shows a

partial charge for teachers that they should explain topics much more clearly. The sub-category "*there is no order*" shows that dictatorial relations still exist in students' consciousness as well as in the educational process but not liberal and democratic relations because students do not work if they are not told to.

The category "*bad conditions*" shows that a majority of students do not search for visual information on the Internet because they do not have good conditions to do that. The first reason pointing at the absence of conditions is "*lack of visual information*". It is evident that students need to be competent in information search, especially talking about learning material, while learning difficult topics. Students who are competent in ICT should be reminded to search for additional information on the Internet. Programs should be oriented to the educational curriculum and fit to the standards and programs; they also have to be designed not to waste time (the sub-category *"lack of time")*. It means that favorable environment could ensure better transmission of scientific knowledge to those students who are motivated and want to get some extra knowledge, more than defined in the educational curriculum.

Discussion

According to data results, an assumption could be made that there are two groups of students: motivated and unmotivated students. Students with strong motivation search for visual information on the Internet with the aim to gain more knowledge and satisfy their higher need for knowledge self-dependently. Those participants of the educational process take responsibility for their learning; individualizing their learning load they are able to improve their knowledge as they control this load themselves. Visual information on the Internet helps them perceive information that was firstly introduced in the classroom in other representation modes, e.g. verbally. Using a dual code theory (Hodes, 1994) as a theoretical background for interpretation, we can assume that visualization of any concept on the Internet can create visual structures of phenomena. This visual representation can be coded in a visual code and, according to a mental model theory (Johnson-Laird, 1980; Coll, 2008), can create visual mental models. When a student gets visual and verbal information about the same object, his consciousness builds up two mental models that serve as a structure to operate concepts. This leads to a theoretical assumption (Veker, 1981) that visual information can develop essential visual thinking skills necessary to understand concepts. It should be noted that the number of students in the group of motivated students was small.

It can be assumed that a majority of students are not trained to use the Internet for search of visualization of difficult phenomena because, in their opinion, the teacher has to present all learning material; they do not have enough motivation, time and do not make any effort to understand difficult and unclear phenomena. According to them, teachers are responsible for their misunderstanding; they avoid self-study and self-dependent work. Lack of motivation can be the cause of students' misunderstanding of difficult scientific phenomena; the result of that is negative evaluation of their knowledge what is related with the evaluation of personal abilities. Many external factors are being internalized in the period of adolescence; low marks may cause negative evaluation of personal abilities therefore such consequences as cognitive regression of students' consciousness must be avoided. Defense mechanisms of rationalization and transference also play an important role: students' explanations that disciplines of a comprehensive content are "not interesting, too difficult, stupid and meaningless" show that. Students also raise ontological questions: "Where shall I use this knowledge?", "What is the point of learning?" They are not looking for answers to these questions; their aim is to break training order and avoid responsibility in a difficult educational process. They are attempts to protect their position, avoid responsibility for learning results, minimize their own efforts and thus make search for knowledge least problematic in the learning process. This allows the author identify some kind of students' immaturity in terms of self-study, their consciousness being ill disposed to learning in a modern paradigm. This paradigm stressed students' independent thinking, self-study skills and minimal reliance on their teachers' help. This research shows that a majority of students are still unprepared to study in this new learning paradigm.

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Conclusions

Many students search for visual information on the Internet because they want to perceive, understand and learn more about phenomena that have not been understood by usual environmental tools. Also, students have a need for knowledge in nature science and use the Internet to gain full-scale information for deeper knowledge. Many students do not have a need to look for visual information on the Internet; they do not have motivation to search for information and for many of them it is enough information in textbooks. Students give prominence to teachers' responsibility for students' knowledge. They are satisfied with the knowledge passed over by the teacher in the classroom and are tended to pass overall responsibility for the quality of their knowledge to educators; also, they are doing students' duty if it was ordered by teachers. A majority of students do not search for visual information on the Internet because they feel lack of good conditions to do that.

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Adviced by Todar Lakhvich,
Belarusian State M. Tank Pedagogical University,
Republic of Belarus

Renata Bilbokaitė Young researcher, Šiauliai University,
Natural Science Education Research Centre,
P. Višinskio Street 25-119, LT-76351, Lithuania
Phone: +370 684 40 235
E-mail: renata.bilbokaite@inbox.lt