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Is the Integrative Teaching Approach Beneficial for Learning?

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Abstract: Environmental protection contents are characterized by a wide range of interdisciplinarity. They are realized separately within the teaching of biology and geography (5th–8th grade) in elementary school in Serbia. Numerous concepts and facts are similar, especially within the content Nature Protection. The application of an integrative teaching approach in the realization of environmental protection contents in elementary schools was investigated. Pedagogical experiment with parallel groups of elementary school students was conducted by applying integrative teaching approach in the experimental (E) and traditional approach in control (C) groups of students. The data were obtained through the pre-test and post-test. Integrative teaching approach has proven to be effective in the realization of the above-mentioned program contents.

Keywords: integrative teaching approach, elementary school students, environmental protection contents.

Introduction

The curriculum is organized through isolated subjects, which is a big problem in education, because it prevents students from recognizing and creating connections between subjects (Frykholm and Glasson, 2005; Owen, 2015). Integrated learning provides students with the opportunity to see the interconnectedness and interrelationships between the different parts of curriculum. Away from focusing on learning in particular curriculum areas, an integrated program is based on skill development around a topic that is relevant to the students. Godemann (2006) outlines the path that knowledge needs to change in order to be applicable in an integrative approach. According to Godemann (2006), disciplinary knowledge is simplicity, singularity, linearity and it can cause fragmentation in knowledge and boundary formation. On the other hand, integrative knowledge is characterized by heterogeneity, complexity, non-linearity, connection, collaboration, and consequence.

All school subjects and contents that are more complex and abstract have to use an appropriate teaching approach (Gagić et al, 2019). Children learn better when valid connections are laid out across the entire curriculum. Integrative teaching promotes meaningful learning especially in the initial stages of education, but integration is possible in any of the stages of learning (primary, secondary, and tertiary) (Kaur, 2019). According to Acarli (2020), integrating parts of knowledge from different areas is very important for critical and creative skills of students.

Integrative learning can be defined as the process of making connections between skills and knowledge from teaching sources and experiences. It connects theory and practice, and uses different perspectives to help students understand issues (Lewis, 2017; Huber et al., 2007). Integrative learning suggests that student connect previous knowledge with the newly acquired and see connections in the curriculum (Brownlee and Schneider, 1991; Klein, 2005; Leonard, 2012).

Accordning to Haapaniemi et al (2019) “an essential skill in the twenty-first century is how to make sense of the complex flood of information”. For this reason, it is important for students to develop the ability to connect scattered information. The authors call these students integrative thinkers (Haapaniemi

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et al, 2019).

From the above definitions of integrative learning, it is concluded that this model of learning is the connection of scattered information, as well as the connection of previous knowledge with new. However, integrative learning is much more than connecting scattered information. The term "integration" means the unification of certain parts into one whole and the interconnection of autonomous elements. Teaching, based on this approach, can be very stimulating for students. Content that is interconnected contributes to knowledge that is complete, valuable and usable. An integrative approach implies an active student as well as a teacher. It is not just about conveying facts, but much more about solving problems, asking questions and actively seeking answers from your environment.

Integrative learning represents a challenge for general education programs (Mahoney and Schamber, 2011). The Association of American Colleges & Universities (2007) highlights integrative learning as one of the important teaching approaches in modern university education. Therefore, it is important that students at colleges acquire knowledge in the field of integrative learning. This could be achieved through a curriculum that encourages integrative learning, as well as through various trainings and seminars (Huber and Hutchings, 2004).

Through integrative teaching and learning, students can develop a deeper understanding of content and to improve understanding of a complex problem (Leonard, 2012; Becker and Park, 2011).

This approach can help students in the synthesis and integration of knowledge. In that way, they could acquire the ability to solve problems with an ethical dimension. Also, it could encourage their critical, creative, and unconventional thinking (Ivanitskaya et al., 2002).

Integrative teaching approach allows students to train effectively by solving problems from different fields and to gain a deeper and more systematic knowledge that can be applied to real life. This approach prepares students for the process of lifelong learning as it blurs the traditional boundaries between subjects (Lake, 1994). Integrative learning has proved to be one of the key strategies for students' success. In particular, integrative learning prepares them to respond to complex problems based on interdisciplinary connections, experiential knowledge, and co-curricular learning (Rossing and Lavitt, 2016). According to Miller (2005), "integrative learning refers to many different integrative capacities: the application of theory to practice, the ability to connect skills and knowledge from one course to solve and explore issues in another, and the capacity to reflect and identify connections made over time".

Integrative teaching uses interdisciplinary approaches and it is focused on applying real-world scenarios. It also has a positive effect on the development of the student community (Abraham and Shih, 2015).

Tani, Juuti and Kairavuori (2013) point out that "different disciplines have different ways of 'looking' at the world and constructing people's understanding of the world, and therefore it is important to understand the perspectives they use". An integrative teaching approach is a very good solution for numerous scientific contents in subjects such as: biology, chemistry, physics, geography, mathematics (Johnson and Dasgupta, 2005). In the science subjects, numerous links can be found in content dealing with the problem of environmental protection (Abdullah, Halim and Shahali, 2011). According to Clark and Linn (2010), "knowledge integration involves a dynamic process of linking, connecting, distinguishing, organizing, and structuring ideas about scientific phenomena. These ideas include facts, patterns, templates, views, theories, models, and visualizations."

Environmental protection is one of the main topics in modern world. Because of that, environmental education occupies an important place in the curriculum. The teachers training has a significant role in the ecological education system and including environmental protection topics in school lessons are very important (Mróz, Ocetkiewicz and Walotek-Ściańska, 2018). Geography and biology are very important subjects that ensure the realization of environmental competencies (Mwendwa, 2017). There is a great potential for achieving an integrative approach between geography and biology, because it is possible to connect a large number of topics (Tani, Juuti and Kairavuori, 2013). Education for a sustainable future is a huge challenge for educational systems. Some authors (Hua, 2004; Kimaryo, 2011) agree that environmental education should go beyond the education in a classroom and into society, everyday life, and nature. Using active teaching methods and connecting theory and practice with examples from real life situations provide an opportunity for students to learn better. According to Moon (2008), using active teaching methods encourages students to think critically and encourages them to learn, which is very important in the field of environmental education.

Elementary programme contents related to environmental protection are taught separately within two teaching subjects (biology and geography) in Serbian elementary schools. The most similarities in the topics related to environmental protection between these two subjects are in the eighth grade. In biology classes, eighth-grade students learn about the ways the environment is threatened, types of erosion, the

effects of climate change, natural and cultural assets, and similar issues, while in geography classes, students are taught the national geography of their country.

The topics that exist in both biological and geographical contents and which contain the most of the same (common) concepts are National parks of the Republic of Serbia (Geography) and Categories of protected natural assets (Biology) (Figure 1). They are very suitable to be realized and combined with the integrative teaching approach.

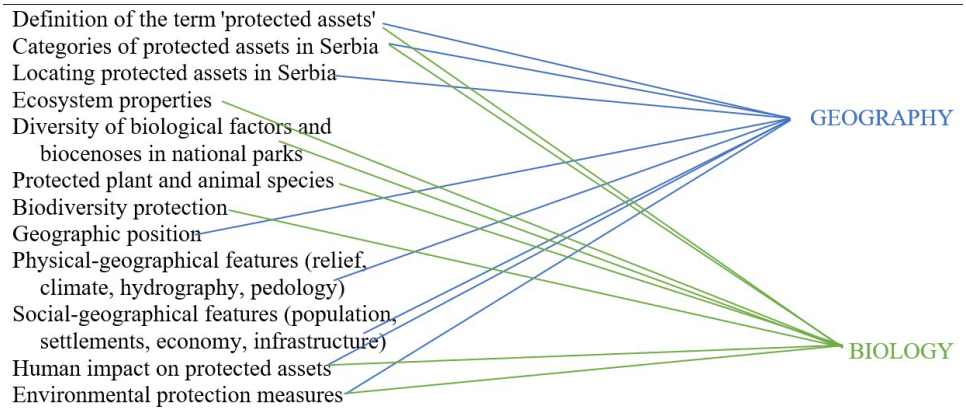

Figure 1. Geography and biology topics and concept

Based on the above, the application of the integrative teaching approach was started concerning these program contents in the eighth grade of elementary school. The main goal was to discover whether this type of teaching is helpful, in terms of obtaining knowledge and its retention. The intention was to answer the following research questions:

Does the application of integrative teaching approach contribute to a quantity of the obtained knowledge?

Does the application of this approach contribute to knowledge retention?

It was expected that there would be a difference in the quantity of the acquired knowledge and knowledge retention between the students (in favor of the students who had integrative teaching). The goal was to identify and measure this difference.

Materials and Methods

The pedagogical experiment with parallel groups [experimental (E) and control (C)] was applied (Killermann, 1998) in order to investigate if the integrative teaching approach is beneficial for learning.

The data was gathered through the pre-test, post-test, and re-test to determine whether the integrative approach (experimental factor) is effective as a teaching approach for presenting the concepts of topics *National parks of the Republic of Serbia* (Geography) and *Categories of protected natural assets* (Biology).

In Group E, the lessons were done through an integrative teaching approach, and in Group C a traditional approach (in both subjects, separately) was used. The research was conducted at the elementary schools in Novi Sad.

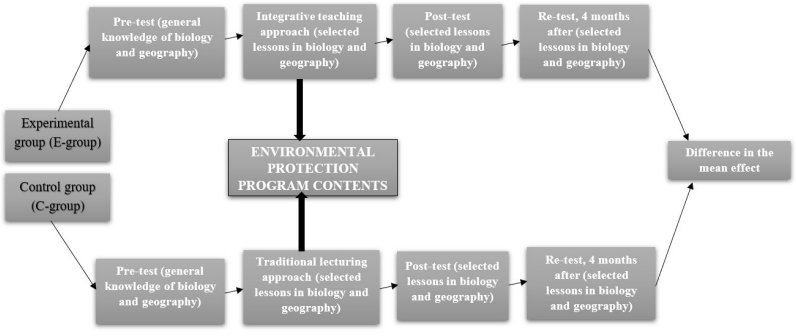

Figure 2. Research organization

The research included a total of 135 eighth-grade students (fourteen years old) from the elementary schools from Novi Sad, Serbia. The students were grouped into Group E (N= 68) and Group C (N=67).

Before the introduction of the experimental factor (integrative teaching approach) in the experimental group, the groups were made uniform concerning general knowledge of geography and biology, as determined by the results of a pre-test of knowledge.

All the participants, including students' parents, gave the permission for research which was in a way that agrees with the permission of the ethics committee of the Faculty of Sciences.

The pre-test included fourteen tasks in total, classified into three broad categories of the cognitive domain: Rank 1 (remembering and understanding), Rank 2 (applying and analyzing), and Rank 3 (evaluating and creating). In order to determine difficulty levels of knowledge, the tasks were divided based on the adopted Bloom's taxonomy (Anderson and Krathwohl, 2001), where the cognitive domain is divided into six categories (remembering, understanding, applying, analyzing, evaluating, and creating). The test is based on all program contents that precede the lessons about *National parks* and *Categories of protected natural assets.*

After making the experimental group (E) and the control group (C) equal, Group E was taught both geography and biology contents by applying an integrative teaching approach, and in Group C a traditional approach was used.

There were one geography and one biology teacher, who realized integrative teaching for the E group. After short teachers' instructions, educational integrative materials were distributed to each student. This integrative material, in the form of a worksheet, consisted of four questions that they had to answer, map of Serbia and images of Serbian national parks, protected plant and animal species (Appendix 1). Students had to choose the appropriate images for each Serbian national park and to put them on the map of Serbia. In doing so, they were able to use textbooks and other available teaching resources.

After working with integrative teaching material, they all discussed correct answers and repeated the presented common concepts on the map, for each Serbian national park, with the help of teachers.

In the development of integrative teaching materials for elementary school students, the cooperation team in this research included biology and geography teachers from this elementary school, as well as university teachers from the departments of teacher education for these teaching subjects (the University of Novi Sad and the University of Belgrade).

The control group of students was taught by the traditional approach. The students watched and listened to the consecutive Powerpoint presentations, which were presented by biology and geography teachers. The first presentation contained only biological and the second only geographical teaching content. There was no students' discussion after these presentations, nor an opportunity for their independent work and reasoning.

Groups E and C were independent, in separate classrooms. Students from Group E had no practice about the integrative teaching (Kember, 2003). After that, a post-test was distributed to evaluate the knowledge acquired by the students who used the integrative teaching approach and by those exposed to the traditional teaching approach. The post-test was divided into three ranks/categories, as it was the case in the pre-test (Figure 3). The tasks in the test were of different types and ranked by difficulty. The test was performed by students of both groups (experimental and control), and the results were later analyzed.

Rank 1

Circle the letter of the correct answer:

The largest National Park in Serbia is:

1. Tara
2. Kopaonik
3. Fruška Gora
4. Đerdap

The river that flows through Tara National Park is:

1. Dunav
2. Drina
3. Ibar
4. Sava

Rank 2

Write the appropriate number on the line next to each term, depending on which National Park the term is related to. Enter number:

1 for **Fruška gora**, **2** for **Đerdap**, for **Tara**, **4** for **Kopaonik** and **5** for **Šar Planina**

Golubac fortress ____

Glacial lakes ____

Salamander ____

Picea omorika ____

Brown bear ____

Rank 3

In the appropriate fields, enter the name of biomes characteristic of the specific latitude in which they spread.

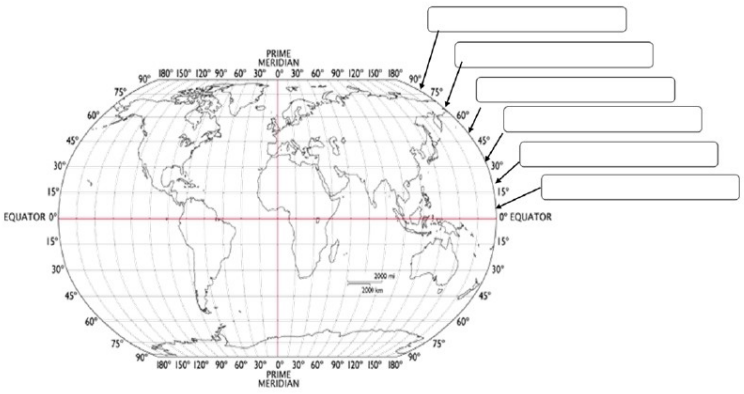

Figure 3. Example of some tasks used as an Indicator of Ranks 1, 2 and 3 (post-test).

Four months later, a post-test was distributed (re-test) to compare the knowledge retention in E and C groups of students. The tasks in the re-test were of different types and ranked by difficulty. The re-test, was also performed by students of both groups (experimental and control), and the results were later analyzed.

The data were analysed by the following statistical procedures (sum, percentage frequency, mean, standard deviation, and Student's t-test for testing any differences between Groups E and C). The software package SPSS 23 was used for statistical analyses (Sheridan, 2012).

Results and Discussion

The results of the pre-test are showed in Tables 1 and 2. The standard statistical indicators (mean of the number of achieved points-M and standard deviation-SD) are given in Table 1. It shows the students' achievement on the pre-test expressed in the above-mentioned terms, in all three ranks of tasks, as well as in the test as a whole. The E group students achieved 63.29% points and the C group students 57.48% points (in total).

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

Group	*Rank 1*			*Rank 2*			*Rank 3*			*Total*		
	N	**M**	**SD**	**N**	**M**	**SD**	**N**	**M**	**SD**	**N**	**M**	**SD**
E	68	20.62	4.48	68	23.88	7.87	68	19.03	9.80	68	63.29	19.58
C	67	19.52	5.95	67	21.28	9.71	67	17.09	10.26	67	57.48	23.56

Note: N – number of students, M – mean of the number of achieved points, SD – standard deviation

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

Table 2.
Testing group uniformity in the pre-test, using an independent two-sample t-test.

Group	*Rank 1*		*Rank 2*		*Rank 3*		*Total*	
	t-value	*p*-value	*t*-value	*p*-value	*t*-value	*p*-value	*t*-value	*p*-value
E : C	2.114	**.036**	1.641	.103	.742	.460	.607	.545

Based on the given results for the pre-test for Groups C and E, it can be noticed that only in Rank 1 exists slightly statistically significant difference (Rank 1: p = .036). Groups E and C were equalized in terms of students' general knowledge of geography and biology before involving the experimental factor (correlating concepts from geography and biology).

Table 3 shows the students' achievement on the post-test expressed in the above-mentioned statistical indicators (*M* and *SD*), in all the three ranks of tasks, as well as in the test as a whole. The E group students achieved 72.33% points and the C group students 63.16% points (in total).

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

Group	*Rank 1*			*Rank 2*			*Rank 3*			*Total*		
	N	**M**	**SD**	**N**	**M**	**SD**	**N**	**M**	**SD**	**N**	**M**	**SD**
E	67	24.31	4.34	67	24.75	8.44	67	23.27	8.38	67	72.33	18.29
C	62	20.69	6.36	62	20.98	10.57	62	21.44	11.35	62	63.16	26.40

Note: N – number of students, M – mean of the number of achieved points, SD – standard deviation

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

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

Group	*Rank 1*		*Rank 2*		*Rank 3*		*Total*	
	t-value	*p*-value	*t*-value	*p*-value	*t*-value	*p*-value	*t*-value	*p*-value
E : C	3.617	.000	2.347	.020	3.310	.001	4.003	.000

By comparing the average values of the results achieved (Table 4), a clear difference can be observed between Groups E and C in terms of the individual ranks and in the test as a whole, favoring the former. On the basis of the results presented for the post-test of knowledge for Groups C and E, it can be noticed that there are statistically significant differences in the number of points achieved in all the three levels of tasks and in the test as a whole, in favor of Group E.

The results of the re-test are presented in Tables 5 and 6 and show the students' achievement in the post-test expressed in above mentioned statistical indicators (*M* and *SD*), in all the three ranks of tasks, as well as in the test as a whole. The E group students achieved 56.5% points and the C group students 45.3% points (in total).

Table 5.
Basic statistical data for the re-test.

Group	Rank 1			Rank 2			Rank 3			Total		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD
E	68	19.37	5.49	68	20.81	10.15	68	16.32	8.86	68	56.50	21.98
C	60	16.10	5.94	60	15.70	10.97	60	13.50	10.89	60	45.30	25.43

Note: N – number of students, M – mean of the number of achieved points, SD – standard deviation

Table 6 shows relations between Groups C and E, according to t-value (for re-test).

Table 6.
Testing group uniformity in terms of the re-test, using a t-test.

Group	Rank 1		Rank 2		Rank 3		Total	
	t-value	*p*-value	*t*-value	*p*-value	*t*-value	*p*-value	*t*-value	*p*-value
E : C	1.253	.213	.899	.370	2.253	.026	1.244	.216

On the basis of the results presented for the re-test of knowledge for Groups C and E, it can be noticed that there are statistically significant differences in the number of points achieved in Rank 3, in favor of Group E.

The results of the final test show that the experimental group, achieved better results than the control group, and the students from experimental group showed a significantly higher quantity of knowledge acquired. This was proven in all the Ranks (Rank I-remembering and understanding, Rank 2-applying and analyzing, Rank 3-evaluating, and creating), where the values were outstanding compared to the Rank of the control group.

The application of integrative teaching approach in the realization of geography and biology curricula in primary schools (in Serbia) proved to be very effective for acquiring knowledge.

There were many studies related to this topic. The study, which analyzed the effects of applying an integrative approach (mathematics and science instruction) on the achievements of third-grade students (applied on two groups: experimental school and control school), presented evidence that such an approach was beneficial (Adamson et al, 2011).

The researchers found that the integrative approaches among science, technology, engineering, and mathematics (STEM) subjects make significant progress in learning. According to Becker and Park 2011, elementary school students showed better results through integrative teaching. Berlin and White research program emphasizes the importance of teaching science and mathematics as integrated curricula, especially when understanding abstract mathematical concepts (Freitas and Bentley, 2012).

It was evident that an integrative approach had a positive effect on knowledge, skills, and attitudes across subject areas and develop a more powerful understanding and connectivity of key ideas (Kadji-Beltran, 2002). In the integrative learninig research, through simulation and problem-based learning (Walshe et al., 2013) the results indicate performance improvement in all research domains of competency while the integrative approach showed a stimulating effect on students' further learning.

By analyzing student essays, it was determined that the integration of geography with physics and visual arts had positive effects on the learning and the attitudes of students and teachers (Tani, Juuti and Kairavuori, 2013). Authors point out „the students experienced integration as an interesting and fruitful way of working as future teachers".

The results of the assessment project indicate that interdisciplinary learning and teaching is effective in promoting knowledge retention, development of general education skills, and high levels of students' engagement (Carmichael and LaPierre, 2014).

The results presented in this research (primary schools in Novi Sad), showed that the retention of knowledge is higher in the experimental group, where the integrated approach was applied. Compared to that, it was evidenced by a correlation between knowledge retention and interpretation activities on the ability to integrate knowledge (Marsh and Stock, 2006). Also, the integrated education plays an important role in environmental education and training and has importance for understanding the problems of the environment. Topics related to environmental protection are treated only superficially in the science curriculum. It is necessary to make changes in the curriculum and adapt it to current environmental problems (Abdullah, Halim and Shahali, 2011).

Most of the students think that ways of teaching integrative content are quite important and very helpful for learning geographical and biological content. According to Milanković Jovanov et al. (2019), the overall students' attitudes were positive about the class with integrative teaching model. The students agreed that they were much more egaged than in regular classes and there was a good atmosphere during the class.

The organization and preparation of the presented research indicated that teachers, who have been involved in this research did not have enough support in the curricula in terms of providing cross-curricular topics and integrative organization of teaching (Milankovic Jovanov et al., 2019). One of the main problems is that class programs are not arranged according to the integrative approach to teaching. It is very difficult to achieve outcomes and reach standards according to subject programs that do not match. In countries that have an organized curriculum based on classical subjects that are divided, it si very important to plan team and integrative teaching.

Teachers pointed out that the main obstacles to organizing such classes were that they were not sufficiently prepared during their education Also, one of the main problems is that new teaching models can cause students aversion. This is evidenced by the different responses of students in a school that organizes integrative teaching compared to students who have never worked under this teaching model (Milankovic Jovanov et al., 2019).

The positive results of implementing the integrative approach not only relate to progress in different aspects of student development, but it also has a beneficial effect on teachers as well. It provides them with a more dynamic organization of their time and a modern method of teaching because they can use numerous sources in teaching. Integrative teaching experiences face many challenges and it is very important to train teachers during their studies to use new learning models. To achieve the best results and provide quality education, it has been proven that it is necessary to combine different forms of teaching approaches. The most effective results in education are provided by a combination of integrative teaching and interdisciplinary studies (Newell, 2010).

Conclusions

The experiment provided an answer to both research questions. It can be confirmed that the application of the integrative teaching approach has contributed to better quantity of the acquired knowledge. Also, the application of this approach contribute to knowledge retention.

Experimental group achieved better results in the post-test (and re-test) of knowledge than Control group. The high level of statistically significant difference is particularly noticeable between the groups (in favor of the experimental group) in Rank 1 and Rank 3 (remembering, evaluating, and creating).

It can be concluded that the application of the integrative teaching approach directly contributed to better learning and knowledge acquisition in teaching the content *National parks* and *Categories of protected natural assets*. The positive effects of the integrative teaching approach were especially higher in Rank 3 (evaluating and creating). Also a higher retention of knowledge was noticed in students who had integrative teaching classes.

The interconnection of contents between subjects allows teachers to present certain contents as more interesting. In that way, students' knowledge can be increased. Also, it would greatly contribute to the retention of knowledge.

The integration requires detail and creative planning and thinking and the subject integration is often a challenge for teachers (Heywood, Parker and Jolley, 2012). It challenges lecturers to reflect reality in the curriculum and it also challenges students to become active and to be prepared to research, to work independently in order to think and solve problems (Walshe et al., 2013).

To improve teaching by using an integrative teaching model, it is important to provide training for pre-service and in-service teachers, because the implementation of the integrative approach mostly depends on the teacher. Biology and geography teachers need to be trained for applying an integrative

approach. It is also necessary to provide resources for that. Curricular integration of environmental protection contents in elementary schools in Serbia is also planned to increase the efficacy of teaching. The issue of environmental protection and sustainable development is important in the modern world and therefore it is necessary to promote it in every subject in which this issue arises.

Future research in the area of integration in different teaching subjects, and take into account cognitive load, i.e., mental effort as indicator of the efficiency of the teaching approach (Radulović and Stojanović, 2019; Radulović, 2021; Županec et al., 2018). It is expected that this will encourage teachers to cooperate and thus effectively integrate similar teaching contents from different subjects.

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Conflict of interests

The authors declares no conflict of interest.

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Appendix 1.

Example of worksheet for students with integrative contents

I Circle the letter of correct answer:

1. Protected plant species in the Tara National Park, Picea omorika (Pančićeva omorika) grows in the vegetation zone at a height of:

a) below 500 meters

b) from 500 to 2000 meters

c) above 2000 meters

2. What type of biome extends on the edge of the national park Fruška gora due to the humid-continental climate of the Pannonian plain?

a) Steppe

b) Tundra

c) Savanna

3. Which national park is facing the problem of cutting down trees to build ski slopes?

a) National park Đerdap

b) National park Tara

c) National park Kopaonik

4. What factor influenced the reduced fish populations in the upper Danube River in the Djerdap National Park?

a) Climate change

b) Construction of a dam on the Danube

c) Increased traffic on the river

II On the map of Serbia, arrange the material on the site of the appropriate national park