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Application of interactive whiteboard in the consideration of concepts pollination and pollinators

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Abstract: *Teaching biology is characterized by a great number of concepts and facts. Particularly, it is very important that students understand the role of insects (especially insect pollinators) and their importance in nature. In order to effectively present important concepts such as pollination and pollinators, interactive white board (IWB) can be used. In this paper, an analysis of the efficiency of application of an IWB in the biology teaching was presented in terms of attained knowledge among students. In particular, the pedagogical experiment with parallel groups was applied to determine whether the IWB was effective as teaching technology compared to the usual teaching approach without this technology. The E group covered programme content related to pollination and pollinators by applying IWB. The C group was exposed to the same content, without IWB in teaching process. It was evidenced a difference of the attained knowledge in favor of the experimental group after the introduction of the experimental factor (application of IWB). The application of IWB directly contributed to better learning and knowledge acquisition in teaching the biology content Pollination and Pollinators. It was concluded that IWB are determined as very effective teaching technology.*

Key words: *interactive whiteboard (IWB); biology teaching; insect pollinators; pollination; elementary school*

1. INTRODUCTION

The interactive board is an information and communication technology [12]. It is an electronic device that allows interactive work with the computer directly connected with the table by clicking on the projected image with an interactive pen or finger [11]. Information is sent from the board to the computer for further storage, or in the form of a command that is projected in a fraction of a second on a board. The image is controlled by a computer and it serves as a curtain on which information is continually designed and as a generator of feedback into the computer system [15]. It can be distinguished two types of IWBs from the point of view of the projection direction, those with the front projection and those with the rear projection. They can also be divided into static, mobile, and portable in relation to the way they are connected and set up. Connection of the board can be provided via USB cable or wireless [3].

The interactive whiteboard (IWB) is part of information and communication technologies (ICT) which enhances learning and teaching and is able to combine a lot of beneficial features of ICT in one medium [7]. It was considered that interactive whiteboard is a large touch-sensitive and interactive display that connects computer and projector. The use of IWB in the classroom can make a difference for students who have trouble with thinking abstractly in abstract subjects, because it makes the teaching/ learning process more concrete, when using the features of the IWB [4]. Within the context of using the interactive whiteboard in the teaching and learning of Science, many surveys emphasize the effectiveness of using this technology tool to improve students' capacities and teachers' professional development [16].

In the traditional frontal form of teaching, the student is passive and oriented to lecturing professors and capturing notes, while in interactive teaching it is much more active. There are few studies based on the presentation of good practices on integrating IWB in teaching science, where teachers can promote an interactive learning and stimulate students' creative potential [18].

The wide spread introduction of IWB technology and screens into classrooms, makes the multimodal resources of color, image, dynamic movement, and sound available for pedagogic design in newly connectable ways. These facilities present teachers with new questions about how to design and use teaching materials, new possibilities and constraints [8].

An IWB represents an important turning point in the classroom around the world and researches by numerous authors suggest that if properly used they could have a positive effect on student results [19].

1.1. Application of IWB in the assessment of the terms pollination and pollinators

Pollination is a fundamental, essential process in any ecosystem that allows reproduction of plants and the production of food for humans and animals [10], [17].

Pollinators are a key component of global biodiversity, providing vital ecosystem services to crops and wild plants [14].

Among animal pollinators the most effective are insect pollinators. In addition to numerous insect pollinators, bees have the greatest effect. When most people think of bees, they mostly think of the honey bee. The honey bee is the principal species used for honey production and crop pollination. Although honey bees pollinate a wide variety of crops, they are often relatively ineffective pollinators. Apart from honey bees, solitary bees are used for pollination. Efficiency in pollinating fruit trees of one female solitary bee can be compared with the efficiency of 120 honey bees. Also, in the process of collecting pollen, solitary bees cross the pollination, which enables a better and higher yield of fruit [17].

There is clear evidence of recent declines in both wild and domesticated pollinators, and parallel declines in the plants that rely upon them [14]. The decline of pollinator populations is one form of global change that actually has credible potential to alter the shape and structure of terrestrial ecosystems. Pollinator declines can result in loss of pollination services which have important negative ecological and economic impacts that could significantly affect the maintenance of wild plant diversity, wider ecosystem stability, crop production, food security and human welfare [1]. This has led to demands for a response by land managers, conservationists and political decision makers to the impending 'global pollinator crisis'. In questioning this crisis, it becomes apparent that perceptions of a pollinator crisis are driven mainly by reported declines of crop-pollinating honeybees [5].

Results of recent studies and experts in pollination ecology confirmed that losses of honey bee and other bee colonies leave us in the uncertainty of survival in terms of food and life as a whole [14]. Based on the aforementioned importance of the concepts of pollination and pollinators, there is an urgent need for their complex interactive presentation. In that sense, the application of IWB would be very appropriate.

2. THE AIM AND METHODOLOGY OF RESEARCH

The aim of this research was to determine whether the IWB is effective as teaching technology compared to the usual teaching approach without this technology, in terms of acquiring knowledge of the programme content of pollination and pollinators in elementary school. The task of the research was to determine and measure the difference in acquiring student knowledge by applying these didactic models and comparing the efficiency of these models.

The basic zero hypothesis from which it proceeded is that there is no statistically significant difference in achieving results in master content between the students of the control and experimental group after the introduction of the experimental factor (application IWB) into the experimental group.

An alternative hypothesis was: there is a statistically significant difference in master content of Pollination and Pollinators between the experimental and control group after the introduction of the experimental factor (IWB) into the experimental group.

The difference in the quality of acquired knowledge between the experimental and control group of students is expected in favor of the experimental one. The pedagogical experiment with parallel groups was applied [9].

The research involved 64 students of the sixth grade of elementary school (Elementary school Nikola Tesla, Belgrade, municipality Rakovica), who were divided into one experimental (E) and one control (C) group. The E group covered programme content related to Pollination and Pollinators by applying IWB. The C group was exposed to the same content, without these innovations in teaching process.

Before the introduction of the experiment (IWB) in experimental group, the groups were made uniform concerning the number of students, gender and general knowledge of biology, as determined by the results of a pre-test of knowledge. The test was related to all the program content that preceded the teaching field of Pollination and Pollinators. The pre-test included tasks classified into three broad categories of the cognitive domain [2]. The maximum points that student could score on the test was 100. After equalizing the experimental (E) and control group (C), group E was taught the prepared programme content Pollination and Pollinators by applying IWB. Within the figure 1, 2, 3 and 4, the look of the IWB is presented in the realization of this content for the E group. Different types of animal pollinators were shown at the beginning of the introductory part of the school class (Fig. 1).


Butterfly

Fly

Bat

Bee

Figure 1. *Animal pollinators*

Also, the different types of pollinator bees have been discussed (Fig. 2).


Honey bee

Red solitary bee

Blue orchard bee

Bumble bee

Figure 2. *Insect pollinators*

Students had the opportunity to see the differences between honeybee and solitary bees (Fig. 3), as well as the consequences of declines of pollinators (Fig. 4).


Community of honeybee's

Solitary bee

Figure 3. *The difference between the honey and the solitary bee*

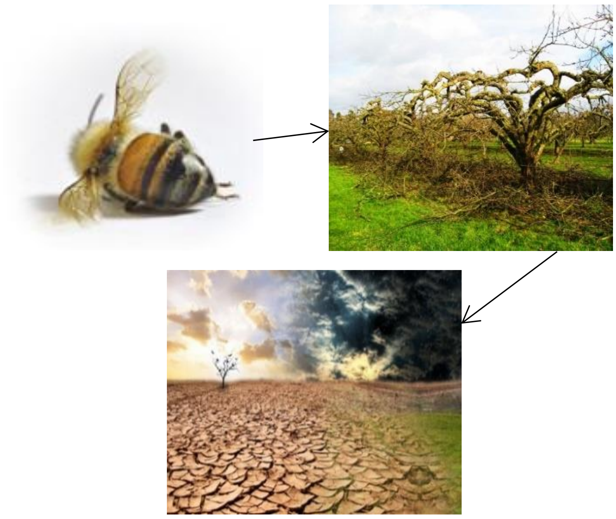

Figure 4. *Consequences of pollinator declines*

Flipchart software made it possible to organize those teaching materials through the pages that are not visible simultaneously, but it was easy to display them again, with the ability to print concepts below the presented photos.

The students in Group C were exposed to the usual teaching approach without IWB for the same teaching content. Teaching methods that are used are oral presentation, illustrations and demonstrations. Also, students didn't have opportunity to see photos of pollinators and schema of pollinator declines. After that, a post-test was distributed in order to evaluate the knowledge acquired by the students who were learning by using IWB and those exposed to the usual teaching approach without this technology. This test measured the quantity of the students' knowledge only in the teaching field Pollination and Pollinators. Like in pre-test, there was the same number of the tasks and the maximum points that student could score was 100.

3. RESULTS AND DISCUSSION

The results of the pre-test are presented in Tables 1 and 2. The standard statistical indicators (mean of the number of achieved points-M, standard deviation-SD and coefficient of variation-CV) are presented in the table 1.

Table 1. *Basic statistical data for the pre-test*

Group	**M**	**SD**	**CV**
E	38.5	13.18	0.34
K	41.1	13.82	0.33

Table 2 shows relations between E and C group, according to t-value (for pre-test).

Table 2. *Relations between E and C group, according to t-value (for pre-test)*

Relation	t
E: K	0.40

Based on the results presented for the pre-test for Groups E and C, it can be observed by using Student's t-test for a significant level of p=0.05 and a critical value of t=1.96, that there is no statistically significant difference in the achieved number of points between Groups E and C (Total: t=0.*40*<1.96). These two groups were balanced in terms of their general knowledge of biology before the introduction of the experimental factor (*IWB*).

The results of the post-test are presented in Tables 3 and 4. Table 3 shows the students' achievement on the post-test expressed in above mentioned statistical indicators (M, SD and CV).

Table 3. *Basic statistical data for the post-test.*

Group	M	SD	CV
E	60.26	16.80	0.27
K	46.20	18.27	0.39

Table 4 shows relations between E and C group, according to t-value (for post-test).

Table 4. *Testing group uniformity in terms of the post-test, using a t-test*

Relation	t
E: K	3.10

By comparing the average values of the results achieved, a clear difference can be observed between Groups E and C in the test as a whole, favoring the former. On the basis of the results presented for the post-test of knowledge for Groups E and C (Table 3 and 4), it can be noticed that there are statistically significant differences in the number of points achieved in the test as a whole, in favor of Group E (Total: *3.10*>2.58).

The obtained results show that the experimental group to which the content of pollination and pollinators was presented through IWB achieved better results in the final test of knowledge than the control group to which the same content was presented without them.

There are also many other studies based on the use of IWB in natural sciences and other topics related to biology.

The use of IWB has yielded good results in other field of biology such as genetic (with concepts of chromosomes and DNA) [20].

In research on the topic: "Photosynthesis: Energy Linking" it was concluded that the use of IWB was more effectively on students' achievement than teaching according to the curriculum [13].

The application of IWB in the theme of the Cell Division proved to be very effective in order to acquiring of knowledge [22].

Lessons about food chains and gas exchange in the lungs, also were presented with IWB. It has been shown that teachers have had different pedagogical approaches to encouraging and supporting activities in which students shared, evaluated and developed their ideas using an IWB [6]. In that sense, the teachers will be able to use the benefits of IWB in active learning process and support students in their collaborative work and active dialogue [21].

4. CONCLUSION

The teaching content Pollination and Pollinators was implemented through IWB in the experimental group, while in the control group it was implemented through the usual teaching approach without this technology. After introducing the experimental factor (IWB) in Group E, this group achieved better results in the post-test of knowledge than Group C. There is a statistically significant difference in mastering the given content between the students in the experimental and the control group. It was proved that the experimental group had a greater quantity of acquired knowledge as compared to the control group. Therefore, the zero hypothesis is rejected and the alternative hypothesis is accepted that there is a statistically significant difference in mastering of the program content of the pollination and pollinators (in the final test) between the experimental and control group of students in favor of the experimental group. It can therefore be concluded that the application of IWB directly contributed to better learning and knowledge acquisition in teaching the biology content *Pollination and Pollinators*. IWB allows teachers to present certain content more easily, so quantity of students' knowledge has been increased. In order to improve biology teaching by using IWB, it is necessary to provide training for teachers to apply this technology. From this aspect, further continuous training of teachers for the applying of this technology is planned.

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REFERENCES

[1] Abrol, D, P. (2011). Decline in Pollinators; Biodiversity Conservation and Agricultural Production

[2] Anderson, W. L., & Krathwohl, D. R. (2001). Taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives. New York: Longman.
[3] Brecka, P., & Oleksakova, M. (2013). Implementation of interactive whiteboards into the educational systems at primary and secondary schools in the Slovak Republic. International conference on advanced information and communication technology for education (ICAICTE), Hainan, China. Retrieved in November 2017 from https://www.atlantis-press.com/php/download_paper.php?id=8804
[4] Bui, V. (2009). Interactive Whiteboards Impact on Education. Los Angeles: California State University.
[5] Ghazoul, J. (2005). Buzziness as usual? Questioning the global pollination crisis; Trends EcolEvol. 20(7):367-73
[6] Hennessy, S., Deaney, R., Ruthven, K., & Winterbottom, M. (2007). Pedagogical strategies for using the interactive whiteboard to foster learner participation in school science. Learning, Media & Technology, 32(3), 283-301
[7] Isman, A., Abanmy, F.A., Hussein, H.B., & Saadany, M.A., (2012). Saudi secondary school teachers' attitudes' towards using interactive whiteboard in classrooms. The Turkish Online Journal of Educational Technology, 11(3), 286-296
[8] Jewitt, C., Moss, G., Cardini, A., (2007). Pace, interactivity and multimodality in teachers' design of texts for interactive whiteboards in the secondary school classroom. 303-317 | Published online: 08 Aug 2007
[9] Killermann, W., (1998). Research into biology teaching methods. Journal of Biological Education, 33 (1), 4-9
[10] Klein, A.M., & Vaissière, B.E., (2007). Importance of pollinators in changing landscapes for world crops. Proceedings of the Royal Society B. Biological Sciences 274, 303-313
[11] Mercer, N., Hennessy, S., & Warwick, P., (2010). Using interactive whiteboards to orchestrate classroom dialogue. Technology, Pedagogy and Education, 19(2), 195-209
[12] Mernjik, M. (2013). Interactive whiteboards in teaching physics. Graduation, Novi Sad: University of Novi Sad.
[13] Onder, R., & Aydin, H. (2016). The effects of the use of smart board in the biology class on the academic achievement of student. I-manager's Journal on School Educational Technology, 12(1), 18-29
[14] Potts, S.G., Biesmeijer, J.C., Kremen, C., Neumann, P., Schweiger, O., Kunin W.E. (2010). Global pollinator declines: trends, impacts and drivers, 25(6):345-53
[15] Raonić, R. (2012). A strategy for using an interactive whiteboard. Sombor: Secondary Technical School Sombor
[16] Smith, H., Higgins, S., Wall, K., & Miller, J. (2005). Interactive whiteboards: Boon or bandwagon? A critical review of the literature. Journal of Computer Assisted Learning, 21(2), 91-101
[17] Stanisavljević, L. (2012). Insekti oprašivači i njihov značaj za čoveka [Insects as pollinators and their importance for man]. In Z. Tomanović (Ed.), Primenjena entomologija [Applied Entomology] (117-147). Beograd, Serbia: University of Belgrade, Faculty of Biology.
[18] Stoica, D., Paragina, F., Paragina, S., Miron, C., & Jipa, A. (2011). The Interactive Whiteboard and the Instructional Design in Teaching Physics. Procedia Social and Behavioral Sciences, 75, 3316-3321
[19] Torff, B., & Tirotta, R. (2010). Interactive whiteboards produce small gains in elementary students' self-reported motivation in mathematics. ComputEduc, 54(1), 379–383
[20] Veselinovska, S. (2014). Use the interactive whiteboard in teaching biology. Technics and Informatics in education. Fifth International Conference, Faculty of Technical Science Čačak.
[21] Warwick, P., Mercer, N., Kershner, R., & Kleine Staarman, J. (2010). In the mind and in the technology: The vicarious presence of the teacher in pupil's learning of science in collaborative group activity at the interactive whiteboard. Computers & Education, 55(1), 350 – 362
[22] Yang, K., & Wang, T. (2012). Interactive whiteboard: effective interactive teaching strategy designs for diology teaching. E-Learning - Engineering, On-Job Training and Interactive Teaching. Taiwan. 139-156