

# THE EFFECTS OF USING BLOG AS A WEB TOOL IN BIOLOGY TEACHING IN HIGH SCHOOLS

**Tihomir Lazarević,  
Tomka Miljanović,  
Vera Županec,  
Goran Zarić**

## Introduction

Teenagers are a part of general population that spends a lot of time in front of their computers, tablets and smart phones using at the same time the Internet. Via this network they pursue their interests, share photos, videos and other data, and some of them use the Internet in order to fill the gaps in their knowledge of school subjects. By wide usage of information technologies in schools, the conditions were created for more quality innovations within educational technologies. The current perspective suggests that new literacy is rapidly changing and transforming - a parallel process to emerging new communication and information technologies and to changing social practices (Aberšek, 2013; Aberšek, Borstner & Bregant, 2014). The trend of using the Internet for purposes of education can efficiently be utilized for communication between teachers and students in after-school hours by means of emails, social media, websites or blogs.

Blog as an Internet tool of web 2.0 technology enables its users to participate in designing the web contents, which is exactly the characteristic of the second generation of web and hosting services. Instead of one-way information flow (web 1.0), there is a two-way, interactive communication between users and the computer or users and other participants in the communication. Society grounded in information technologies is faced with a big task: possibilities provided by use of computers and internet should be effectively used in education. The old teaching habit where a teacher frontally teaches the material is left behind, so the teaching supported by information and communication technologies (interactive learning from blogs, Facebook and programmed curriculum by computers) has to find its true place in educational system. For more than two decades, researchers have called for our attention towards the fact that besides new abilities and competences the educational system should focus on the changed reading competencies, needed for finding and processing the information and



JOURNAL  
OF BALTIC  
SCIENCE  
EDUCATION

ISSN 1648-3898 /Print/  
ISSN 2538-7138 /Online/

**Abstract.** *The Internet is a service where much information from the world of science, technology, fashion and entertainment can be found. With the development of mobile devices, information from the Internet has become available almost everywhere. This fact should be used to help students learn curriculum e-materials from smartphones, tablets and netbooks. One of the Internet services that can be successfully applied in teaching is a blog. This research has analyzed the effects of using blog as a web tool in biology teaching. The sample under research included 171 students divided into two groups: an experimental group which used a blog and a control group in which the teaching was conducted without a blog as a teaching tool. The students from both groups were first tested by means of a pre-test according to which the groups were at the same level of knowledge of biology and after covering the topic of Cytology both groups did the post-test. The research showed that the students who used the blog had statistically a significantly better result on the post-test. Further research showed that students make equal progress at all levels of knowledge with the help of blogs and that the blog is the most useful to advanced students.*

**Keywords:** *blog in teaching biology, ICT in classroom, internet and education, learning biology.*

**Tihomir Lazarević, Tomka Miljanović,  
Vera Županec**  
*University of Novi Sad, Serbia*  
**Goran Zarić**  
*University Business Academy, Serbia*



knowledge, accessible in the new media in the age of information (Aberšek, Borstner & Bregant, 2014). Beside ability to read and browsing information on the internet, digital competence includes: 1. Information and data literacy, 2. Communication and collaboration through digital technologies, 3. Digital content creation, 4. Safety in digital environment, 5. Problem solving in digital environment (Vuorikari, Punie, Carretero, & Van den Brande, 2016). Possibilities for using the Internet in education are great and they are reflected in using the Internet as a source of information, using online educational applications in teaching, studying via social networks, using blogs in teaching and learning.

Web journal, commonly known as blog, can be used as a fun and interesting tool for additional activities inside or outside the classroom. Also, it can be used to help students with their development of important skills which are related to the communication in science, or as a readers' club of specifically determined scientific contents through group formation (De Souza-Hart, 2010). Although, when blogs first appeared, most of them were personal or journalistic, later the interest for blog application in education increased (Godwin-Jones, 2003). According to the sources (Achtennan, 2006; Godwin-Jones, 2003; Ray, 2006), blog has a potential to be used as an additional means of communication, mutual tool or educational means in school.

The usage of blogs in the learning process depends on the teaching goals and the topic that is being studied. When it comes to designing educational contents that are going to be presented on the blog, creativity and imagination of the author are important. The possibilities for using blogs in teaching are enormous because blogs can replace students' work on paper and they can get feedback information in the form of comment by the teachers or other students. Most studies about blog application include text blogging in different courses (Tang & Lam, 2014; Yang & Chang, 2012), or programs for education of teachers (Chou, 2011; Pavo & Rodrigo, 2015), while several researchers used audio and video blogs in language teaching classes (Hung, 2011; Shih, 2010; Sun, 2012).

In educational context, a blog is much more than "Internet journal", the term by which that tool is often defined. In a simple online environment, teachers and students can publish contents in the form of texts, presentations, photos, videos and audio recordings. Posting comments on published contents allows all forms of interaction (teacher student, student other students), encourages critical thinking, exchange of opinions and discussion. Blog contents can be organized according to categories and they can be grouped by topic. Different statistical contents can be published and tasks for teams of students can be formed by creating pages and subpages. On the other hand, every student can make his/her own blog on a specific topic and, using links, they can connect with the blogs of members of their group, teacher's blog or other blogs. Due to blogs, a teacher can create an environment in which students feel they are important factors of a teaching process (Churchill, 2009). Another observation one might make of the existing academic literature on blogging is that in those instances where educational applications of the blog are considered. This literature tends to be concentrated in the areas of teacher training and other professions where the use of reflective journals as a learning tool is an accepted custom and practice, and where, as a consequence, there is an increased likelihood of a favorable disposition to blogs in the first place (Stiler & Philleo, 2003).

Blog can be used in different ways for teaching and has the potential to become a primary tool for mastering the curriculum. Blogging can be a source of increasing students' self-confidence, motivation and confidence in writing (Pinkman, 2005; Zhang, 2009). In education, blog is most commonly used as a help in learning native tongue and foreign language (Zhang, 2009). From these classes, teachers use blog to send students assignments for work from home, as well as useful advice which can help with the problem solving. However, use of blog in science classes like biology or chemistry is still very rare, and so the research related to the use of blog in these areas is scarce. Most research about the use of blog in teaching, done so far, show benefits of blog as a tool utilized for remote learning and information exchange, but very few of them are researching the use of blog in the class itself. Also, numerous research of use of blog in teaching, documented the achievement of the students within one class, not comparing them to the students of some other class, which is not using blog in teaching (Golonka, Bowles, Frank, Richardson, & Freynik, 2014; Sim & Hew, 2010).

From numerous research of blog application in teaching, several pedagogic guidelines could be drawn. First, a blog has a great potential for encouraging students to learn and study, because it offers interaction with their peers who practice the same mode of learning. Besides language courses, where text blogging is dominant, an audio or a video blog can be efficiently applied in other courses. Second, blog authors expect it to offer more guidelines, support and encouragement to the students for mastering the curriculum. According to Vaughan (2010), the presence of a teacher plays a significant role, even with online learning. Third, it is very important to relieve the students' fear by giving them online assignments based on blog-aided learning. This approach



gives students more flexibility and time to post their problem solutions on the blog, and online discussion can help development of higher social relations and mutual trust among the members of online community (Bulu & Yildirim, 2008). Finally, the relationship and connection between teacher and students has a great significance, and results of blog-aided online learning very much depend on them (Lee and Bonk, 2016). In order to improve interaction and communication, if necessary, online games and chatting between members of the community on the blog could be integrated into work assignments (Reinders and Wattana, 2014). However, according to previous research (Huang and Hung, 2013; Sun, 2012), students can feel discomfort in the new online environment until they master working on the new application. But, since today's population of teenagers is mostly well acquainted with possibilities of the internet, and services it offers, a fear of new technologies may be experienced only by a few, which is negligible compared to the benefits this mode of learning has to offer. It could be tedious for some students to enter into online discussion on the blog, because even the preparation for such form of discussion is time-consuming, which can influence their whole development and willingness to communicate (Cavanagh, Bower, Moloney, & Sweller, 2014; Sun, 2009).

This research is based on educational possibilities for blog utilization in biology classes, in the class itself, as well as when students are not at school, but requesting additional explanation from home while learning, and all this comparing to students who do not utilize blog as learning assistance. Today research about blog usage in teachings are mostly based on usage in mathematics, informatics as well in language teachings. Usage of PC and internet services in biology teachings has not been researched in that volume, so this research is focused on that problem. This research is focused on a specific problem whether blog usage in biology teachings contributes to improvement of Students' understanding and achievement in biology.

*The main aim of this research* is to investigate the effects of using blog in biology teaching and its effects on students' biology achievement.

This research, apart from its main aim, should also show other characteristics of a blog, so, in relation to the main aim, *specific aims* of the research have been formulated:

1. It should be determined whether there is a significant difference in achievement in biology between the students who use blogs in teaching and the students who do not use blogs;
2. It should be determined at which level of knowledge (basic, intermediate or advanced level) the blog contributes the most to the improvement of students' biology achievement;
3. It should be determined which group of students (weak, average, advanced) makes the greatest progress with the help of a blog.

## Methodology of Research

### *General Background*

This research investigated the effects of using blog as a web tool in biology teaching. The research was conducted during the September of 2015/2016 school year in biology classes within the topic of Cytology in the first grade of general upper-secondary school (age 15-19 years). We used a quasi-experimental research design. Quasi-experimental approaches rely on design features to rule out confounding factors rather than relying solely on controlling measured covariates in analyses (Shadish, Cook, & Campbell, 2002). Before the teaching was conducted, the students from experimental (E) and control (C) groups were tested by the pre-test in order to equalize the groups.

After applying the pre-test, the students from E group attended the teaching program of Cytology with the help of a blog. The lessons presented on the blog had an integrated multimedia presentation including images and videos of complex biological processes that take place in cells. Some students from the experimental group utilized the possibility to communicate with the teacher from their homes via comments on the blog at the moment of studying or immediately after that, and other students from the experimental group joined those comments. As for the students in C group, the teaching of the same material was conducted through classic form, where the teacher dominantly presents the curriculum of teaching (frontal work), without using a blog. Teaching in both groups was carried out by the same teacher. After the teaching was conducted in different ways for E and C groups, both groups did the post-test in order to check their knowledge about material from the topic of Cytology.



### Research Design

For the purpose of examining the effects of using blogs in biology teaching, a blog called *Biosoikoslogos* was created at the address <http://biosoikoslogos.wordpress.com>, which is oriented to the biology curriculum for the students of general upper-secondary school. The topic of Cytology used in this research is integrated into the materials published on the blog *Biosoikoslogos*. Within this topic there are units planned by Biology Curriculum for the first grade of general upper-secondary school in the Republic of Serbia. This topic includes curricular content about cell structure and cell cycles that are often very difficult for students to understand, as it is about the structures and processes that are happening on the micro level. Within the Cytology theme, the structure of the cell membrane and cellular organelles, as well as the individual phases of the cell division, are described in detail. Due to complicated processes, any support in overcoming and understanding these content is of exceptional importance. All the units include presentations with pictures, and most of them contain audio and video showing complex biological processes at a cellular level.

Experimental group used a blog in teaching in such a way, that the teacher, in the first part of the class period (15 minutes), realized the curriculum by showing the students presentations, pictures, audio and video files integrated on the blog. Then, in the second part of the class period (15 minutes), students would independently solve the problems, which are designed in advance and related to the given teaching unit, by using the blog and all online material on it. In the final part of the class period (15 minutes), students and the teacher together evaluated the curriculum.

Students of the experimental group were also able to use the blog from home, while studying, and, from home, ask the teacher questions, when they needed clarification. Statistics integrated into Wordpress platform, through which the blog *Biosoikoslogos* has been created, show that students used the blog from home mostly in the days before the exams, as much as fifty times more than on usual days.

Control group realized the same curriculum through frontal and group form of teaching, where the teacher dominantly presents the curriculum. The control group did not have the access to the blog because it was password protected. Only the experimental group could use the blog. The control group was not able to communicate with a teacher from home via blog in order to determine the effects of the blog to the experimental group.

The students from the experimental group were in the first grade of general upper-secondary school, whereas the students from the control group, also first graders, went to another general upper-secondary school in another town, so that the students from these two groups did not meet nor shared their experiences.

Further research follows the effects of blog usage on students' biology achievement in two different groups (E and C groups), but also the effects of blog usage at different levels of knowledge (basic, intermediate and advanced level), as well as the effects of blog usage on different students who use blogs within the experimental group (weak, average, advanced). The weak group consisted of the students with the F's and D's grades in biology, the group of average students consisted of those with C's grade in biology, whereas the advanced were those students who had B's and A's grades in biology. Weak group had 24 students, average group had 23 students and advanced group had 38 students.

### Sample

The convenience sample consisted of 171 students, divided into two groups: 85 in the experimental group and 86 in the control group. Experimental group consisted of three classes of first year students of general upper-secondary school from the town of Šabac, while control group was made of three classes of the first-year students of general upper-secondary school from Novi Sad, all between ages 15-16 years. Every of the three classes in experimental group had between 27 and 30 students, and every of the three classes of control group had between 28 and 30 students. In experimental group there were 38 boys and 47 girls and in control group there were 41 boys and 45 girls.

### Research Instruments

The instruments used for the purposes of this research were: a pre-test and post-test of knowledge. The instruments used in this research were previously tested during 2014/2015 school year with first-grade general upper-second school students. Each of these tests included tasks divided into three different levels: the level of



fact cognition (the basic level), the level of understanding and connecting the concepts (the intermediate level) and the level of analysis, reasoning and knowledge application (the advanced level). Basic level contains 8 simple tasks consisting of multiple choice answers or pictures of cell parts which students are supposed to recognize. Intermediate level of knowledge comprises 4 tasks in which the students should connect the words with certain processes which happen in a cell. Advanced level consists of two illustrated tasks where students should observe certain phases of cell cycle or cell parts in the context of normal function of cell and organism, and to answer to specific task requests. On each individual test a student could get at most 100 points in the following way: 30 points at the basic level, 40 points at the intermediate level and 30 points at the advanced level of knowledge. One task gave the students the possibility of scoring minimum points, maximum points, or scoring a number of points between minimum and maximum, depending on how many points a certain question brings, which is in correlation with the difficulty of the question and the level of knowledge needed for the question to be answered.

Pre-test and post-test were reviewed by two university professors of Cytology, one a full professor of the Chair of Biology Education, and two upper-secondary school biology teachers. The value of Coefficient of Reliability (Cronbach's Alpha) for the pre-test is  $\alpha=.80$ , whereas for the post-test  $\alpha=.81$ .

### Data Analysis

Various statistic procedures were applied in analysis of collected data. For initial exam data processing t-test was used. Data about students of E and C group progress from initial to final exam was processed with split-plot ANOVA. Split-plot ANOVA was also used for processing data about achievement differences between E and C group on different levels (basic, intermediate and advanced), as well as data about student groups (poor, average, advanced) within E group which showed most progress with the help of the blog. All analyses are done in SPSS program.

### Results of Research

With the aim of analyzing the effects of blog usage in biology teaching on students' achievement in biology, E and C groups were tested by the pre-test and post-test. Table 1 contains the descriptive statistics of the pre-test and post-test on three levels of knowledge. The acceptable range for skewness or kurtosis is above -1.5 and below +1.5 (Tabachnick & Fidell, 2013).

**Table 1. Descriptive statistics of the pre-test and post-test on three levels of knowledge (basic, intermediate and advanced).**

N=171	Min.	Max.	M	SD	Mode	Median	Skewness	Kurtosis
Pre-test basic	3	30	14.75	5.85	17	15	-.10	-.49
Pre-test intermediate	7	39	24.18	6.75	17	24	.02	-.49
Pre-test advanced	0	30	16.61	6.05	16	16	.06	-.38
Pre-test total	22	93	55.54	15.26	57	55	.07	-.38
Post-test basic	2	30	23.05	6.60	28	25	-1.17	.71
Post-test intermediate	10	40	29.15	7.24	30	30	-.64	-.35
Post-test advanced	6	30	21.46	6.34	25	23	-.56	-.64
Post-test total	27	100	73.65	17.32	72	78	-.69	-.22

The results of the pre-test were processed by the t-test. On the basis of the analyzed and presented results it was shown that there was no statistically significant difference between the experimental and control group in their biology achievement on the pre-test. Levene's test was implemented ( $F=4.36, p<.05$ ) and the results were shown for t-test with edited numbers of degrees of freedom (Table 2). This result points to the fact that the groups were well equalized in their knowledge of biology, which was one of the preconditions for the validity of the further research.



**Table 2. Statistical significance of the difference in the biology achievement on the pre-test between the students from E and C groups (t-test).**

Group	N	M	SD	t (df)	p	d <sub>Cohen</sub>
E	85	55.52	13.85	.17 (164.29)	p>.05	.003
C	86	55.56	16.62			

After the pre-test was done, for the students from E group the teaching of the topic of Cytology was conducted with the help of a blog, whereas for the students of C group through teaching without blogs, where a teacher frontally teaches. Immediately after the completion of this topic the students did the post-test. The difference in the achievement between the students from E and C groups was examined by the analysis of variance at different levels of knowledge (basic, intermediate, advanced) in two periods of measuring (before and after the blog application). The analysis showed that both groups progressed from measuring on the pre-test to the measuring on the post-test at all three levels of knowledge. It was also shown that using blogs in biology teaching contributes to better achievement of students at all three levels of knowledge since E group got better results at basic, intermediate and advanced level than C group (Table 3).

**Table 3. The results of E and C groups on the initial and the final test at different levels of knowledge.**

Group	Basic level		Intermediate level		Advanced level	
	M pre-test	M post-test	M pre-test	M post-test	M pre-test	M post-test
E	15.24 (5.38)	24.21 (5.60)	23.34 (6.23)	30.15 (6.81)	16.94 (6.30)	23.79 (5.17)
C	14.28 (6.27)	21.90 (7.31)	25 (7.17)	28.15 (7.56)	16.28 (5.82)	19.15 (6.58)

Note. The number in brackets represents the value of standard deviation

The analysis showed that there was a significant main effect for the non-repeated factor *Group*, as well as for both repeated factors: *Testing* and *Level of knowledge* (Table 4).

**Table 4. The statistical significance of the blog effects for the non-repeated factor Group and repeated factors Testing and Level of knowledge.**

	F	df1	df2	p	$\eta^2_p$
Group	4.74	1	169	p<.05	.03
Testing	178.54	1	169	p<.001	.51
Level of knowledge	365.78	2	338	p<.001	.68

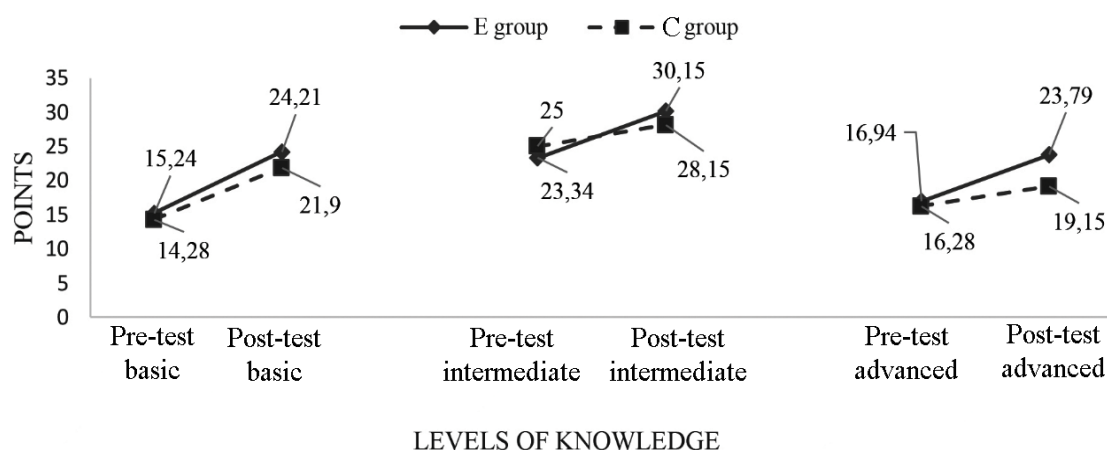
The analysis showed that the interaction between the non-repeated factor *Group* and the repeated factor *Testing* was also statistically significant, as well as the interaction between the non-repeated factor *Group* and the repeated factor *Level of knowledge*. When the interaction between two repeated factors *Testing* and *Level of knowledge* was tested, it was also shown to be statistically significant. However, when the interaction between all three factors: *Group*, *Testing* and *Level of knowledge* was tested it was not shown to be statistically significant (Table 5).



**Table 5. Statistical significance of the interaction between the non-repeated factor Group and the repeated factors Testing and Level of knowledge.**

	F	df1	df2	p	$\eta^2_p$
Interaction Group x Testing	10.98	1	169	p<.01	.06
Interaction Group x Level of knowledge	7.20	2	338	p<.01	.04
Interaction Testing x Level of knowledge	17.80	2	338	p<.001	.09
Interaction Group x Testing x Level of knowledge	2.39	2	338	p>.05	.01

When tested the level of knowledge at which the blog contributed the most to students' biology achievement, in spite of the fact that there were differences in achievement in E group's favor between different levels, they were not statistically significant. Such a result indicates that the blog equally contributes to the students' achievement at all three levels of knowledge (Figure 1).

**Figure 1: The blog contribution to students' biology achievement at different levels of knowledge.**

This research was investigated by the effects of using blog in biology teaching and its general effects on students' biology achievement measured in two periods of time (before the blog usage and after the blog usage). Descriptive statistics of the general effects of using blog was shown in Table 6.

**Table 6. Descriptive statistics of the general effects of using blog in biology teaching.**

Group	N	M (SD) pre-test	M (SD) post-test
E	85	55.52 (13.85)	78.15 (15)
C	86	55.56 (16.62)	69.20 (18.36)

Note. The number in brackets represents the value of standard deviation

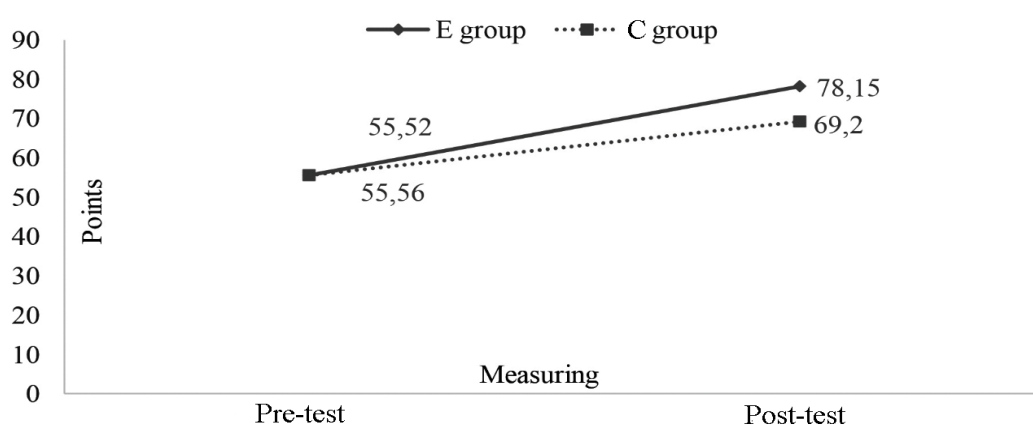
The analysis of the data showed that there was a statistically significant main effect of both non-repeated factor Group and the repeated factor Testing. Furthermore, the interaction of these two factors came out as important (Table 7).



**Table 7. Statistical significance of the difference in biology achievement between E and C groups measured on the initial and the final test.**

	F	df1	df2	p	$\eta_p^2$
Group	15.10	1	169	p<.001	.27
Testing	125.84	2	338	p<.001	.51
Interaction Group x Testing	24.61	2	338	p<.001	.61

Both groups made progress in their achievement in relation to the results they got on the initial test, but E group advanced significantly more than C group. The average number of points on the initial test was  $M=55.52$  for the experimental and  $M=55.56$  for the control group, whereas on the final test E group got the result  $M=78.15$  points and the control got  $M=69.20$  points (Figure 2).

**Figure 2: The difference in biology achievement between the students from E and C groups on the post-test in relation to the pre-test.**

In this research it was also tested which group of students (weak, average, advanced) made the greatest progress with the help of a blog. The students were divided into these three groups according to their previous success in biology. The weak group consisted of the students with the Fs and Ds in biology, the group of average students consisted of those with C's in biology, whereas the advanced were those students who had B's and A's in biology.

The difference in achievement between the weak, average and advanced students within E group was investigated by means of the analysis of variance. Descriptive statistics of the difference in achievement between the weak, average and advanced students was shown in Table 8.

**Table 8. Descriptive statistics of the difference in achievement between the weak, average and advanced students within E group.**

Group of students	N	M (SD) pre-test	M (SD) post-test
Weak students	24	49.54 (13.77)	64.54 (12.77)
Average students	23	54.17 (10.44)	78.04 (12.63)
Advanced students	38	60.11 (14.38)	86.82 (10.86)

Note. The number in brackets represents the value of standard deviation

The measuring took place in two periods of time (before using the blog and after it). The analysis showed that there was a significant main effect of the non-repeated factor *Group*. There was also the significant main effect for the repeated factor *Testing*. The interaction between these two factors turned out to be statistically relevant (Table 9).

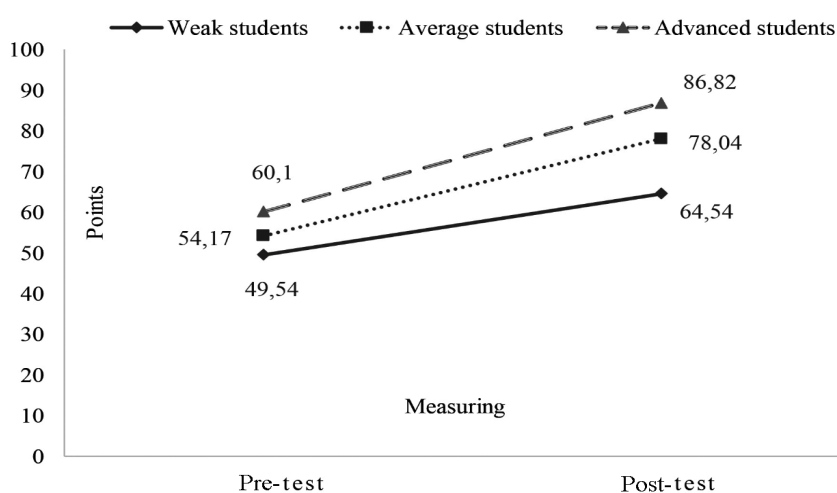




**Table 9. Statistical relevance of the difference in biology achievement within E group in relation to the group of students (weak, average, advanced) measured on the pre-test and post-test.**

	F	df1	df2	p	$\eta^2_p$
Group	19.38	2	82	p<.001	.32
Testing	172.35	1	82	p<.001	.68
Interaction Group x Testing	4.61	2	82	p<.05	.10

Among the students who used the blog in their biology teaching, all three groups of students (weak, average, advanced) made progress in between the two testing periods, but the students from the advanced group progressed the most. Somewhat smaller progress was made by the average students, whereas the weak students made the smallest progress (Figure 3).

**Figure 3: The difference in the achievement between the weak, average and advanced students who used the blog.**

## Discussion

Although blog has been used in teaching for several years, further research of the blog effects in biology teaching is required. The main aim of this research was to investigate the effects of the blog usage in biology teaching on students' biology achievement. According to the results, the blog usage in biology teaching contributes to the better achievement of students in biology in relation to the teaching without blog usage, where a teacher frontally teaches, because the students who used the blog as a help in their learning had a statistically significantly better result on the post-test than the students who did not use the blog. These findings point to the fact that the blog contributes to the better understanding of the teaching material which is in accordance with the previous research of blog usage in teaching (Churchill, 2009). Many authors proved that a blog influences the improvement of learning performance (Ching, 2012; Chou, 2011; de Andrés Martínez, 2012; Goktas and Demirel, 2012; Halic, Lee, Paulus, & Spence, 2010; Hramiak, Boulton, & Irwin 2009; Mansor, 2011; Tang and Lam, 2014). For example, Halic, Lee, Paulus, & Spence (2010) state that interaction of in-class teaching combined with blog-aided teaching significantly improves understanding of the matter. According to Cavanagh, Bower, Moloney, & Sweller, (2014) findings, video blog application improves learning performance of certain contents of a matter.

When the fact that the topic of Cytology, which the students often find abstract, was taught in these lessons during this research, is taken into account, the blog becomes a significant factor which contributes to the improvement of students' achievement because the students can see on it pictures of cells and videos of complex biological processes that take place inside the cell. For example, if we can show that the use of computer animations of cellular



respiration lead to greater conceptual understanding, as well as transfer of the knowledge, to diagnose metabolic disease compared to the effect of students simply reading about it in the textbook, there is not necessarily a direct transfer to animations of cell division, for example, and its transference to understanding of genetic diseases. However, if we can show that animations of cellular respiration lead to greater conceptual understanding and knowledge transfer because they appeal to more than one learning modality (i.e., both visual and auditory) directly relating to the theory of modality, then perhaps if the cell division animations also appealed to both learning modalities, we could assume that these would lead to greater improvements in student understanding, as well (Jensen, Dario-Becker, Hughes, Amburn, & Shaw, 2012).

This research also measured at which level of knowledge (basic, intermediate, advanced) the blog contributed the most to the students' biology achievement. Although, before this very research had taken place, it could have been expected that the blog contributed the most to the students' achievement at the advanced level since the tasks at this level of knowledge were the most demanding and thus included pictures and charts, these findings did not confirm that. The results showed that the blog contributed to the students' biology achievement in general at all three levels of knowledge and that the blog contribution statistically did not stand out at any level in particular in relation to the other levels of knowledge. In earlier research it was confirmed that a blog could be an efficient means for students who wish to deepen their knowledge in general and advance in their skills (Tekinarslan & Izzet, 2008).

One of the aims of this research was to show which group of students (weak, average, advanced) made the greatest progress with the help of a blog. The research showed that with the help of a blog the advanced students progressed the most, somewhat smaller progress was made by the average students, whereas the weak students made the smallest progress in relation to their biology achievement. One of the reasons for such a result is the fact that the advanced students are capable of solving tasks at all three levels of knowledge so the blog covers a wide range of teaching materials for such students. These findings are in accordance with previous ones which showed that using blogs in teaching was useful for the development of learning skills at higher levels of knowledge where the students are more active, and the learning in itself is authentic and in the center of students' activities (Farmer, 2006; O'Donnell, 2006). Since larger investments in the sense of studying and working harder are necessary for success at school, it can be assumed that the advanced students are at the same time the most hard-working and the most interested in a specific subject. More often than not, the advanced students search for the information about the teaching material on the Internet, and therefore, in this case, the blog makes their job of finding information significantly easier because most of the information related to the specific lesson is located in one place in the form of presentations, pictures, videos.

The groups of weak and average students often learn at the level of reproduction while the advanced students are capable of learning at the level of understanding, analysis and application of knowledge. According to the previous research where students were supposed to assess the blog, the results had shown that it enabled progressive studying and not only learning the facts by heart (Farmer, Audrey, & Brooks, 2008), which was in accordance with the expectation that the best students who studied with understanding should have most benefits from using a blog.

The findings generally confirm the positive effects of blogs on students' biology achievement. The computers and Internet services are widely used in schools and students nowadays generally manage with informational technologies very well, often even better than many teachers do. Designing and writing a blog is simple and once the presentations are finished, the later maintenance of the blog does not take a lot of time. In most cases teachers already have presentations which they show to the students in class, so it would be extremely useful to integrate them into the blog (students', teachers', school blog) or any other tool of Web 2.0 technology so that the communication between the students and the teachers would go both ways even when the students are not at school.

#### *Research Limitation*

Despite the importance of these findings, one should bear in mind the following limitations of this research. The sample is of appropriate type and it included only the students of the first grade of high school, so this research cannot be generalized to the whole students' population. Potential future research should perceive (determine) whether the effects of blog application are gender dependent. The topic that was taught with the help of the blog is appropriate for this type of teaching because the processes that take place inside the cell are often abstract to the students, so it is much easier to present them with the help of a video material, so therefore the results cannot be generalized to other teaching topics.



## Conclusions

The general conclusion of this empirical research is that using blogs in biology teaching significantly contributes to the improvement of students' achievement. Since this research was conducted within the topic of Cytology, the results cannot be generalized to the entire biology teaching. It is definitely certain, that the blog is not the only good solution, so in some future research it would be useful to investigate the effects of blog usage on students' biology achievement within some another topic or to compare the effects of blog usage in teaching in relation to some other type of teaching, such as learning in nature or learning through experiments.

The results of this research of the effects of blog usage as a web tool in biology teaching in general upper-secondary school generally show statistically significant positive effects of the blog on the students' biology achievement. The students who used blogs in biology learning made greater progress in comparison to the students who did not use blogs but had the topic of Cytology presented to them by the teaching where a teacher frontally teaches. Also, the research showed that the students with the help of the blog equally progress at all levels of knowledge. When the group of students that made the greatest progress with the help of the blog is in question, the research showed that the blog contributed the most to the advanced students' biology achievement.

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Received: August 24, 2017

Accepted: April 05, 2018

**Tihomir Lazarević**

MA, PhD Student, University of Novi Sad, Faculty of Sciences,  
Department of Biology and Ecology, Trg Dositeja Obradovića 3,  
21000 Novi Sad, Serbia.  
E-mail: tihomirlazarevic@uns.ac.rs  
Website: <http://www.dbe.uns.ac.rs/en>

**Tomka Miljanović**

PhD, Full Professor, University of Novi Sad, Faculty of Sciences,  
Department of Biology and Ecology, Trg Dositeja Obradovića 3,  
21000 Novi Sad, Serbia.  
E-mail: tomka.miljanovic@dbe.uns.ac.rs  
Website: <http://www.dbe.uns.ac.rs/en>

**Vera Županec**

PhD, Assistant Professor, University of Novi Sad, Faculty of Sciences,  
Department of Biology and Ecology, Trg Dositeja Obradovića 3,  
21000 Novi Sad, Serbia.  
E-mail: vera.zupanec@dbe.uns.ac.rs  
Website: <http://www.dbe.uns.ac.rs/en>

**Goran Zarić**

MA, PhD Student, University Business Academy, Faculty of  
Economics and Engineering Management, Cvečarska 2, 21000 Novi  
Sad, Serbia  
E-mail: zaric.goran5@gmail.com  
Website: <http://www.fimek.edu.rs/en>

