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An educational framework for implementing healthy lifestyle practices in primary school curricula

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ABSTRACT

The aim of the study is to verify the educational method developed in the field of health education, environment, and lifestyle through prepared interactive assignments in real conditions of the pedagogical process. In the introduction, we refer to some models of implementing health education in curricula, presented by experts in relevant sources. Programs for health education are most appropriate to implement as preventive programs in elementary school conditions. We prefer a natural pedagogical experiment with the implementation of prepared assignments in selected subjects, and we investigate a statistically significant difference in knowledge during the experiment within the control and experimental groups. Because there is no individual subject of health style and healthy nutrition within the national curriculum, the assignments are scattered in a cross-curricular manner. The present paper examined the effectiveness of a 3-year project on a healthy lifestyle at 10 selected primary schools with groups of 9–10-year-old students. First, a pilot study was conducted to validate the research concept. Consequently, activities were organized by teachers at elementary schools. The research team of university teachers built a set of 3 innovative packages of tasks and activities. The main evaluation method was quantitative analysis, including descriptive statistics, box plots, and statistical testing of hypotheses for control and experimental classes regarding the significance of the input and output tests. Therefore, the discussion concluded that the application of prepared assignments contributes to improving knowledge about healthy nutrition, a healthy lifestyle, and physical and mental health.

Contribution/Originality: This study contributes to the existing literature by implementing healthy nutrition and lifestyle topics across various subjects. It employs a methodology that enhances interdisciplinary approaches, originating from the preparation of problem tasks and activities centered on the same topic for different subjects. The focus is on curricular reform within the real educational process.

1. INTRODUCTION

1.1. Background to the Study

According to Hardcastle, motivating an individual to engage in activities that promote healthy behaviour requires the application of effective strategies to promote behaviour change. In individuals with little or no motivation to change, such strategies are relatively scarce (Hardcastle et al., 2015). The published strategies are based on relational motivational interviews with a future perspective. Another strategy is environmental solutions, where the surrounding environment can help increase the individual's motivation to initiate health-related behavior change. Lifestyle, defined by sociodemographic traits, attitudes, behaviors, and values, determines different methods and

possibilities for satisfying needs (Brivio, Viganò, Paterna, Palena, & Greco, 2023). Well-being includes the presence of positive emotions and moods (e.g., contentment, happiness), the absence of negative emotions (e.g., depression, anxiety), satisfaction with life, fulfillment, and positive functioning (Park et al., 2023). Well-being is directly linked to mental health, as many of its components are interconnected. Physical activity and sport can create positive experiences and promote a good mood, so all activities should also take this intention into account (Pupala, 2022). According to some authors, food security and the adoption of healthy and sustainable diets are necessary to meet the proposed target of quality nutrition for all and environmental preservation. Although malnutrition does not occur in the European Union, obesity is becoming an alarming problem (Grosso, Mateo, Rangelov, Buzeti, & Birt, 2020). According to Vincy and Drishya, in order to promote healthier habits among adults and adolescents, children must be taught to discourage these harmful activities from an early age (Vincy & Drishya, 2023).

Like any institutional learning, health education does not start from zero but builds on a certain level of knowledge and skills that people already possess, which can be developed or might even have to be re-shaped (Řehulka, 2011). A lot of research has recommended that health topics should be compulsorily integrated into the school program, starting at the first grade and continuing until graduation from high school (Brook & Heim, 1992). The main objective of socially oriented healthcare is prevention, particularly primary prevention, based on well-structured health education. The development of prevention, which relies on health education or applied health behavior research, is the starting point of a good health education program (Řehulka, 2011). Health education is defined as a continuous, dynamic, complex, and planned teaching-learning process to promote or initiate lifestyle-related behavioral changes that promote positive health status outcomes. Health education can lead to an increase in knowledge, skills, and/or attitudes; a change in health-related behaviors, individual capability, and empowerment; positive health outcomes; and positive social/economic impacts (Pueyo-Garrigues, Whitehead, Pardavila-Belio, Pueyo-Garrigues, & Canga-Armayor, 2019). Health education is defined with an emphasis on active access, motivation, and multidisciplinary (Líšková, 2011). Health is displayed by goal three of SDGs, which pass to "Ensure healthy lives and promote well-being for all at all ages" (Machado et al., 2020).

1.2. Research Question

Our study was based on the following research question: Can practical tasks about a healthy lifestyle in mathematics, mother tongue, PE, and art education improve knowledge about healthy nutrition, a healthy lifestyle, and physical and mental health?

2. REVIEWS OF LITERATURE

2.1. Introduction and the Role of School Programs

In terms of relevance, schools are the most promising place to promote health education by implementing preventive activities and programs that convey values and information to both students and the community of families, friends, and loved ones. Schools represent one of the most important places to promote health, apply preventive activities and programmes, and communicate values and information towards not only pupils and students but also a large community families, friends, and neighbors (Al Makadma & AbdulKarim, 2017). Reducing health-related risk behaviours, maintaining and improving health, and preventing disease should be ensured by teaching health education in schools (Kann, Telljohann, & Wooley, 2007). Health education at schools must be based on a holistic health concept, be action-oriented, and involve the active participation of pupils (Jensen, 1997). A comprehensive view of the individual emphasizes the involvement of both the physical and psychological dimensions in working with human health, corresponding to a holistic approach to health, while the psychological dimension includes mental and social aspects (Jensen, 1997). The WHO announced, in 1946, that health education aims to treat the social, mental, and physical components of well-being. Currently, there are several methods, models, and directions. According to Hagquist and Starrin (1997), we distinguish four basic models Figure 1.

1. Traditional educational models

- Are like that, where the pupils are for the most part passive receivers of information during lessons.

2. Modern educational models

- Are like that, where the pupils take an active part. These models are mainly practiced in the classroom.

3. Planner models

- Which are characterized by a top-down strategy for change and a wide contextual framework. In these models, the entire school, and sometimes also the community outside, is included in health education.,

4. Empowerment models

- Which are characterized by a bottom-up strategy for change and a wide contextual framework. In these models, participant orientation is essential, and the school environment and social conditions are considered important for health education (Hagquist & Starrin, 1997).

According to the above models, in our research, we tried to apply a modern educational model with elements of the empowerment model, in which we prepared active tasks that were solved by pupils, and the knowledge obtained was forwarded to the teacher or parent.

2.2. Contemporary Approaches to Health Education in Schools

The activities in our tasks consisted of solving problems using IT tools, through mathematics, mother tongue, PE, and art education. The empowerment model, therefore, focused on strengthening knowledge of health and environmental education through a wide range of subjects.

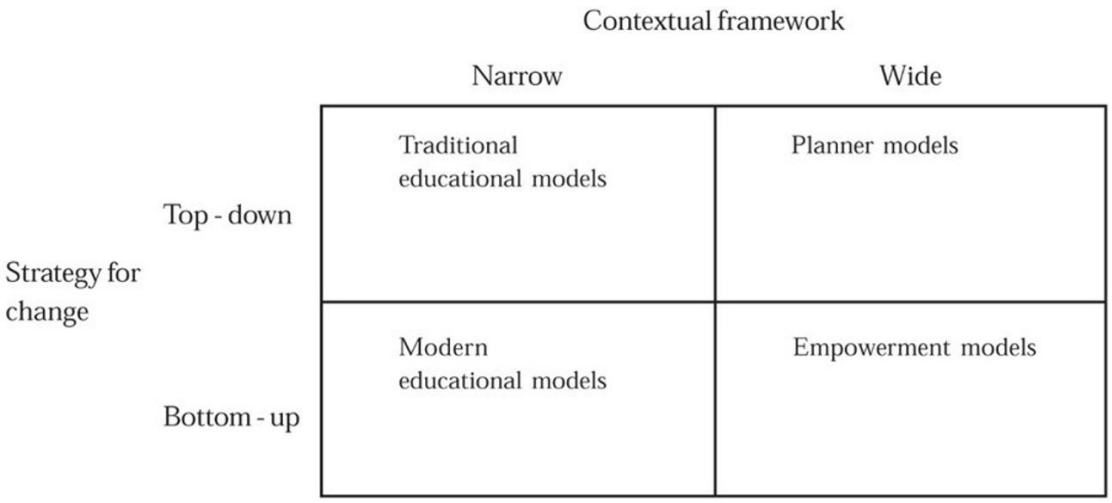

Figure 1. Basic models of the contemporary approach.

Source: Hagquist and Starrin (1997).

The empowerment education model effectively promotes health in all personal and social arenas. This model involves individuals in group actions and dialogues, focuses them on the goals of the community (in our case, the class and family community), and increases the ability to manage and persuade people to change their lifestyles (Wallerstein & Bernstein, 1988).

Empowering the educational model, some authors recommend that school gardens were most commonly used for teaching science, environmental studies, and nutrition (Graham, Beall, Lussier, McLaughlin, & Zidenberg-Cherr, 2005).

2.3. Theoretical Perspectives of the Study

According to Gerrard, the structure of the curriculum in different countries includes the topic of health either as a separate subject of health education or as part of other subjects (Merkle & Treagust, 1988; Pollock & Hamburg,

1985) on the other hand, state that the study of health is mostly included in the subjects of natural science and physical education (Pollock & Hamburg, 1985).

Curricular documents in Slovakia have integrated health education into the educational field of Health and Movement. This field creates space for the development of movement literacy among students, including the development of lifelong movement competencies, with a focus on acquiring knowledge and skills related to movement and sports activities. The Health and Movement educational field naturally includes topics related to health and a healthy lifestyle. These topics encompass healthy nutrition, hygiene, prevention of addictive substances, cold plunge, and mental balance (Antala et al., 2023).

Thus, students are educated about healthy eating in school during biology, civics, and classroom lessons. Students must not only understand the main theory in the field of health but also understand the importance of learning about health and fitness and must accept a significant degree of responsibility for their personal well-being. The conclusions presented are intended to provide a perspective and a practical tool for concerns about health and well-being (Maddock, 1983). Family, the internet, and mass media are also important sources of information about healthy eating for students.

According to the basis for changes in the curriculum for the 21st century of the Slovak Republic (Pupala, 2022), recommendations were issued that systematize the components of the educational area.

- Health and Lifestyle.
- Movement skills.
- Physical fitness and movement performance.
- Sport and physical activity.
- Protection and safety of the life and health of the population (Antala et al., 2023).

Although schools should promote the consumption of healthy foods, teachers and school staff are not trained in nutrition, and it is difficult to appropriately address healthy eating issues during classes. Therefore, according to Peers & Christie, students often leave school without understanding many health concepts (Merkle & Treagust, 1988).

It seems the importance of health education courses for university stakeholders is not clear, or probably there are not enough health education specialists in the universities. Therefore, we recommend teaching health education and patient education by health education specialists or training faculty members who teach health and patient education courses (Sadeghi & Heshmati, 2019). The teaching of health education can be supported by innovative methods. Such methods include problem solving, simulation, videos on a YouTube channel, or a smartphone or tablet.

Healthy eating is considered to include the number of meals a day, quality food products, and the recommended amount of food intake from all food groups. It is very important for our pupils to be aware that morning meals provide proper nutritional energy contribution, and an important contribution is also provided by whole grains, fresh fruits and vegetables, dairy, and meat. Parents can play an important role in planning and serving breakfast in the family (Topada, 2016).

3. METHODOLOGY

3.1. Approach and School Involvement

The present paper examines the effectiveness of a 3-year project on a healthy lifestyle at 10 selected primary schools with groups of 9–10-year-old students. The paper presents the implementation of our project, within which we prepared tasks and activities that are included in the curriculum of ten elementary schools involved in the project in West Slovakian towns such as Nitra, Nové Zámky, Komárno, and Dunajská Streda (the names of participating schools are listed in Table 1). Prepared tasks and activities focused on knowledge of healthy nutrition, healthy lifestyle, physical and mental health, and environmental health, according to the National Institute for Education (2024).

3.2. Structure of the Participants

Table 1 introduces the name of the elementary school, class designation, number of involved students, and students' ages. The project was implemented under the supervision of professional educators from the Institute for Teacher Training at Constantine the Philosopher University in Nitra, in cooperation with elementary school teachers.

Table 1. Elementary schools involved in the project.

Elementary school	Number of students	Students' age	Involved classes
King Svätopluk in Nitra	43	8 - 9	3. A, 3. B
Velké Záluzie	32	8 - 9	3. A, 3. B
Fatranská Street in Nitra	63	8 - 9	3. A, 3. B, 3. C
Topolová Street in Nitra	60	8 - 9	3. A, 3. B, 3. C
Duke Pribina in Nitra	64	8 - 9	3. A, 3. B, 3. C
Munka Utcai Alapiskola in Komárno	35	8 - 9	3. A, 3. B
Kodály Zoltán Alapiskola in Galanta	32	8 - 9	3. A, 3. B
Ady Endre Alapiskola in Štúrovo	30	8 - 9	3. B, 3. C
Czuczor Gergely Alapiskola in Nové Zámky	41	8 - 9	3. A, 3. B
Vámbéry Ármin Alapiskola in Dunajská Streda	52	8 - 9	3. A, 3. B, 3. C, 3. D

3.3. Pilot Testing

In preliminary testing, consensus among research team members affirmed face and content validity and extent. At the outset, a pilot study was performed on 50 children aged 9 years to check their comprehension of the questionnaire. The pilot testing sessions revealed that some questions were redundant, and specific topics were not adequately covered primarily mental health. After another round of consensus building to address these revelations, the research team diminished the number of questions and their content on the questionnaire and added pictures to make the content more visible. We excluded questions to generate multiple-choice response options for each question so students could choose only one proper answer uniformly. The resulting final version of the input test contained 15 basic health knowledge items regarding the prevention of physical, mental, and social health. As a final check of face and content validity, a group of 10 participating teachers involved in the project was asked to comment on the content of the test. Their input was used for final editing. No additional pilot testing was conducted.

In the second step, we evaluated the knowledge level of third-grade primary school students in the aforementioned areas. A multiple-choice questionnaire with colour illustrations was used to assess students' knowledge at the beginning and the end of the three-year intervention period. The questionnaire consisted of 15 questions focused on diet, eating habits, movement, environment, and a healthy lifestyle.

The quantitative data were collected by administering a piloted questionnaire to 10 primary school students (n = 467), with 272 students in Slovak language and 195 students in Hungarian language.

We used two parallel groups of classes control and experimental groups. In the third step, we prepared tasks and activities aimed at supporting knowledge in the field of a healthy lifestyle, covering all three areas of health physical, mental, and social. We focused on healthy nutrition, a healthy lifestyle, physical and mental health, and environmental health. In our study, we used two models of health education.

A. A traditional education model in control classes. This model was based on traditional school teaching direct dissemination of knowledge; students were passive recipients of information through subjects.
B. A modern, innovative educational model where students were involved as active participants through a set of three tasks. It was utilized in experimental classes.

3.4. Ethical Considerations

Before collecting data from participants (students attending elementary schools), informed consent was obtained from the student's legal representative to participate in the project, where the legal representative stated in writing that he/she was clearly informed and agreed to his/her child participating in the project implemented in the elementary school attended. The study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board. The Ethical Committee of Constantine the Philosopher University in Nitra, Slovak Republic, granted approval for this study on 7 October 2024 (UKF/1082/2024/191013:002).

3.5. Data Collection Procedure

We obtained data on the progress of solving tasks from students' worksheets and from the entrance and exit tests, which were carried out via Google Forms.

3.6. Analyse Procedure

All activities were organized by teachers from September 2021 to June 2024, i.e., in the third and fourth grades in ten selected primary schools. Teachers were educated about the duration of the project, during which all activities were discussed with members/experts of the research team. After notifications, all activities were rewritten according to teachers' suggestions regarding technical support and accessories. The second model of education the innovative project method was implemented in experimental classes.

Firstly, our research teams developed a set of three innovative packages of tasks and activities. The first package was implemented by teachers of the third and fourth classes from January to June 2022, the second in 2023, and the third in 2024. These three packages, covering all areas of health, support a holistic approach to health.

The primary evaluation method was quantitative analysis followed by statistical processing, aimed at identifying differences and significance in the scores of input and output tests for control and experimental classes using MS Excel. In MS Excel, descriptive statistics, box plots, and statistical tests were prepared to represent both tests for the control and experimental groups. Hypotheses were established to test for equal variances using the F-test. The results of the F-tests indicated equal variances in the input and output tests of both groups; therefore, a t-test assuming equal variances was employed to examine differences in test results. The significance level was used to determine whether the differences in input and output test scores were statistically significant. This procedure was applied to both control and experimental classes. Consequently, it was possible to assess whether there were differences in the test results and if those differences were statistically significant. The main data analyzed consisted of scores from input and output tests, each with a maximum of 15 points.

4. RESULTS AND DISCUSSIONS

Health education is a process of transferring knowledge and skills necessary to improve quality of life. Health literacy measurement studies are important for the success of health promotion efforts targeting adolescents. However, the majority of health literacy measurement tools were originally developed for adult populations and may not be reflective of health literacy in the context of adolescence (Naigaga et al., 2024).

The presented paper investigated the knowledge of three- and four-grade students in primary schools in the field of personal health issues using modern education models and their relation to the control group using the traditional education model. Formerly, we introduced results of control classes in terms of descriptive statistics of the test scores, box plots of input and output tests, and analysis of test scores by the t-statistics with two-sample assuming equal variances, whereby we tested equal variances by an F-test with two-sample for variances.

4.1. General Performance of Control Classes that Applied Traditional Education Model

We use quantitative methods to identify differences and assess the impact of the research. Therefore, we first introduce a methodology for control classes and, subsequently, for experimental classes. Hence, we consider the differences between these groups of students.

Table 2. Descriptive statistics of input and output tests in control classes.

Descriptive statistics	Input test	Output test
Mean	8.45	9.40
Standard error	0.205	0.202
Median	9	9
Mode	9	9
Standard deviation	2.348	2.258
Sample variance	5.511	5.097
Kurtosis	-0.267	-0.510
Skewness	-0.277	-0.241
Range	12	10
Minimum	2	4
Maximum	14	14
Sum	1107	1175
Count	131	125
Confidence level (95.0%)	0.406	0.399

Table 2 shows that the average score reached 8.45 points on the input and 9.4 points on the output test. Therefore, we can confirm an increase of 0.95 points between both tests in the control classes Figure 2. They also observed an increase of 1.84 points. 131 students took the input test, and 125 students completed the output test in the control classes, so the sample of students for the input and output tests was not the same. Therefore, we cannot use the paired t-test for our sample.

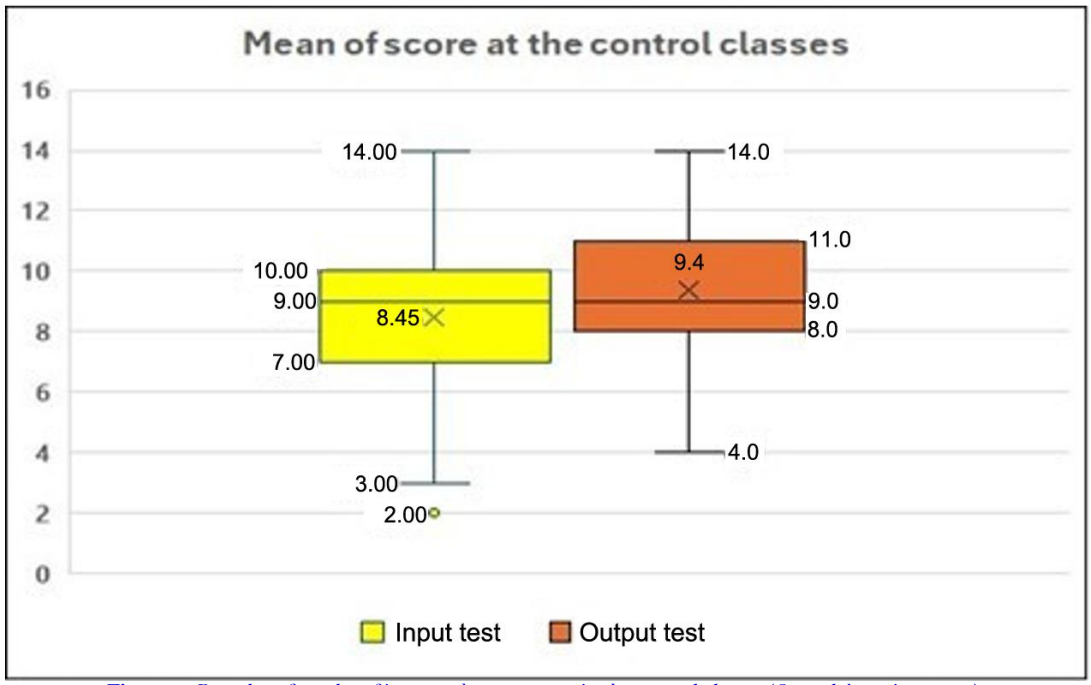

Figure 2. Box plot of results of input and output tests in the control classes (Own elaboration, 2025).

We are using t-statistics to investigate differences in input and output tests for control classes. Whereas we need to find if the variances of input and output tests are equal or unequal, we apply a two-sample F-test for variances.

First, we set the null hypothesis H0: The variances of input and output tests at the control classes are equal. Secondly, after the answer to the F-test, we determine the type of the t-test.

Table 3. Two sample F-tests for variances of input and output tests in control classes.

F-test	Input test	Output test
Mean	8.45	9.40
Variance	5.511	5.097
Observations	131	125
Df	130	124
F	1.081	
P(F<=f) one-tail	0.331	
F Critical one-tail	1.341	

Note: Df = Degree of freedom. F = Value of Fisher distribution.

As is seen from Table 3, the value of Fisher distribution in input and output tests for control classes is F = 1.081. The critical value is F_{crit} = 1.34. Hence, the value of the Fisher distribution for the results of input and output tests, F, is less than F_{crit} ($F < F_{crit}$). Therefore, we accept the null hypothesis H0 and state that the variances of input and output tests at the control classes are equal. To determine whether there are significant differences in input and output tests, a t-test for means with equal variances is used. Next, we apply a t-test for the mean with equal variances at the control classes. Since we are assessing whether the differences in the results of input and output tests in control classes are statistically significant, we use the t-statistic for a two-sample t-test for the mean assuming equal variances. First, we set the null hypothesis H0: The results of input and output tests at the control classes are not statistically significant.

Table 4 shows that the statistical value t = -3.29627 and the critical value t_{crit} = 1.969348. Therefore, the t-test for two samples assumes equal variances. We state that the absolute value of $t > t_{crit}$. The t-statistics for input and output tests in the control classes fall outside the area defined by the critical value t_{crit} within the Gaussian curve, confirming a significant improvement in scores in the control classes. Additionally, the p-value of the t-test is 0.00112. We are conducting t-tests at a significance level $\alpha = 0.05$. Since $P < \alpha$, the difference between input and output results is statistically significant.

Table 4. Test for two samples assuming equal variances of input and output tests in control classes.

T-test	Input test	Output test
Mean	8.45	9.40
Variance	5.511	5.097
Observations	131	125
Pooled variance	5.309	
Hypothesized mean		
Difference	0	
Df	254	
t Stat	-3.297	
P(T<=t) one-tail	0.001	
t Critical one-tail	1.651	
P(T<=t) two-tail	0.001	
t Critical two-tail	1.969	

Note: Df = Degree of freedom. t = Value of student's distribution.

We reject the zero hypothesis and accept the alternative hypothesis H1: There is a statistically significant difference in the results of input and output tests at the control classes. Although the control classes did not solve prepared tasks focusing on healthy nutrition, healthy lifestyle, physical and mental health, and environmental health, we can state that the improvement in knowledge was statistically significant. This suggests that students had sufficient time and experience from the beginning of the third to the end of the fourth grade to acquire knowledge in

real daily situations or other ways. This can be partially explained by the fact that students' knowledge of health and healthy lifestyles is attained within the educational area of Health and Movement included in the curriculum documents in Slovakia. Curricular reform in primary schools in Slovakia aims to increase the quality of physical education teaching and create motivation among children and youth for physical and sport activities and lifelong participation (Antala et al., 2023).

The findings of the Greek study confirm the importance of programs in health promotion and disease prevention. The positive outcomes can also be caused by the reorganization and expansion of health programs into compulsory curricula of schools (Manios, Moschandreas, Hatzis, & Kafatos, 2002). Three elements of the school curriculum, the school environment (hidden curriculum), and the school interaction with home and the wider community (school outreach) have been proposed as the basis of the Health Promoting School (HPS). It has been advocated as an effective approach to promote health in schools (Nutbeam, 1992).

Students in schools that had adopted the HPS framework demonstrated a more positive health behavior profile than those in non-HPS schools (Lee et al., 2008). The Framework of Health Promoting Schools would go beyond the improvement of health literacy to enable a more efficient system for education and health in children, hence a good investment in children (Lee, Lo, Li, Keung, & Kwong, 2020).

Another possible explanation for these findings is another source of health information and promotion family, friends, and social media. As the tools for communication have been transformed by digital communication, health education has continued to evolve to reflect these changes (Nutbeam, 2019).

4.2. General Performance of Experimental Classes with the Application of Innovative Methods

The reorganization and expansion topics of health, physical, and environmental education realized by the project at schools in the experimental classes were essential to our project. The combination of health, nutrition, and environmental education with physical education classes was designed to optimize physical activity and fitness effects. Overall, during all three years of intervention, the project provided at least 20 ± 25 hours of intervention activities annually, mainly on nutrition, environment, psych hygiene, physical activity, and fitness.

Table 5. Descriptive statistics of input and output tests in experimental classes.

Descriptive statistics	Input test	Output test
Mean	8.14	10.50
Standard error	0.117	0.115
Median	8	11
Mode	9	12
Standard deviation	2.124	2.051
Sample variance	4.509	4.207
Kurtosis	-0.363	-0.023
Skewness	-0.151	-0.593
Range	11	10
Minimum	3	4
Maximum	14	14
Sum	2686	3348
Count	330	319
Confidence level (95.0%)	0.230	0.226

Table 5 shows the average score reached around 8,14 points at the input and 10,50 points at the output test. So, we can confirm an increase by 2,36 points between both tests at the experimental classes Figure 3. 330 students did the input test, and the output test was done by 319 students in the experimental classes, so the sample of students at the input and output test was not the same; hereby, we cannot use the paired t-test for our sample.

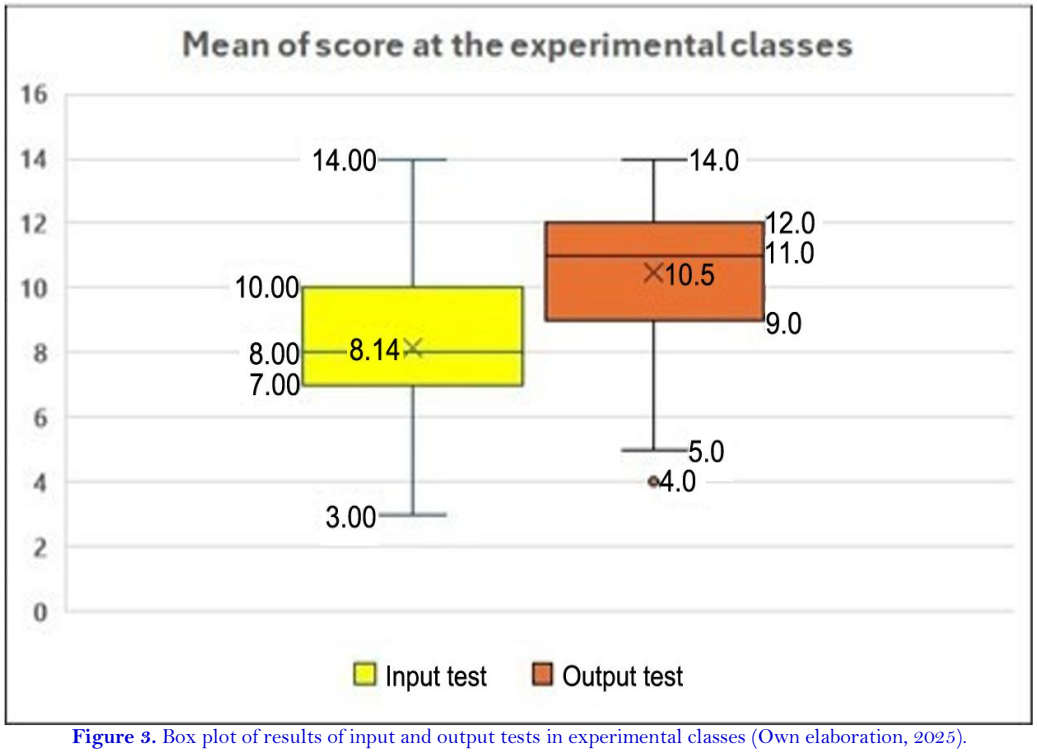

Figure 3. Box plot of results of input and output tests in experimental classes (Own elaboration, 2025).

We applied for an F-test application in experimental classes. As done above, we determine which test to apply, using t-statistics to investigate differences in input and output tests for experimental classes. Since we need to find whether the variances of input and output tests are equal or unequal, we apply a two-sample F-test for variances. First, we set the null hypothesis H0: The variances of input and output tests in the experimental classes are equal. Second, after the F-test, we determine the type of t-test to use.

Table 6. Two sample F-tests were used to compare the variances of input and output tests in experimental classes.

F-test	Input test	Output test
Mean	8.14	10.50
Variance	4.509	4.207
Observations	330	319
Df	329	318
F	1.0719	
P(F<=f) one-tail	0.267	
F Critical one-tail	1.201	

Note: Df = Degree of freedom. F = Value of Fisher distribution.

According to Table 6, the value of the Fisher distribution in input and output tests at the experimental classes is F = 1.071943. The critical value is F_{crit} = 1.201251. Therefore, the Fisher distribution value of the results of input and output tests, F, is less than F_{crit} ($F < F_{crit}$), indicating that the F value falls within the critical region in the Fisher diagram. This leads us to accept the null hypothesis (H_o), suggesting that the variances of input and output tests of the experimental classes are equal. To examine the differences in means between input and output tests, a t-test for means with equal variances is employed.

We apply a t-test for the mean with equal variances in experimental classes. We are determining whether the differences in the results of input and output tests at the experimental classes are statistically significant. To do this, we use the t-statistic by conducting a two-sample t-test for the mean, assuming equal variances. First, we set the null hypothesis H0: The results of input and output tests at the experimental classes are not statistically significant.

Table 7. T-test for two samples assuming equal variances of input and output tests in experimental classes.

T-test	Input test	Output test
Mean	8.14	10.50
Variance	4.509	4.207
Observations	330	319
Pooled Variance	4.361	
Hypothesized Mean		
Difference	0	
Df	647	
t Stat	-14.369	
P(T<=t) one-tail	0.000	
t Critical one-tail	1.647	
P(T<=t) two-tail	0.000	
t Critical two-tail	1.964	

Note: Df = Degree of freedom. t = Value of student's distribution.

Table 7 shows that the statistical value t = -14.3685 and the critical value t_{crit} = 1.963637 because the t-test for two samples assumes equal variances. We state that the absolute value of t is greater than t_{crit}. Since the t-statistic for the input and output tests of the experimental classes lies outside the area defined by the critical value t_{crit} within the Gaussian curve, we confirm a significant improvement in scores in the experimental classes. Additionally, the probability value p = 7.82E-41 is very small. We are conducting the t-test at a significance level $\alpha = 0.05$. Therefore, since $P < \alpha$, the difference between the input and output results is statistically significant. We reject the null hypothesis and accept the alternative hypothesis H_1: There is a statistically significant difference in the results of input and output tests in the experimental classes.

Table 8. Descriptive statistics of input and output tests of all classes.

Class	Mean input test	Mean output test	Differ. Output/ Input	Standard Error	Median mode	Standard dev.	Sample variance	Range	Min.	Max.	Sum	Count	Confidence (95.0%)
1.Con.	8.96	9.62	0.67	0.53	9	9	2.44	0.08	9	5	14	202	21
2.Con.	7.94	8.70	0.76	0.51	8.5	11	2.27	0.20	8	5	13	174	20
3.Con.	9.26	10.08	0.82	0.61	10.5	12	2.11	-0.48	7	6	13	121	12
4.Con.	9.85	10.71	0.86	0.42	11	12	1.72	-0.15	5	8	13	182	17
5.Con.	8.00	9.06	1.06	0.51	9	7	2.18	0.04	8	5	13	163	18
6.Con.	7.80	8.86	1.06	0.40	9	10	1.82	-0.59	9	4	13	186	21
7.Con.	7.79	8.94	1.16	0.64	9.5	12	2.73	-0.50	8	4	12	161	18
8.Exp.	7.88	9.32	1.43	0.38	10	10	1.67	-0.24	6	6	12	177	19
9.Exp.	9.10	10.57	1.47	0.72	11	12	1.90	-0.15	5	8	13	74	7
10.Exp.	8.40	9.95	1.55	0.36	10	10	1.66	-0.06	6	7	13	209	21
11.Exp.	8.10	9.67	1.57	0.40	10	10	1.68	0.01	5	7	12	174	18
12.Exp.	8.40	10.13	1.73	0.35	10	10	1.41	0.08	4	8	12	162	16
13.Exp.	8.95	10.75	1.80	0.38	11	12	1.71	-1.17	7	6	13	215	20
14.Exp.	8.76	10.63	1.86	0.65	11.5	12	2.60	-0.77	9	5	14	170	16
15.Exp.	8.00	10.14	2.14	0.48	10	10	1.79	-0.10	6	6	12	142	14
16.Exp.	7.23	9.40	2.17	0.40	9	9	1.26	0.28	3	8	11	94	10
17.Exp.	7.40	9.69	2.29	0.58	9	9	2.10	0.99	7	7	14	126	13
18.Exp.	9.00	11.36	2.38	0.41	12	12	1.63	-0.70	6	8	14	182	16
19.Exp.	9.43	11.87	2.44	0.32	12	13	1.25	-0.99	4	9	13	178	15
20.Exp.	7.88	10.44	2.57	0.46	11	11	1.95	-0.23	7	7	14	188	18
21.Exp.	8.71	11.48	2.76	0.40	12	12	1.83	-0.85	7	7	14	241	21
22.Exp.	7.57	10.62	3.05	0.43	11	12	1.96	-0.68	8	6	14	223	21
23.Exp.	6.75	9.86	3.11	0.41	10	10	1.88	-0.97	7	5	12	207	21
24.Exp.	7.55	11.74	4.19	0.57	13	13	2.47	-2.01	10	4	14	223	19
25.Exp.	7.00	12.63	5.63	0.13	13	13	0.50	-0.57	1	12	13	202	16

Note: Exp. – Experimental classes.
Con. – Control classes.

Although the control classes reached statistically significant improvement in the output test, comparing the t value of control classes, which is an absolute t = 3.29627, and the t value of experimental classes, which is an absolute t = 14.3685, we can see a strong influence by applying prepared tasks and activities aimed at supporting knowledge on healthy nutrition, a healthy lifestyle, physical and mental health, and environmental health.

5. DISCUSSIONS

The results showed a significant increase in the input and output tests, by 16% in the experimental groups and by 6% in the control groups. We, therefore, conclude that the application of prepared assignments contributes to improving knowledge about healthy nutrition, a healthy lifestyle, and physical and mental health.

5.1. General Performance

Table 8 shows the scores in all classes' input and output tests. Results are organized according to the fifth column by increasing the score in the output, in contrast to the input test, which is ascending. First, we see from Table 8 that the test score increased from 0.67 to 1.16 points in the control classes (rows 1—7). Secondly, from the same table, the test score increase was from 1.43 to 5.63 points in the best experimental class (row 25). Therefore, the arrangement of Table 8 indicates that applying prepared tasks and activities contributes to improving knowledge in healthy nutrition, healthy lifestyle, physical and mental health, and environmental health. Merkle's study investigated a group of eighth and ninth-grade students' knowledge of personal health and physical fitness concepts and its relation to locus of control. A 20-item true-false knowledge questionnaire with opportunities for students to explain their choices indicated that, while students scored relatively well on the items, the explanations of their responses frequently indicated erroneous reasoning based on preconceptions or misconceptions (Merkle & Treagust, 1988). This investigation indicated the need for further study since it is not enough to know the knowledge level of a healthy lifestyle among students; it is also important to maintain it in real life. Knowledge of related facts examined health knowledge among students using input and output tests. According to Pénzes, Vincze, Sándor, and Bíró (2020), the study pointed out that the living context significantly influences adolescents' health behavior (Pénzes et al., 2020). Simple knowledge is necessary for a healthy lifestyle but ineffective in improving adolescents' behavior. Comprehensive health promotion programs could provide solutions for encouraging healthy behavior. It is essential to move their health knowledge into positive health behavior, and health education should be one possible way to achieve this goal.

6. CONCLUSIONS

This study concluded that the average knowledge score of students improved after three years of the project, in which we developed knowledge about a healthy lifestyle through tasks and activities. Statistically significant results in knowledge scores were found in experimental classes involved in the health education project for the years 2022-2024. The findings indicate that, from a public health perspective, it is necessary to develop programs that will increase students' health literacy. However, the study to ensure the retention of knowledge even after the completion of health education requires further longitudinal studies involving health education projects with children, teachers, and parents, with follow-up at various intervals. Based on interviews with teachers and direct observation of students while solving the tasks, we can conclude that students had a positive relationship with the application tasks prepared in this way. Because the prepared application tasks were directly related to the educational goals according to the curriculum, these tasks strengthened the acquisition of prescribed and necessary knowledge. Since the mentioned topics were part of tasks in other subjects, the students also improved their use of information and communication technologies. The students were keenly interested in topics about ecology, healthy lifestyle, consumption of healthy foods, and understood the importance of water in nature and its impact on humans. The positive correlation between environmental impact indicators and cost further highlights the interplay between diet, sustainability, and economics,

where greater environmental impact was associated with higher costs for all diets, especially those associated with current diets (Caldeira, Vandevijvere, Swinburn, Mackay, & Claro, 2024).

7. RECOMMENDATIONS

We bring our recommendations that are supported by the study's findings in experimental classes:

1. The use of created tasks made the topic more attractive, and the method of solving it interested students and attracted them to communicate about solving the task.
2. Teaching took on a playful form, while students did not feel stressful influences. Students discovered solutions in a playful way.
3. Students worked with different materials than in traditional classes.
4. Students had immediate feedback on solving the task.
5. School management supported visits by project team members and created conditions for solving the project.
6. The tasks created were published for the public on the project website.

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Institutional Review Board Statement: The Ethical Committee of the Constantine the Philosopher University in Nitra, Slovak Republic has granted approval for this study on 7 October 2024 (UKF/1082/2024/191013:002).
Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
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