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Key Factors Among Preschool Teachers in Promoting Sustainable Development in Early Childhood Education

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Early childhood education for sustainable development is the basis for achieving sustainability in all dimensions: ecological, economic, social and cultural. Starting from the theory of education for sustainable development, the aim of this quantitative, empirical study, which was part of a wider international research on early childhood education for sustainable development, was to examine the perspective of Slovenian preschool teachers on implementing education for sustainable development in kindergarten through an educational assessment of their practice. Data was collected through an online survey with an assessment scale, in 2024, on a sample of 114 preschool teachers employed in Slovenian kindergartens. The results of the factor analysis indicated different approaches to promoting sustainability in the kindergarten context. Three factors have been singled out that indicate that the implementation of education for sustainable development is realized through the following: Planned and comprehensive activities of education for sustainable development (integrative and participatory approach), Encouraging social sustainability (development of social skills and empathy) through daily peer interactions and Promoting sustainable behaviour through the daily routine.

Keywords: education for sustainable development, dimensions of sustainability, preschool teachers, early childhood education environment, methodical approaches

INTRODUCTION

The epochal question of civilization, which is becoming more and more relevant every day, is the question of sustainability, which the current generations should provide for the generations to come, through the ecological, economic, social and cultural dimensions of sustainability. Sustainability is a complex, multidimensional concept (Višnjić-Jevtić et al., 2022), rooted in the early Brundtland definition, which describes it as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs (WCED, 1987). This concept interlinks economic growth, social equity, and environmental protection. Furthermore,

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the dimensions of sustainability for a future-oriented approach are interdependent, dynamically and interactively connected (UNESCO, 2014; Hedefalk et al., 2015; Gokool-Ramdoo & Rumjaun, 2017; UNESCO, 2017).

UNESCO (2017) recognizes education as a means, a driver and an essential strategy for achieving sustainability, which should begin in early childhood, and following the presented goals, contents, themes and activities, and recommends the creation of educational programs for preschool age (UNESCO, 2005). Given that education for sustainable development (hereafter ESD) is one of the key elements of the 2030 Agenda (UN, 2015), Engdahl & Furu (2022) point to the opportunities, but also the challenges, that the framework of the UN 2030 Agenda generates for sustainable development in the area education and care of young children, while Višnjić-Jevtić et al. (2022) in their study indicate the need for a comprehensive and systematic approach in the implementation of ESD in the Early Childhood Education Environment (hereafter ECE Environment-ECEfS) as key components of this Agenda. The complexity of the concept of sustainability, and the occasional inconsistency and contradictions of its dimensions, as seen by Kioupi and Voulvoulis (2019, 2022) and Parry and Metzger (2023) are often reflected as a challenge to the implementation of ESD in the regular educational-upbringing process, while Mogren (2024) questioning ESD highlights the need for change in education and approaches in educational practice to focus more on sustainability, and suggests the integration of sustainability into various aspects of the educational system. Findings from contemporary studies that delve deeper into ESD theory suggest that effective implementation of ESD requires a committed, multi-layered approach that includes different educational strategies aligned with the SDGs (Parry & Metzger, 2023; Mogren 2024; Shephard, 2023). Research on ESD in other parts of the world indicates that approaches to implementing ESD differ in different contacts. At the same time, educators in general have difficulties in implementing ESD due to the multidisciplinary aspects of sustainability, feel unprepared due to the lack of constant opportunities for professional development, and encounter obstacles in the context of student-centred ESD pedagogy, insufficient resources, equipment and suitable environments for ESD implementation (Parry & Metzger, 2023).

Due to the specificity of the preschool age, due to the specificity of early learning and the developmental path of young children, connecting the SDGs with the learning outcomes of young children in regular educational-upbringing practice seems more challenging, but also more significant than at older ages.

Sustainable practices in kindergarten: research and recommendations for the future

Five-year sustainability research projects conducted within the World Organization for Early Childhood (OMEP) aimed to raise awareness and gain knowledge about sustainability among young children, OMEP members and the ECE international community, and achieved recognizable results (Engdahl, 2015). Other research also reveals the importance and need for early access to ESD (Pramling Samuelsson, 2011), to establish a favourable environment for developing sustainable habits and values of young children (Siraj-Blatchford, 2009). Priority is given to a supportive environment, action, children's participation in problem-solving, project-based learning, direct

experiences and questions that encourage children to think and act (Hedefalk, 2015), and experiential learning (Blake et al., 2013). Višnjić-Jevtić et al. (2022), and Bahtić & Višnjić Jevtić (2020), indicate that preschool teachers are key persons for the integration of ESD content and activities in ECE, which requires them to understand and apply the content of sustainable development in everyday life (Borić, Jindra & Škugor, 2008), thus becoming a positive model of sustainable behaviour for children (Ginsburg & Audley, 2020; Šindić et al., 2021). Adopting sustainable habits in a stimulating kindergarten environment is optimally achieved through daily sustainable routines (Mahat et al., 2016; Ginsburg & Audley, 2020). In addition to environmental and economic factors, the focus of ESD is also local, cultural and traditional knowledge about sustainability and the goals of socio-emotional well-being, starting from the development of empathy, solidarity and tolerance, to intergenerational cooperation, promoting children's rights, cultural heritage and building an inclusive society (UN, 2015; UNESCO, 2017; UNESCO, 2023). Research into inclusive practice in kindergartens indicates that a safe and inclusive environment, where children receive the necessary support and their individual needs are recognized and met, is essential within the institution, and additional efforts are needed in this direction (Machmud et al., 2023; Lepičnik Vodopivec et al., 2024). The results of the research indicate that intergenerational cooperation in the context of preschool upbringing and education enables the welfare of all involved actors, contributes to inclusiveness and cohesiveness of society (Šindić et al., 2022a), and connects kindergartens with the local community. Through intergenerational movements, people demand climate justice, as well as social and cultural fairness (Engdahl & Furu, 2022). Although the focus of ESD is placed on global issues and local priorities, it is recommended to take into account the context in which it takes place (UNICEF, 2012). The emphasized influence of the kindergarten context as a microsystem - peer group, through daily interactions and life situations (Bronfenbrenner, 1979), enables the preschool teacher to encourage social sustainability (Johansson & Rosell, 2021), nurturing cooperation, tolerance and empathy among children. Numerous studies indicate positive sustainable practices (Mahat et al., 2016; Poje et al., 2024; Ginsburg & Audley, 2020; Samuelsson & Kaga, 2008; Johansson & Rosell, 2021), but also the need for a more emphasized integration of ESD topics and content into the regular program and curriculum (Mahat et al. 2016; Višnjić Jevtić et al., 2022). The competence of preschool teachers, i.e. the possession of knowledge, skills, values and attitudes, is an essential prerequisite for the successful realization of the educational-upbringing process (Pažur et al., 2024), and thus the implementation of ECEfS. Therefore, numerous studies indicate the essential role of preschool teachers, the importance of professional development of preschool teachers and the development of their competencies for the implementation of ECEfS (Višnjić Jevtić et al., 2022; Šindić et al., 2021; Šindić et al., 2022; Farewell et al., 2021) through the application of various aspects of strategy, support, organization and implementation of activities, selection of educational-upbringing content, selection and creation of environments suitable for sustainable practices in education and upbringing. Different obstacles that educators encounter when implementing education for sustainable development are also observed (Gokool-Ramdoo & Rumjaun, 2017). Additionally, the complex and multifaceted aspects of sustainability can make it difficult to design coherent educational programs that encompass all dimensions (economic, social, cultural, and

environmental) (Hedefalk & Ostman, 2015; Parry & Metzger, 2023). Preschool teachers may find it challenging to create a unified approach that effectively balances these various aspects and aligns with the developmental tasks of preschool children.

Acknowledging the key role of preschool teachers in the implementation of ECEfS, in this paper the emphasis will be on how preschool teachers do it, that is, the diversity of methodical approaches to the implementation of ECEfS will be examined from the perspective of practitioners-preschool teachers. In other words, differences in methodical approaches to the implementation of ECEfS according to preschool teachers' perceptions will be investigated.

METHOD

Research design

Starting from the theory of sustainable development, in this quantitative, empirical study, which is part of a broader international research (project) on ESD at early childhood and preschool age, the goal is to examine the perspective of Slovenian preschool teachers on the implementation of ECEfS through an educational assessment of their own practice. The study features a cross-sectional design, with elements of a descriptive and correlational approach. The technique of surveying and scaling was used to collect relevant data, based on voluntariness and anonymity, while respecting ethical considerations. The research was approved by the decision of the Ethics Committee of the Faculty of Teaching, University of Zagreb, with the note that the research will be conducted in different countries. The research was carried out in 2024.

Sample

114 respondents participated in the research. The sample was convenient and uneven concerning gender. It consisted of 112 (98.2%) preschool teachers and 2 (1.8%) male preschool teachers, from different cities in Slovenia. Table 1 presents the characteristics of the sample.The preschool teachers were employed in Slovenian preschool institutions and worked with different age groups of children. 36% of respondents worked with children of nursery age/toddlers (from 1 to 2 years old; from 2 to 3 years old or from 1 to 3 years old), while 64% of respondents worked with preschool children (in groups ranging from 3 to 4 years old; 4 to 5 years; 5 to 6 years and 3 to 6 years).Some respondents worked in age-homogeneous groups, while others worked in age-mixed groups. More than 75% of respondents work in kindergartens that are included in the Eco School/Eco Kindergarten program, which is part of a global network under the auspices of the organization Foundation for Environmental Education (FEE) and aims to integrate ecology education into the daily work of educational institutions[1].The emphasis is on the ecological environment, upbringing and education through which sustainable development is promoted, and preschool teachers have the opportunity to continuously improve their skills. Slovenia is one of the countries that actively implements this program.

[1] https://ekosola.si/predstavitev-ekosole/

Table 1
Sample structure

Sample characteristics		Frequency	Per cent
Sex	Female	112	98.2
	Male	2	1.8
Years of service	Up to 10 YOA	35	30.7
	From 10 to 20 YOA	37	32.5
	From 20 to 30 YOA	24	21.1
	Over 30 YOA	18	15.8
The age group of children in which teacher works	From 1 to 2 YOA	20	17.5
	From 2 to 3 YOA	17	14.9
	From 1 to 3 YOA	4	3.5
	From 3 to 4 YOA	19	16.7
	From 4 to 5 YOA	18	15.8
	From 5 to 6 YOA	22	19.3
	From 3 do 6 YOA	14	12.3
The age of the children teacher works with	From 1 to 3 YOA	41	36.0
	From 3 to 6 YOA	73	64.0
Eco kindergarten / eco-school program	Yes	86	75.4
	No	28	24.6

Note: Preschool education and upbringing in Slovenia include children aged 1 to 6 years.

Instrument

Taking into account the recommendations and settings of ECEfS (UN, 2015; UNESCO, 2017), an instrument for collecting quantitative data relevant to research was independently created. The first part of the instrument, composed of five items, related to basic generalities about the respondents and the kindergarten program. The second part of the instrument is composed of 22 items with a five-point Likert-type scale, through which data were collected, based on self-reporting by preschool teachers, about the frequency of application of various aspects of strategy, support, organization and implementation of activities to promote environmental, social, cultural and economic aspects of sustainability in kindergarten. A five-point scale, which related to the frequency of application, was defined as follows: 1 – never; 2 - once or several times a year; 3 - once or several times a month; 4 - once or several times a week; 5 - daily. The items were chosen to reflect different dimensions of the complex phenomenon of ECEfS implementation. The verification of the metric characteristics of the instrument was carried out through content validity analysis, cross-validation, through empirical evidence, but also non-traditional methods such as the verification of contextual reliability. The instrument was carefully designed to include all relevant aspects of the ECEfS construct (ecological, socio-cultural and economic aspects) while respecting the recommendations and settings of ESD and ECEfS (UN, 2015; UNESCO, 2017) and based on the qualitative OMEP ESD scale: Environmental Rating Scale for Sustainable Development in Early Childhood (OMEP, 2019). The selection of the items of the instrument was based on the preliminary qualitative research of ECEfS carried out with preschool teachers from Bosnia and Herzegovina, Croatia and Slovenia, through which the tendencies of different and multi-layered approaches to the implementation of ESD in the kindergarten contexts of the mentioned countries were observed, and some of the

results of that research were also published (Višnjić Jevtić et al., 2022). Insights about the multi-layered and other specifics of the implementation of ECEfS from the point of view of practitioners following current practice, obtained during this qualitative preliminary research, and the choice of activities of the course "Sustainability from the very beginning" (ECE Academy, 2023) was the basic starting point for the design of the instrument. The instrument received its final form through the consensus of experts who worked on a wider international project. Cross-validation, which provides additional evidence of the instrument's validity, was performed in the next step, in a pilot study (Bosnia and Herzegovina and Slovenia), and the results were compared across different groups (respondents from kindergartens with and without eco-programs. Empirical evidence was also used to check the validity and reliability of the instrument. The results of the factor analysis (Table 4) showed a clear structure of the factors, while the statistical differences between them (Table 5) gave clear empirical evidence that the instrument functions as intended, that is, to identify different approaches in the implementation of ECEfS. The number of items in the second part of the instrument was, after the factor analysis procedure, reduced to 16 statements to distinguish the factors more clearly and reduce the possibility of mutual overlaps, which contributed to the purity of the factors and justified their extraction. Reducing the number of items made it possible to focus on specific aspects of the research, which increased the clarity and precision of the instrument, and the interpretability of the results, and facilitated the connection of factors with the outcomes being investigated. Cronbach's Alpha coefficient of the reduced scale is (α = .851) and indicates adequate internal consistency (reliability) of the instrument. The communalities of the items are in the range from .306 to .724 (> .30), and the corrected item-total correlation (> .15) (Table 2) indicates their appropriate discriminativeness.

Table 2
Item communalities

Items	h^2	Corr. IT Correlat.	λ
I organize some activities that encourage intergenerational solidarity (visits to homes for the elderly, visits of grandparents to kindergarten, etc.).	.724	.616	.826
Through different stories, conversations, experiments, practical, discovery activities, etc. I introduce children to renewable energy sources (water, sun, wind).	.702	.742	.733
I teach children not to waste food.	.664	.205	.812
I encourage children to resolve conflicts by fostering non-violent communication and tolerance.	.643	.197	.599
I encourage children to cooperate in groups.	.624	.358	.540
I perform various experiments that contribute to environmental awareness (pollutants, plastics, decomposition of materials, clean and dirty water, etc.).	.595	.692	.723
I organize projects (activities) for planting different seedlings (vegetables, roses, ornamental plants, etc.).	.586	.618	.763
I organize volunteer actions, such as collecting donations for the socially disadvantaged (sweets, picture books, toys, clothes, food, etc.).	.582	.620	.755
I organize activities where children learn entrepreneurship and handling money (eg selling handicrafts, works of art, etc.).	.580	.599	.758
I perform activities that have an ecological background and discuss them to develop awareness about the preservation of local flora and fauna.	.575	.671	.679
Through my personal example, I inspire children to conserve water, electricity, and money	.569	.164	.753
I organize activities for the promotion of children's rights (eg celebrating Children's Week).	.566	.619	.726
I encourage children to properly separate waste.	.465	.209	.576
I encourage children to care for each other (eg care for younger children, children with difficulties, etc.).	.464	.265	.662
Through literary and other artistic activities, I try to encourage the understanding of cultural diversity.	.454	.591	.603
I organize visits to nature so that children can directly experience the natural environment and feel connected to it.	.306	.469	.503

Note: Extraction Method: Principal Component Analysis.h^2- Communalities; λ-Factor saturations

Data analysis

To statistically process the collected data, principal component analysis was used, along with the Varimax factor rotation method. For a more detailed interpretation of the isolated factors, an analysis of descriptive statistical indicators (Mean, Standard deviation, etc.) and Paired sample T-test and Independent Samples Test (t-ratio) were performed. Reliability analyses were performed to check the reliability of the instrument. The Kolmogorov-Smirn test was used to check the distribution of the factor variables. IBM SPSS Statistics 26 software was used for statistical data processing.

FINDINGS

It was established that the metric prerequisites for accessing the factor analysis of the data are fulfilled. Namely, the number of respondents is satisfactory (114 > 101). Also, the calculated value of the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO = 0.825) represents a good level of this prerequisite (Field, 2017; Hair, et al., 2014), and Bartlett's test of sphericity is satisfied ($\chi 2 = 724.076$, $p < 0.001$) (Table 3).

Table 3
Data adequacy assumptions for factor analysis

Kaiser-Meyer-Olkin test of sampling adequacy		.825
Bartlett's Test of Sphericity	Approx. Chi-Square	724.076
	Degrees of freedom (df)	120
	Statistical significance (Sig.)	.000

Based on the Kaiser-Gutmann criterion of eigenvalues, by Horn's parallel analysis and Katel's landslide test (Chart 1), three factors were singled out.

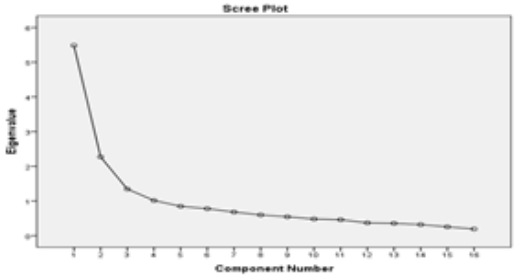

Chart 1
Scree plot

After different matrix rotations, the Rotation Method: Varimax with Kaiser Normalization was chosen, because it proved to be the most appropriate for the interpretability of the three-factor solution. Table 4 shows the factor pattern matrix. During factor extraction, factor saturations above .50 were taken into account (Hair et al., 2014) and are practically significant, which supports the extraction of three pure factors confirms their validity and is suitable for the interpretation of the factor matrix. For the sake of transparency in the complete presentation of the factor analysis, the stated saturations are in bold. Higher factor saturations are noticeable, and within the first factor they range from .503 to .826, the second factor from .662 to .799, and the third factor from .576 to .812, which can be considered an indicator of the quality factor structure of the instrument. Factor saturations are greater than the value of .50 and are practically significant and suitable for the interpretation of the factor matrix (Hair et al., 2014).

Table 4
Rotated component matrix: Implementation of ESD in kindergarten

Items	Component		
	1	2	3
I organize some activities that encourage intergenerational solidarity (visits to homes for the elderly, visits of grandparents to kindergarten, etc.).	.826	-.079	-.188
I organize projects (activities) for planting different seedlings (vegetables, roses, ornamental plants, etc.).	.763	-.055	.028
I organize activities where children learn entrepreneurship and handling money (eg selling handicrafts, works of art, etc.).	.758	-.061	-.030
I organize volunteer actions, such as collecting donations for the socially disadvantaged (sweets, picture books, toys, clothes, food, etc.).	.826	.053	-.095
Through different stories, conversations, experiments, hands-on activities with discovery, etc. I introduce children to renewable energy sources (water, sun, wind).	.763	.134	.283
I organize activities for the promotion of children's rights (eg celebrating Children's Week).	.758	.158	-.119
I perform various experiments that contribute to environmental awareness (pollutants, properties of plastics, decomposition of materials, clean and dirty water, etc.).	.723	.191	.190
I perform activities that have an ecological background and discuss them to develop awareness about the preservation of local flora and fauna.	.679	.236	.242
Through literary and other artistic activities, I try to encourage the understanding of cultural diversity.	.603	.200	.223
I organize visits to nature so that children can directly experience the natural environment and feel connected to it.	.503	.214	.084
I encourage children to resolve conflicts by encouraging non-violent communication and tolerance.	.027	.799	-.063
I encourage children to cooperate in groups.	.170	.740	.219
I encourage children to take care of each other (eg younger children, children with problems, etc.).	.113	.662	.113
I teach children not to waste food.	.059	.000	.812
Through my personal example, I inspire children to conserve water, electricity, and money.	.014	.046	.753
I encourage children to properly separate waste.	.017	.365	.576
Percentage of explained variance (Total: 56.87%)	34.27	14.2	8.4
Eigenvalues	5.121	1.997	1.98

Note: Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

By analyzing the grouped items and the level of saturation by factors (Table 4), and the frequency of implementation of the mentioned activities (Table 5), taking into account the modern settings on ESD and the specifics of the ECE Environment, the isolated factors were named as follows:

F1: Implementation of planned and comprehensive activities of ESD - integrative and participatory approach;
F2: Encouraging social sustainability (development of social skills and empathy) through everyday peer interactions
F3: Improving and promoting sustainable behaviour through daily routines in kindergarten.

The isolated factors explain 56.87% of the total variance of the examined phenomenon, of which the first factor accounts for 34.27%, the second factor accounts for 14.2%, and the third factor accounts for 8.4% of the variance. Most of the variance is due to

common factors, with the first factor being dominant. This is also visible based on their eigenvalues, which for the first factor are 5,121, and for the other two significantly less (1.997 and 1.980) (Table 4).

The items of the instrument were chosen to reflect different approaches to the implementation of the complex phenomenon (ECEfS). In the case of complex phenomena, reliability cannot always be expressed exclusively by traditional methods. Namely, the Cronbach's Alpha coefficient for factor F1 ($\alpha = .884$) indicates the high reliability of this factor, while for other factors F2 ($\alpha = .637$) and F3 ($\alpha = .645$) the low number of items is the main reason contributing to low values Cronbach's Alpha coefficient.To obtain higher values of Cronbach's Alpha coefficient, more than three items per factor are usually required. Although a coefficient above .7 is desirable, its values between .6 and .7 could be contextually acceptable taking into account both the specificity and the breadth of the complex phenomenon that is sustainable development, ECEfS and its implementation. In this regard, one can talk about contextual reliability for the corresponding items of factors F2 and F3.

The calculated statistical indicators, presented in Table 5, indicate that preschool teachers are mediocre - once or several times a month they implement the mentioned planned activities of ESD (M = 3.1184; SD = .73492). On the other hand, social sustainability is encouraged daily through the development of social skills and empathy within daily peer interaction (M = 4.7573; SD = .40470) and sustainable behaviour through the daily routine (M = 4.7251; SD = .50610).

Table 5
Descriptive statistical parameters of ESD implementation factors in ECE and differences between them (Paired sample T-test)

	N	Min.	Max.	Mean	SD	t	df	p
F 1	114	1.30	5.00	3.1184	.73492	-23.977	113	.000
F 2	114	3.00	5.00	4.7573	.40470			
F 1	114	1.30	5.00	3.1184	.73492	-20.943	113	.000
F 3	114	2.33	5.00	4.7251	.50610			
F2	114	3.00	5.00	4.7573	.40470	.632	113	.528
F3	114	2.33	5.00	4.7251	.50610			

Note: SD – standard deviation; t – t-ratio; df - degrees of freedom; p - statistical significance.

With the help of the Kolmogorov-Smirn test, it was determined that the distributions of research variables (factors) are not spread normally (Table 6).

Table 6
Tests of normality of the extracted factors

	Kolmogorov-Smirnov		
	Statistic	df	Sig.
F 1	.126	114	.005
F 2	.357	114	.000
F 3	.373	114	.000

Note: df - degrees of freedom; Sig. - statistical significance.

Even if the distributions are not normally distributed, the analysis of variance will be robust and reliable results will be obtained using parametric t-tests and correlation

analyses, if the sample size per group is greater than 30 (Pallant, 2009), i.e. over 15 (Green & Salkid, 2016)). In this empirical work, it was observed that the stated conditions were met (N = 114), and parametric tests (Paired Sample T-test and Independent Samples Test) were chosen for statistical analysis.

Using the Paired Sample T-test, the calculated t-ratio ($t = -23.977$; $p < .001$) indicates that there is a statistically significant difference between the arithmetic means of the extracted factors F1 (M = 3.1184) and F2 (M = 4.7573). Also, the t-ratio ($t = -20.943$; $p < .001$) confirms the differences between the arithmetic means of factors F1 (M = 3.1184) and F3 (M = 4.7251). It is observed that the differences are in favour of factors F2 and F3. Therefore, the findings confirm that ESD is more often implemented in the kindergarten program through the encouragement of social sustainability (development of social skills and empathy) through daily peer interactions (F2) and sustainable behaviour through the daily routine (F3), concerning planned and integrative activities of ESD (F1). The difference between factors F2 and F3 ($t = .632$; $p > .05$) is not statistically significant (Table 5).

For a more thorough analysis of the extracted factors, the statistical significance of the differences in the representation of the factors was checked concerning the years of work and gender of the preschool teachers, the age of the children in the group and the representation of the eco-project in the kindergarten. With the application of the t-test for independent samples (Independent Samples Test), the difference was confirmed only in respondents who work in a kindergarten included in the international Eco-kindergarten/eco-school Program[2] and those whose kindergartens are not included in the mentioned program (Table 7). The calculated t-ratio ($t = 3.110$; $p < .01$) indicates that there is a statistically significant difference between the arithmetic means of the representation of the F3 factor in kindergartens with an eco-program (M = 4.8062) and those not included in that program (M = 4.4762). Based on the height of the arithmetic means, it can be seen that the promotion of sustainable behaviour through the daily routine (F3) is more common in kindergartens with an eco-program. Although the arithmetic means of the other factors are more pronounced in kindergartens with the eco-program, statistically significant differences were not confirmed for factor F1 ($t = 3.110$; $p > .05$) and for factor F2 ($t = 3.110$; $p > .05$) (Table 7).

Table 7
Implementation of ESD in kindergarten with and without eco-program: Independent Samples Test

	Eco-program	N	Mean	SD	t	df	p
F1	Yes	86	3.1872	.69854	1.768	112	.080
	No	28	2.9071	.81419			
F2	Yes	86	4.7868	.37890	1.370	112	.173
	No	28	4.6667	.47140			
F3	Yes	86	4.8062	.43526	3.110	112	.002
	No	28	4.4762	.62479			

Note: SD – standard deviation; t – t-ratio; df - degrees of freedom; p - statistical significance.

[2] https://ekosola.si/predstavitev-ekosole/

DISCUSSION

The items of the used instrument were designed to reflect different dimensions of the complex phenomenon of ECEfS implementation. Factor analysis identified three potential independent factors that indicate different approaches to the implementation of ECEfS. Although most of the variance of the examined phenomenon - the implementation of ECEfS is determined by common factors *Implementation of planned and comprehensive activities of ESD - an integrative and participatory approach(F1), Encouraging social sustainability (development of social skills and empathy) through daily peer interactions (F2)* and *Promoting sustainable behaviour through the daily routine (F3),* the first factor dominantly describes the implementation of ESD, while the other two complement it. These findings, along with the significant differences obtained between the extracted factors, may indicate potential obstacles to the implementation of Education for Sustainable Development (ESD) that particularly arise during school age, as observed by educators worldwide. These challenges include difficulties stemming from the multidimensional and multidisciplinary aspects of sustainability and the struggle to fully integrate these dimensions through the alignment of the Sustainable Development Goals (SDGs) with learning outcomes (Parry & Metzger, 2023).

Implementation of planned and comprehensive activities of ESD - an integrative and participatory approach

The research results indicate that the most prevalent educational approach to the implementation of ESD is through pre-designed and planned activities. These activities integrate and intertwine different dimensions of sustainability. Considering that sustainability is a complex concept with interdependent and related dimensions (UNESCO, 2017), integrative action and thinking are recommended (UNESCO, 2012). Factor F1 explains as much as 34.27% of the variance (Table 4), which shows the impact of this approach. Preschool teachers organize activities, projects and actions of an ecological, social, cultural and economic nature, which are realized once or more times a month (M = 3.12; SD = 0.74) (Table 5). In their studies, Kioupi & Voulvoulis (2022) and Gokool-Ramdoo & Rumjaun (2017) point out that ESD goals are best achieved through an integrative and systematic approach. The prevalence of the integrative approach in ESD in the kindergarten environment is indicated by the results of various contemporary research (Višnjić Jevtić et al., 2022; Samuelsson & Kaga, 2008).

Intergenerational solidarity has a significant contribution to this factor, with the item "I organize some activities that encourage intergenerational solidarity" having the highest factor saturation values (λ=0.826) and Communalities (h^2=0.724) (Table 4). Poje et al. (2024), based on the concept of sustainability that focuses on meeting the needs of present generations without compromising the ability of future generations to meet their own needs, highlight the importance of intergenerational cooperation for the optimal achievement of goals. In his article, Wals (2017, 155) argues that children are more in tune with sustainability than most adults and that both adults and children can benefit

from intergenerational dialogue and expanded learning opportunities in so-called ecologies of learning. Sustainability is a matter of justice for children, and it is crucial to involve collaboration among different societal and generational actors with children (Englahl et al., 2022). Elliott et al. (2020) recommend that ECEfS (Early Childhood Education for Sustainability) should be at the center of dialogue between different generations, stakeholders, and groups in society. UNESCO (2023) promotes sustainable development projects based on intergenerational cooperation, encouraging the exchange of knowledge and experiences between generations, understanding, empathy, and solidarity. The education of preschool teachers and their emotional competencies are crucial for the successful implementation of these activities (Šindić et al., 2022; Lepičnik-Vodopivec & Šindić, 2023).

The findings indicate that in addition to cooperation with the elderly (grandparents, visits to homes for the elderly), preschool teachers include other members of society in their upbringing and educational activities, and thus the emphasis is placed on connecting the kindergarten and the community (through volunteer actions, promoting children's rights, selling handicrafts and fig.). Participatory approaches allow all parties to get involved and act (Bullock & Hitzhusen, 2015), and local activities can lead to regional and global actions, thus realizing the essential requirements of ESD (Kioupi & Voulvoulis, 2022).

Encouraging social sustainability (development of social skills and empathy) through everyday peer interactions

The second factor (F2) refers to social learning in the real context of a kindergarten group, through daily peer interactions that promote social sustainability through group cooperation, non-violent communication and tolerance, and mutual care of children. This narrower methodological approach includes recommended factors of social sustainability such as the development of empathy, tolerance and solidarity (UNESCO, 2017) and takes place within the educational group. It explains only 14.2% of the variance of ESD implementation in ECE (Table 4), which is less compared to the integrative and participatory approach and can be seen as its supplement. Varela-Losada et al. (2022) emphasize that education should maintain a macro view, but not neglect social micro-instances, whereby one approach does not exclude the other, but complements them.

Although the focus of ESD is placed on global issues and local priorities, it is recommended to take into account the context in which it takes place (UNICEF, 2012), be it cultural, political or social. In this case, it is the kindergarten context, where the peer group becomes a learning community through daily interactions and life situations that promote social sustainability (Johansson & Rosell, 2021). The preschool teacher's role in that process is to encourage and model adequate communication, cooperation, empathy, tolerance and understanding among children. The frequency of performing this approach is high ($M = 4.76$; $SD = .40$), indicating daily implementation (Table 5). The statistically significant t-ratio of the arithmetic means of factors F1 and F2 ($t = -23.977$; $p < .001$) indicates that F2 is implemented more intensively, although it

represents a narrower approach and a supplement to the integrative and participatory approach.

The findings related to the frequency of application of the F2 approach can be explained by the ecological theory of Bronfenbrenner (1979), which looks at child development in the context of the group, community, society and culture to which the child belongs. Although all ecosystems are important, the immediate environment of the child, the microsystem (family, kindergarten group) usually has the greatest influence on the child's development (Bronfenbrenner, 1979). The research results of El Zaatari & Maalouf (2022) indicate that the development of a sense of belonging to the school is encouraged by numerous interactions that represent the advantage of this school microsystem. The intensity of interactions, modelling of behaviour, support and experiences that the microsystem provides are crucial for the child's development (Šindić, 2021). That is why the peer group provides inexhaustible opportunities for gaining social experience and developing social competencies for children, including fostering friendships, skills of joining a group, accepting group members and paying attention to others, and developing prosocial dispositions (compassion, generosity and cooperation) (Katz & McClellan, 2005) which are at the basis and an integral part of the goals of ESD (UNESCO, 2017). This narrower approach (F2), reduced to a peer group microsystem, is an excellent complement to the integrative and participatory approach (F1) in ECEfS.

Improving/promoting sustainable behaviour through daily routines in kindergarten

The third factor (F3) indicates the possibility that the usual daily routines in kindergarten can serve to promote sustainability and grow into sustainable daily routines. The preschool teacher becomes a model of sustainable behaviour for saving water, electricity and money, not throwing away food, and properly sorting waste during his stay in the kindergarten. This factor (F3) explains 8.4% of the variance, that is, the approach to the implementation of ECEfS, and like the second factor (F2), it is a complement to the integrative and participatory approach to ECEfS. The frequency of performing this approach is high ($M = 4.73$; $SD = .51$) (Table 5), indicating daily implementation. A statistically significant t-ratio of the arithmetic means of factors F1 and F3 ($t = -20.943$; $p < .001$) (Table 5) indicates that F3 is implemented more intensively, although it represents a narrower approach and a supplement to the integrative and participatory approach (F1) in the context of ESD. Some authors like Hosany et al. (2022) emphasize the importance of developing sustainable behaviour in children, including environmentally friendly shopping, recycling and resource conservation. Ginsburg and Audley (2020) note that preschool teachers are important models of behaviour, where through their own actions they influence the adoption of sustainable practices among children. Šindić et al. (2021) indicate that the sustainable behaviour of preschool teachers has a significant role in shaping the attitudes and sustainable behaviour of children, and education is essential in forming predispositions for the sustainable behaviour of future preschool teachers, especially in non-cognitive aspects. The results of the study by Farewell et al. (2021) confirm that the professional development of preschool teachers leads to improvements related to eating behaviour

and physical activities as a way of encouraging sustainable environments in preschool institutions. Mahat et al. (2016) in their research clearly indicate the implementation of daily sustainable practices through the curriculum, where daily sustainable routines through daily practices that include waste sorting and proper resource management are essential. Other researchers testify to the importance of sustainable routines in the context of ESD (Poje et al., 2024; Ginsburg & Audley, 2020). The findings of this paper indicate differences in the level of representation of all three approaches in the implementation of ESD in kindergartens with an eco-program compared to those that do not implement that program, but that they are statistically significant only for the third factor ($t = 3.110$; $p < .01$) (Table 7). Preschool teachers in kindergartens with an eco-program promote sustainable behaviour every day through daily routines in the kindergarten ($M = 4.81$, $SD = .44$), while preschool teachers who are not involved in the program do so on average several times a week ($M = 4.48$, $SD = .62$). (Table 7). The reason for this can be the benefits of the eco-program, additional environmental education of the staff and more adequate kindergarten environment institutions included in the eco-kindergarten/eco-school program. On the other hand, findings that indicate insignificant differences regarding the implementation of an integrative approach by preschool teachers with and without eco-programs may indicate the assumption that eco-programs are more directed towards the development of sustainable behaviour based on ecological settings, and less towards complete ESD, even though ecological sustainability is an integral part of ESD. It would be good to examine this assumption in future research.

The results of research by Poje et al. (2024) confirm the benefit of the curriculum for sustainability, including the acquisition of sustainable habits in children through daily activities, sustainable routines such as proper nutrition, and waste recycling, but also through numerous other activities, and recommend that ESD be included as one of the basic principles in the national curriculum, so that kindergartens are equipped, and preschool teachers are additionally trained for ESD. Although the F3 approach is narrowly oriented to daily routines in the kindergarten context, they indicate that these can grow into sustainable routines, and should not be neglected during the implementation of ECEfS.

CONCLUSIONS

The study investigates the strategies of Slovenian preschool teachers for the integration of ECEfS. The results indicate different approaches and factors that influence the implementation of ESD in preschool institutions and emphasize the importance of preschool teacher competencies for the successful achievement of ESD goals. Research shows that the most effective approach to EDS in kindergartens is one that integrates different dimensions of sustainability through planned and comprehensive activities. Today, the holistic approach occupies a central place in the education of preschool children (Ari, 2023), and this integrative and participatory approach enables children to learn about sustainability holistically, encompassing environmental, social, cultural and economic aspects (UNESCO, 2017). It is supplemented by promoting social sustainability through daily peer interactions, and through the adoption of sustainable behaviour and the formation of sustainable habits through daily routines in

kindergarten. In other words, it is observed that the promotion of sustainability is not only planned in advance and carefully implemented but becomes a daily part of life in kindergarten groups. Observing from the perspective of the specificity of early childhood, separating the second and third factors, it could be recognized that in some segments the developmental tasks of a young child overlap with the tasks of ECEfS. Also, the existence of different approaches to the implementation of ECEfS insufficiently connected with the integrative and supporting approach could point to the possible difficulties of complete integration of the content and dimensions of ECEfS due to the complexity and multidimensionality of the concept of sustainability and the impossibility of its equal connection with developmental tasks and learning outcomes of preschool children.

It was observed that the additional education of preschool teachers, which represents an important instrument for the well-being of individuals and society as a whole Lemus et al. (2024), contributes to the competence for the formation of an environment that promotes sustainability in kindergarten.

The findings of the study emphasize the importance of intergenerational cooperation in the context of sustainable practices in Slovenian kindergartens. Also, the importance of the eco-program in the implementation of sustainable practices in the kindergarten environment can be observed.

The limitation of the study refers to the self-reporting of preschool teachers, so it is necessary to look at the issue, in subsequent research, from the point of view of other actors involved. In their research Engdahl (2015) and Engdahl and Furu (2022) emphasize the importance of taking a child-centred perspective in the context of ESD, and researching the children's perspective would shed additional light on the investigated phenomenon and provide quality insights. Also, focus groups with preschool teachers or observation of preschool teachers in the natural environment by pedagogues or other actors could deepen the obtained findings with additional data. Given that F2 and F3 are isolated factors with a small number of items, additional revisions could be considered in future research that would allow better insight into the causes of overlapping items that were eliminated, if similar items reappear.

An observed research question, which can open new directions of research and improvement of sustainable practices in all kindergartens in Slovenia, is why eco-kindergartens in Slovenia lead the way in the implementation of ESD approaches through daily routines, while this tendency has not been statistically proven for other approaches.

The findings of this study cannot be fully generalized to all preschool teachers and preschool institutions, given that the data were collected through self-reporting by Slovenian preschool teachers, but they can be significant for setting concrete guidelines for preschool teachers to improve ECEfS in Slovenia. Also, they provide insight into possible patterns and approaches that could be relevant to similar contexts, with the need for additional research that would include a wider population and perspectives of other actors. This would further contribute to the development of the theory of education for sustainable development and strengthen its application in practice.

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