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The Problems of Contemporary Education

Effectiveness of Experiential Learning of Roma Pupils in Terms of Educational Results – A Case Study

Elena Čipková [a], Michael Fuchs [a, *], Dominik Šmida [a]

[a] Department of Didactics in Science, Psychology and Pedagogy, Faculty of Natural Sciences, Comenius University, Bratislava, Slovak Republic

Abstract

The case study focused on exploring the potential of experiential learning in enhancing factual biological knowledge among Roma fifth-grade pupils (ISCED 2) from socio-economically disadvantaged backgrounds. Based on the analysis of academic sources, an educational programme incorporating experiential learning was developed, tailored to the specific educational needs of Roma pupils and emphasising active knowledge acquisition. The research employed a quasi-experimental design to compare whether there were statistically significant differences between the experimental and control groups. The experimental group was educated using the designed educational programme, while the control group received traditional instruction, characterised by the direct transmission of information from the teacher to the pupils. Following the educational intervention, pupils' levels of acquired knowledge were assessed using a custom-designed test. Data analysis demonstrated that the experimental group achieved statistically better results on the administered test compared to the control group. The research findings thus suggest the potential benefits of employing experiential learning in educating Roma pupils to improve factual knowledge levels.

Keywords: Roma, primary school, experiential learning, biology.

1. Introduction

Currently, social and cultural backgrounds exhibit a significant and direct correlation with individuals' educational outcomes (Hillemeier et al., 2009; Avvissati, 2020; Tan, Fang, 2023). People with low socioeconomic status acquire new knowledge and skills more slowly, which is significantly reflected in their overall educational results. The main challenge, which contemporary

* Corresponding author
E-mail addresses: elena.cipkova@uniba.sk (E. Čipková), michael.fuchs@uniba.sk (M. Fuchs), smida8@uniba.sk (D. Šmida)

teachers all around the world face, is the gap in educational attainment between pupils from poor and those from privileged communities (Takashiro, Clark, 2020; García, Weiss, 2017; Blustein et al., 2010). Socioeconomic barriers profoundly diminish the professional aspirations of individuals from lower socioeconomic strata, leading to significant disparities in career attainment and progression opportunities (Tomaszewski et al., 2022). One way to break down this barrier is to improve the educational process and adapt it to the possibilities and abilities of educated pupils. One of the groups in which we encounter a significant impact of socioeconomic barriers is the Roma.

The Roma interest in education is determined not only by their low socioeconomic status but also by their cultural orientation (Cismaru et al., 2015; Rostas, Kostka, 2014). Cultural factors encourage learning, help to improve educational skills – they lead learners to the awareness that education is important for their present and future life. On the other hand, cultural factors can dampen the educational skills of learners because one is socialized in a background that underestimates the importance of education (Gomez et al., 2022; Mundi, 2009). A higher socioeconomic status often correlates with greater cultural capital and a more pronounced cultural orientation. In practice, however, this may not be the case, as cultural status is essentially a heritage that an individual acquires from the environment in which he lives, while the level of social status is the result of his actions (Hollins, 2015). Given the low socioeconomic and cultural status and insufficient support from the family, the home environment does often not provide Roma pupils with opportunities to deepen their factual knowledge. It is factual knowledge that is the essential element with which the pupils must be acquainted (Azevedo et al., 2023; Hew, Cheung, 2014) to be able to develop other levels of cognitive thinking. Factual knowledge, encompassing concepts, definitions, and scientific facts, is pivotal in education due to its foundational role in cultivating individual literacy, particularly in scientific domains (Kubiatko et al., 2018; Hine, Medvecky, 2015; Taber, 2014). This factual knowledge needs to be arranged into an organized system that will allow the pupils to use it in different situations.

2. Specifics of Roma education

Based on the available data, despite a slight improvement in recent years, we still find that up to 68 % of Roma youth receive only lower secondary education. This reflects their low chances of finding a job in the labour market and thus perpetuates the cycle of poverty that is experienced by most members of this ethnic group (European Economic..., 2018). As it is estimated in Europe, only 40 % of Roma pupils regularly attend compulsory education, with significant differences in the school attendance of Roma pupils between countries. Compulsory education is not attended by 43 % in Greece, 22 % in Romania, the Czech Republic, Hungary, Poland, Slovakia, and Spain from 5 % to 7 % of Roma pupils, in Bulgaria, France, Italy and Portugal, the proportion of school-aged Roma children who do not go to school is between 11 and 14 % (European Union..., 2014). Many Roma pupils struggle with institutional education (e.g., Herţanu et al., 2023; Ferrández-Ferrer et al., 2022; Stark, Berlinschi, 2021; Tóth, 2020; Kassis, 2020; Rizova et al., 2020; Rostas, 2014) or are reluctant to engage in their own education. The educational disadvantage of Roma is often associated with their low socioeconomic status (European Union..., 2023) or their attitudes towards education (Želinský et al., 2021; Macura-Milovanović, Peček, 2013; Peček, Munda, 2015). The professional unpreparedness of teachers, the established educational policy and the curricular documents, in which there are no elements that would take into account the specifics of Roma education, for example in terms of language, contribute significantly to this fact (Limaj, 2022; Samko, 2020; Miskovic, 2009; Levinson, 2008). However, it is imperative to consider the pedagogical approach underpinning the education of Roma pupils, as research focused on the implementation of educational methods and strategies involving active engagement has demonstrated their potential to enhance educational outcomes (e.g. Pankevič, 2021; Valcheva et al., 2017; Kaldi et al., 2011; Georgiadis et al., 2011).

Obtaining institutional education, which is a prerequisite for independence from the family and securing one's future, is usually not one of the Roma's priorities (Herţanu et al., 2023; Ugur Rizzi, 2021; Wilkin, Derrington, 2010). The European Commission, in its report on educating the Roma in the European Union, states that: "*Many Roma children do not complete school at all. Many families do not even see the point of securing an education for their children*" (European Commission, 2012: 1). This problem can be caused by parents' negative experiences with the education system (Zachos, Panagiotidou, 2019; Lloyd, McCluskey, 2008), fear of losing their own culture (Levinson, Sparkes, 2006) or feelings of racism and bullying (Zachos, Panagiotidou, 2019;

Myers et al., 2010). Educational needs focus only on the acquisition of basic knowledge and skills, such as reading, writing, and counting. In essence, it is the result of a common way of life, according to which education in Roma communities in the past was based on the transfer of experience and knowledge from generation to generation, or on gaining their own experience and imitating their surroundings. The educational process took place mainly in the family and the surrounding society, while it was strongly determined by relations with the majority population (Kirilova, Repaire, 2003; Vašečka ed., 2012). Acquiring knowledge and skills through one's own experience played an important role in the education of the Roma community. This fact must also be taken into account in current institutional education and thus provide Roma pupils with a space to expand their knowledge base through educational methods and strategies (e.g. experiential education, project-based learning) that will enable them to combine new knowledge with specific activities.

One of the problem areas in the education of Roma pupils is the science (Salvadó et al., 2021; American Psychological Association, 2017). An example of the lack of education of Roma in science is an example of the international comparative testing, or PISA. Based on the analysis of the available database of pupil's answers (OECD, 2015), 320 Roma pupils from four OECD countries (Czech Republic, Finland, Slovak Republic, and Slovenia) participated in the PISA 2015. In terms of the number of Roma pupils, it should be noted that not every pupil is registered as belonging to the Roma ethnic group in their questionnaire, so there is a presumption that the number of participating Roma pupils could have been higher. As in other countries, especially in Central and Eastern Europe, there are numerous Roma communities. The comparison of the achieved average score of Roma and that of the non-Roma pupils in the field of science points to an interesting finding: Roma pupils achieve educational results which are not only significantly below the average of OECD countries, but they are below the average also in their homeland. As it can be seen from the data in Table 1, the calculated average score of non-Roma pupils within the OECD group was 469.6 points, while the average score of Roma pupils was only 369.15 points. For comparison, the lowest score in scientific literacy in a given year was achieved by the Dominican Republic with 332 points. This result, in essence, points to the fact that the education of Roma pupils in the field of science is lagging, and it is necessary to look for ways to support it.

Table 1. Comparison of the achieved average score in PISA 2015 testing between Roma and non-Roma pupils

	n non-Roma pupils	**Average score of non-Roma pupils**	**n Roma pupils**	**Average score of Roma pupils**
Czech Republic	6856	504,2	38	382,5
Finland	5874	531,7	8	338,3
Slovak Republic	6091	468,5	260	324,5
Slovenia	6393	494,6	14	431,3
OECD	519 015	469,6	320	369,15

Source: OECD, 2015

Improving the quality of education for Roma pupils from low socioeconomic backgrounds can be achieved through several measures. These include enhancing the educational process, developing teachers' competencies, fostering family-school cooperation, increasing funding for the education system, and encouraging pupils' interest in education (Muijs, 2009). Research by several authors (e.g., Pankevič, 2021; Valcheva et al., 2017; Dragun, 2000; Hrvatic, 2000; Šućr, 2000) has highlighted the potential of using approaches and methods in educating Roma that enable pupils to become active participants in their education, rather than passive recipients of pre-existing knowledge.

At present time, there is a wide range of teaching methods and approaches through which it is possible to arouse pupils' interest in their own education and lead them to actively acquire new knowledge and skills. One such approach is the use of experiential methods. The use of elements of experiential teaching strives to achieve the greatest possible development of the pupil´s potential. However, we must remember that experience is not the goal of the lesson, it is only a means to the end. Kolb (1984) introduced a theory based on the fact that 80 % of knowledge is based on one's own specific experiences, which increase the probability of remembering a new one. Kolb's cycle of

experiential learning is based on four phases of learning (Figure 1). The first phase is meeting with a specific experience, which is followed by the second phase focused on comparing, thinking, and reflecting of the experience. In the third phase, an abstract concept or idea is formed and in the fourth phase, experimentation is based on the experience gained, or what is learned.

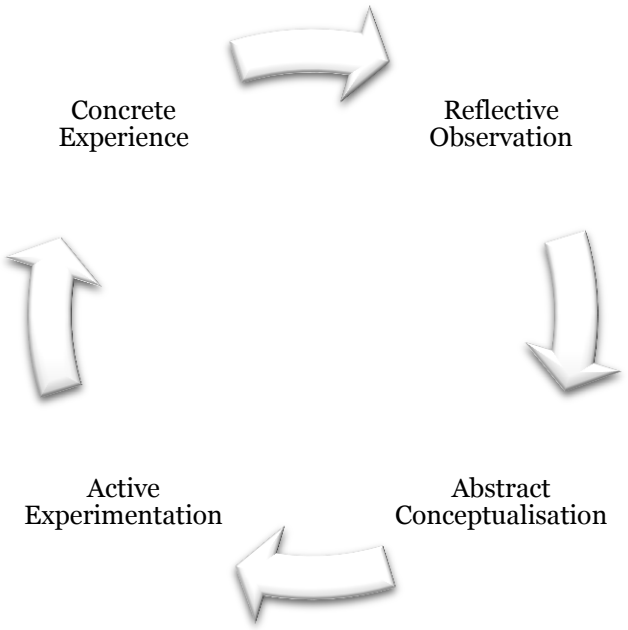


Fig. 1. Kolb's Experiential Learning Cycle (1984)

The cycle created by Kolb represents a spiral in which further education continues from the knowledge gained (Kolb, Kolb, 2018). In the past, Roma education was based on experiential family learning and the transfer of skills and knowledge from generation to generation, which is at odds with traditional institutional education (Lloyd, McCluskey, 2008; Pereira, 2017). It is necessary to seek educational approaches that reflect Roma educational traditions. Experiential learning is rooted in experience as a source of learning and development (Cator, 2019; Kolb, 2014). This type of education aims for pupils to acquire new knowledge through their activities, making it more lasting and applicable in practical life. This approach should be integrated into current institutional education to provide Roma pupils with opportunities to expand their knowledge through teaching methods and strategies that combine new knowledge and skills with specific activities. According to Kolb and Kolb (2005), experiential learning supports the development of factual knowledge and its organization into conceptual frameworks.

3. Methodology

This study aimed to find ways to improve the educational results of Roma pupils with low socioeconomic and cultural status. The study was based on quasi-experimental research design. This is similar to experimental design, but it is not possible to randomly assign the participants to the experimental and control group (Ballance, 2024). The used research design is focused on the comparison of experimental and control groups, where the independent variables are the differences of the level of knowledge between the groups. Although the independent variable is affected, the participants are not randomly assigned to the conditions or to the order of the conditions. The independent variable manipulated before the dependent variable was measured, quasi-experimental research eliminates the problem of directionality (Gopalan et al., 2020). In the school conditions in Slovakia, it is not possible to assign pupils to an experimental and control group randomly, because they are pre-included in classes whose composition cannot be changed during the school year. With respect to these conditions, the quasi-experiment provides a suitable alternative to the traditional experiment in Slovak schools, as it allows sufficient control over the independent variable. The obtained data can also be generalized (Maheswart, Thomas, 2017; Fraenkel et al., 2012). The purpose of the case study is not statistical generalization, but analytical generalization. This generalization does not apply to the entire population whose sample was part of the research, but to the theory of the phenomenon under investigation. The results of the case study represent a concrete example of the investigated phenomenon (Rowley, 2002; Maxwell,

2012). The quasi-experiment was carried out in two steps – the implementation of experiential education and determining the level of knowledge of the pupils.

3.1. Research objectives

This study aimed to find out, by quasi-experiment, whether using experiential methods during teaching biology can have an impact on study results of Roma pupils of primary schools. Following the aim of the study, we have focused on answering the research question:

– How does the use of experiential education impact the educational outcomes of Roma pupils?

The research was focused on verifying the hypothesis:

H0 The learning results of the pupils educated by experiential methods is the same as the pupils educated traditionally.

H1 The learning results of the pupils educated by experiential methods is better than the results of the pupils educated traditionally.

3.2. Participants

The criteria for selecting pupils for the research sample included coming from a socially disadvantaged background. Another criterion was obtaining consent for the research from both the school administration and the pupils' legal guardians. These criteria were met by a group of 32 fifth-grade pupils attending the same primary school in Slovakia. The Roma inhabitants of this village have limited access to public services, sources and goods, low employment rate, low income and material poverty is typical. Their dwellings are characterized by considerable overcrowding and low socioeconomic levels compared to the dwellings of the majority group. The life of the community is determined by social connections (mainly by family and neighbourhood relations), low standard of living, common social and cultural norms, and traditions. The pupils who participated in the quasi-experiment belong to the category of socially disadvantaged pupils (disadvantaged by poverty or culture) under the Education Act in Slovakia, because their background does not provide sufficient incentives to develop the mental, emotional, and social components of personality and insufficient incentives for their education. In the case of these pupils, their families dedicate little attention to institutional education and training, which is also reflected in the insufficient fulfilment of compulsory school attendance. The school is often the only place to acquire factual knowledge and develop individual levels of cognitive thinking.

The research sample was divided into two groups. The experimental group consisted of 15 pupils (8 girls and 7 boys) attending the fifth grade of a primary school. The control group consisted of 17 pupils (10 girls and 7 boys) attending the fifth grade of a primary school. Based on the experience of primary school teachers both groups are characterized by relatively low motivation to study, uneven activity during the lessons, insufficient home preparation and minimal communication with teachers. From the point of view of education, they are characterized by memorizing knowledge, without striving for a deeper understanding, interconnection into logical contexts and attempts to connect with practical life. When reproducing the knowledge, pupils try mainly to describe objects and phenomena, while they do not think more deeply about the causes of their origin or their consequences. They also have problems with verbal communication because the Slovak language is not their first language. At home and in their background, they mainly use the local Romani dialect. We often observe that those pupils are not able to cooperate and communicate to resolve assignments when working in groups. These aspects contribute significantly to the insufficient educational results of the pupils in biology and other subjects. The experimental group included four pupils, and the control group included three pupils diagnosed with learning disabilities (ADHD, dyslexia, dysgraphia, dyscalculia). These pupils learn through individual integration.

The classification of classes into the control and experimental groups was influenced by the achieved average half-year evaluation of biology. The average mark from biology in the control group was 3.85, while the average mark in the experimental group was 3.97 in this evaluation.

3.3. Research methods

To determine the impact of experiential education on the level of knowledge of Roma pupils, we used the test which we created using the content of the National Standard in the context of forest ecosystems as its base. The test consisted of 27 items (11 closed and 16 open). Pupils could have achieved from 1 to 6 points for each correct answer. The open items were focused mainly on the

knowledge of the plants, animals, their importance in the forest ecosystem and environmental issues. Pupils had a choice of three answers in closed items. The number of options was determined on the basis of special pedagogical monitoring of the staff of the Centre for Special Pedagogical Counselling. They found out that pupils attending this primary school are guided only by chance when choosing an answer from a higher number of options, thus reducing their chances of positive assessment. The content validity of the research tool was determined through the evaluation of two experts.

There are some schools in Slovakia where they teach in the languages of national minorities. Roma pupils are the exception. There is no national school for Roma pupils where the pupils could study in the Roma language. The lack of the codification of Romani plays a significant role in this regard. For this reason, the proposed test was administered in Slovak. The pre-research, therefore, verified the comprehensibility of individual items by other pupils attending the school.

Since the test items were not dichotomously scored, we used Cronbach's alpha to determine reliability. Its value reached 0.94. Therefore, the research tool can be considered reliable (Luthfiyah et al., 2023).

To verify the normality of data distribution, we employed the Shapiro-Wilk test, which is suitable for small research samples ($N < 50$). A p-value greater than 0.05 indicates that the data are normally distributed (Mishra et al., 2019; De Winter, 2019). Given that our analysis of the data revealed a normal distribution, we used the parametric Student's t-test to compare the results of the control and experimental groups. This test compares the means of two data sets to determine whether the differences between them are statistically significant (Meléndez et al., 2020). To compare the effect size between the two values being compared, we used Cohen's *d* coefficient (Fritz et al., 2012).

4. Educational program

The unit that focuses on teaching selected ecosystems was included by National Standard in the biology subject in Slovakia in 2014. Forest ecosystem is one of them, pupils should learn to recognize the organisms by their morphological signs, to create food relationships, to name specific factors and their negative impact on the ecosystem, argue the importance of protecting the forest ecosystem, etc. There are various processes taking place in ecosystems, the understanding of those by pupils requires a considerable level of abstraction. This fact is also confirmed by many studies identifying numerous misconceptions of pupils in the field of ecosystems (e. g. Preton, 2018; Putri, Rusyati, 2021; Munson, 1994).

Our educational program took seven weeks in the range of two teaching hours per week. The basis of the concept of the proposed program was the use of elements of experiential education in activities which, in addition to supporting the development of knowledge, also focused on developing the ability to observe, record and evaluate data, assess the current state of the forest ecosystem around the school, etc. During each lesson, one of the following topics was made available to the pupils of the experimental group:

1. The life of the forest (characteristics of the forest ecosystem);
2. Forest trees (characteristics of the trees of the temperate zone);
3. Importance of forest trees;
4. Forest microorganisms and non-flowering herbs;
5. Forest flowering herbs;
6. Forest fungi and lichens;
7. Forest invertebrates;
8. Forest amphibians and reptiles;
9. Forest birds;
10. Forest mammals;
11. Alpine plants and animals;
12. Relationships of organisms in the forest ecosystem;
13. Protection of the forest ecosystem.

As an example of the implemented activity, we used a specific activity presented in Kolb's cycle of experiential learning with a focus on deepening pupils' knowledge of trees and the factors that determine their growth:

1. *Concrete experience*: mapping the occurrence of selected tree species in the local landscape.

The task for pupils: Observe the trees in your area and determine their genus and species name according to the tree identification key. Write according to which characteristics we can distinguish them from other types of trees.

2. *Reflective observation*: observation of natural conditions that suit the trees, asking questions and mutual discussion among pupils aimed at identifying discrepancies between understanding and personal experience.

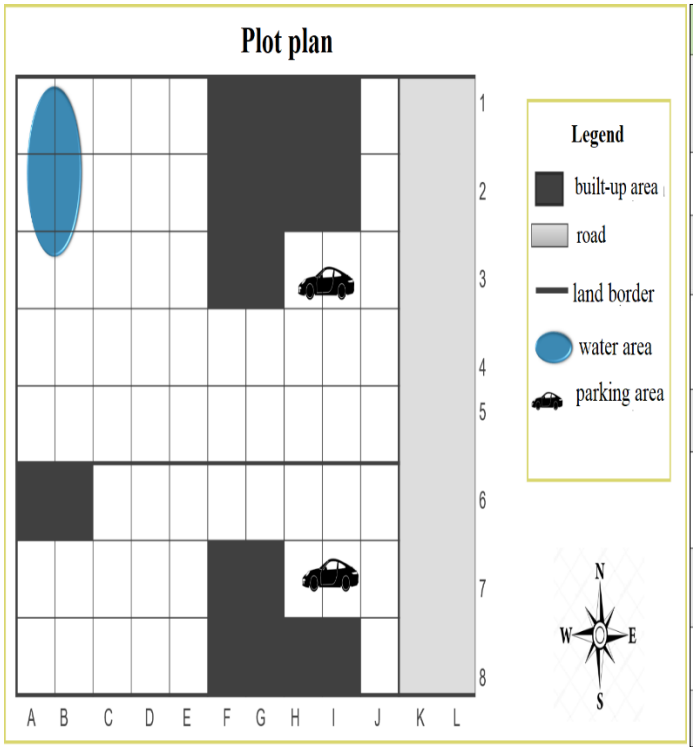
The task for pupils: Observe the conditions where each tree species grow. Create a table with two columns. Write the following terms in the first column – light-loving, shade-loving, free space (solitaire), growth, nutritious soil, poor soil, moisture. Write the trees that meet the conditions in the second column. Discuss if the tree species can grow even in other conditions.

3. *Abstract conceptualization*: drawing conclusions about the conditions of plant growth, reflection of existing knowledge and experience, their comparison with the current understanding (creation or modification of conclusions).

The task for pupils: Based on your observations, evaluate the importance of woody plants in the ecosystem. Compare the old photos with the current state of the country and describe the changes that have occurred.

4. *Active experimentation*: the pupils analyse the assigned task and think about the future (connection with practical life: designing of the garden and placing trees in a suitable environment) (Figure 2).

The task for pupils: Put the trees from the list to the garden plan. Arrange the trees listed in the table in the garden plan. Think about the factors that may affect the growth of trees.



Tree species	Maximum height	Roots	Light requirements	Bark
Goat Willov (Salix caprea)	12 m	deep	heliophilous	initially smooth, dark gray later longitudinally cracked and gray-brown
Silver Birch (Betula pendula)	15 m	deep	silen heliophilous	white and peels into thin circular slices
European Hornbeam (Carpinus betulus)	30 m	deep	sciophytes	dark gray and smooth
Black Elderberry (Sambucus nigra)	8 m	shallow	heliophilous	the old bark is very cracked, light, brownish gray, smooth on the young branches, green
Common Oak (Quercus robur)	30 m	deep	heliophilous	dark gray, coarsely cracked
Wild Cherry (Prunus avium)	25 m	deep	hlaf-sciophytes	reddish-brown and gradually with increasing age of the wrinkled tree
European Spruce (Picea abies)	60 m	shallow	heliophilous	smooth, reddish brown, later it forms brown
Common Hazel (Corylus avellana)	6 m	shallow	heliophilous	usually gray-brown longitudinally cracking
European beech (Fagus sylvatica)	30 – 40 m	deep	sciophytes	smooth, gray, rarely cracked

Fig. 2. Worksheet for pupils with a task focused on the placement of trees in the area

The control group was educated using traditional methods, primarily focusing on memorising knowledge as presented by the teachers, without a deeper connection to real life. This approach is commonly used in teaching Roma pupils in Slovak schools.

5. Results

To determine the level of pupils' knowledge we used the test administered to the experimental and control groups at the same time three weeks after the end of the application of the proposed lessons using experiential education to educate the experimental group. The test consists of 27 opened and closed items. Descriptive statistics of the administered test are shown in Table 2.

Table 2. Descriptive statistics of the administered test

	Experimental group	Control group
Sample size	15	17
Arithmetic mean	42,9	30,5
Standard deviation	11,5	13,7
Coefficient of variance	26,8%	45,0%
Minimum	22	12
Maximum	58	51
Range	36	39
Median	46	31
Standard skewness	-1,02163	0,244337
Standard spike	-0,411275	-1,27949

Pupils in the experimental group received an average of 42.9 points, and pupils in the control group received 30.5 points. The success of the experimental group in the test was 73.96 %, and the success of the control group was 52.58 %. The Shapiro-Wilk test confirmed that the data follow a normal distribution ($p < 0,05$). Therefore, we investigated the presence of statistically significant differences using parametric statistical tests. To determine whether the difference between the averages of the experimental and control groups found in the samples is statistically significant, we used Student's t-test for two independent selections. The F-test showed that the sets did not differ in standard deviations ($F = 0.71$, $p = 0.52$), so we used a t-test that takes this result into account. Test result ($t = 2.76$, $p = 0.01$) confirmed the research assumption formulated in hypothesis H1. Pupils of the experimental group educated through experiential education get statistically significantly better results in the test than pupils of the control group. The result of Cohen's *d* index demonstrated a medium effect size ($d = 0.74$).

Student's t-test revealed statistically significant differences in 12 test items (8 open-ended and 4 closed-ended), with all differences favouring the experimental group. The value of Cohen's *d* index for these items ranged from 0.54 to 0.78, indicating a medium effect size. The open items (Figure 3) had a lower percentage success rate compared to the closed items in both classes. In terms of content, the open-ended items focused on the ability to name selected terms, determine, and organize organisms according to their mutual relations. According to the revised Bloom's taxonomy, these items focused on finding factual knowledge and the dimension of cognitive processes – memorizing (naming, describing, organizing) and understanding (briefly expressing, interpreting, recognizing, processing). Pupils in the control group had problems explaining biological concepts and processes, naming selected natural objects, and arranging them in logical contexts. The experiential activities applied in the process of education of the pupils of the experimental group focused exactly on these areas. In only one item of the test the pupils of the control group have a higher success percentage (item 5, in which the pupils were required to name the individual parts of the mushroom). When evaluating the open items of the test, it was possible to observe insufficient language skills of pupils of both groups. The imperfect mastery of the Slovak language of these pupils could have significantly affected the understanding of individual items and their following solution. These pupils communicate at home almost exclusively in the local Romani dialect and not in the official Slovak language used in public schools.

The pupils of the experimental group achieved better results in the closed type items (Figure 4). Based on the revised Bloom's taxonomy, the primary purpose of the closed items was to verify the level of factual knowledge and the dimension of cognitive processes in memorization (naming, organizing, identifying) and application (sorting, classifying). Pupils were required to choose one answer from the options offered, which were related to the presented natural objects or phenomenon. Pupils in both groups got acquainted with the given concepts and their characteristics during their learning. In case of the experimental group, however, pupils had the opportunity to observe selected objects and phenomena directly in the field during the implementation of various activities. These activities could have enhanced their ability to remember certain facts (e.g. occurrence of selected species in a particular habitat, factors affecting living organisms etc.).

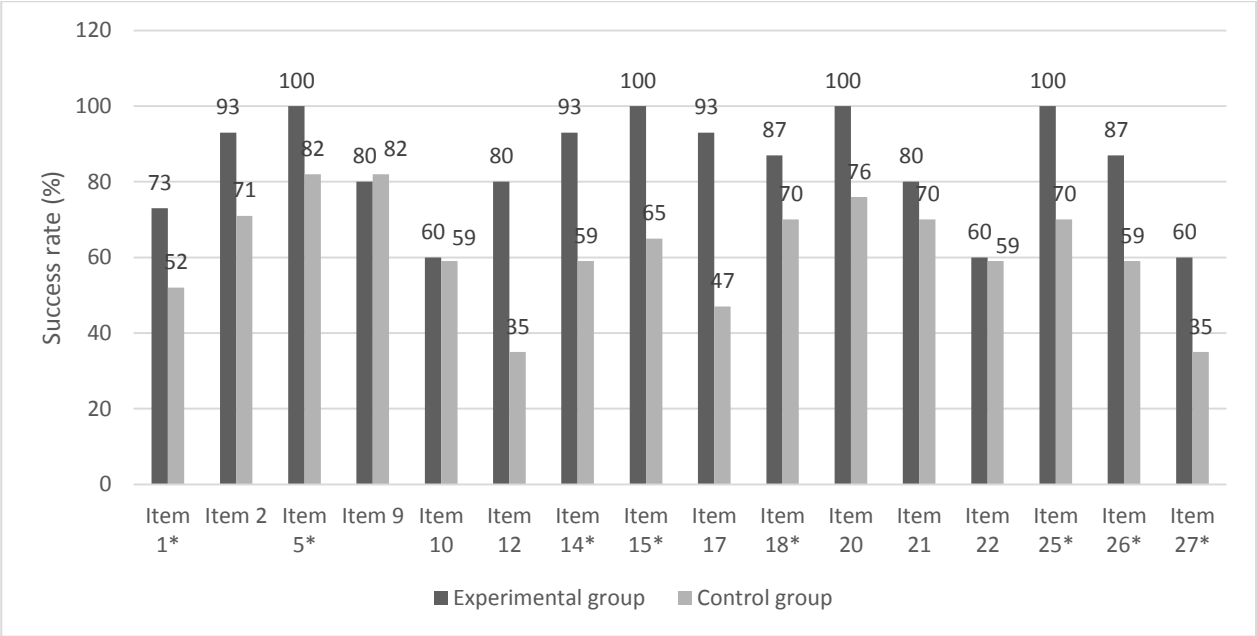


Fig. 3. Success rate of the control and experimental groups in solving open items
Notes: * items with statistically significant differences)

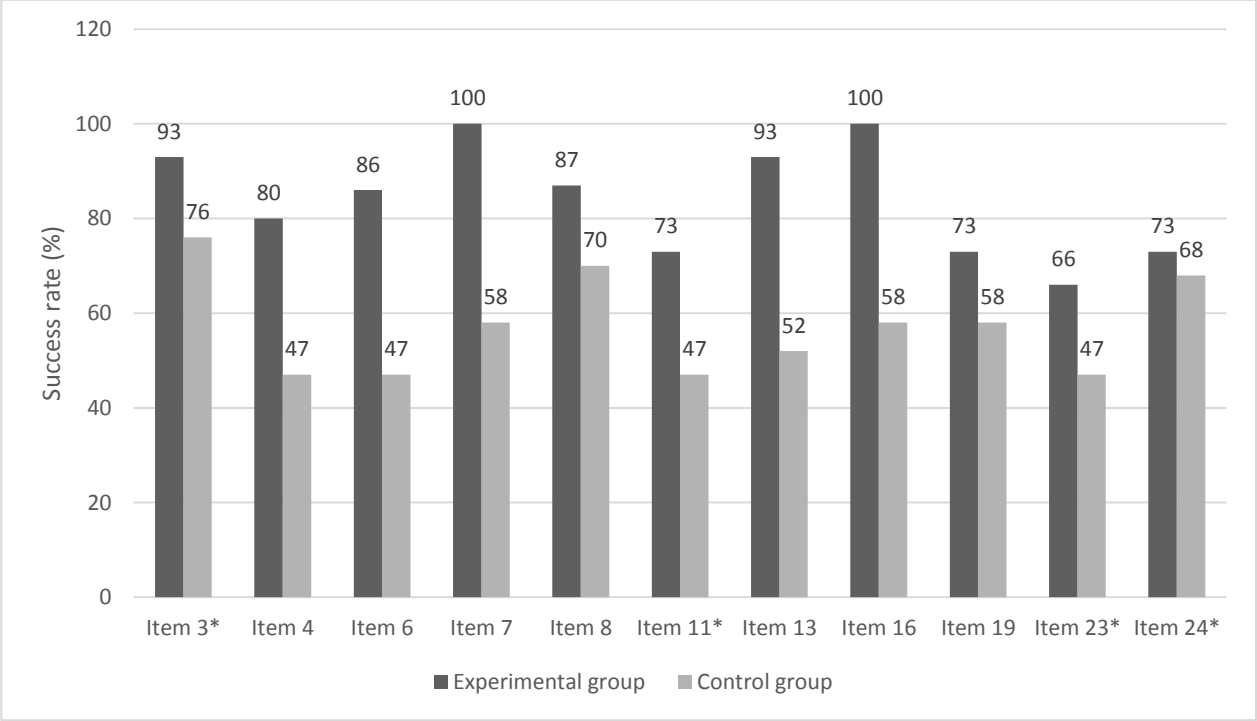


Fig. 4. Success rate of the control and experimental groups in solving closed items
Notes: * items with statistically significant differences)

6. Discussion and conclusions

The presented study highlights that Roma pupils educated through experiential learning achieved better educational outcomes than pupils educated primarily through methods focused on memorising new knowledge mediated by teachers. The implementation of the quasi-experiment confirmed the findings of previous research on the potential use of experiential education (e.g. Ayob et al., 2012; Okoli, Abonyi, 2014, Bradberry, De Maio, 2019; Thote, Gowri, 2021; Asad et al., 2021). In their research focused on teaching biology in a secondary school, they found out that the use of experiential teaching significantly increases pupils' ability to understand biological

concepts and provides an opportunity for their improvement in educational outcomes. The research result pointed to a higher level of factual knowledge of the experimental group about the forest ecosystem, which is the basis for further education. We have thus demonstrated the potential of experiential teaching as a tool to support the formation of factual knowledge from personal experience (Passarelli, Kolb, 2011). It is crucial for Roma pupils to have the opportunity to deepen factual knowledge in biology lessons and to develop individual levels of cognitive thinking. It is appropriate for teachers working with Roma pupils to look for methods and procedures that will suit Roma pupils, but also provide them an opportunity for success. One possibility is to use Kolb's theory of experiential education, which by its nature allows pupils to acquire new factual knowledge and deepen their metacognitive skills through the learning cycle (Kolb, Kolb, 2018; Laverie et al., 2022; Chan, 2023). Biro et al. (2009) point out that the lives of Roma children in environments with low socioeconomic status have adverse consequences for the development of their verbal and cognitive functions. Our results support this statement because control group pupils were unable to acquire factual knowledge at the same level as the pupils of the experimental group. The fact that the Slovak language, in which testing was performed, is not the first language for Roma pupils participating in the quasi-experiment, plays a significant role. In the Romani language, various terms that pupils have to learn according to the National Standard, do not exist. A lot of experts (e.g. Butterworth, 2019; Zachos, Panagiotidou, 2019; Gažovičová, 2015) have been devoted to the topic of language in teaching. These studies have confirmed that the language barrier can be a significant determinant of the education of marginalized groups.

The data obtained from the quasi-experiment consisting of the implementation of elements of experiential education into biology education and following assessment of the level of knowledge through a test indicate the potential of experiential education in supporting the development of Roma pupils' knowledge from a socially disadvantaged background. Thus, there is a presumption that through the regular application of experiential education in the teaching process of Roma pupils, it is possible to increase their level of knowledge, improve overall learning performance and eliminate the influence of some socioeconomic and cultural factors. On this basis, we recommend implementing elements of experiential education in the education of Roma pupils from low socioeconomic status.

7. Research Limitations

Despite the data obtained indicating a potential impact of experiential learning on improving the knowledge level of Roma pupils from socio-economically disadvantaged backgrounds, certain research limitations must be considered. The conducted study involved a relatively small sample size (N = 32). This sample size does not allow for drawing conclusions and generalizations applicable to the entire population of Roma pupils from socio-economically disadvantaged backgrounds in Slovakia. Nevertheless, the data suggest that the use of experiential learning may contribute to improving pupils' educational outcomes. This type of education allows pupils to acquire new knowledge through their own experiences, which also reflects the educational traditions of the Roma community.

8. Ethics contributions

The research did not require ethical approval. The presented study adhered to the principles of the Belmont Report issued by the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research in the United States. Research participants confirmed their consent for the study through their respective schools. The research was conducted anonymously, without collecting personal data from the pupils involved. The administration of the research instrument was based on a code that prevented linking the obtained data to specific pupils.

9. Conflicts of interest

The authors declare no conflict of interest.

10. Authors contributions

The authors have made substantial, direct, and intellectual contributions to the work, and have approved it for publication.

11. Funding

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