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How do we teach safety and sustainability on the roads? Traffic education in 4th grade primary schools in Czechia through the eyes of teachers

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ABSTRACT: Transport education (TE) is an indispensable part of basic education. It aims to improve road safety and promote healthy lifestyles and environmental sustainability. Using an online questionnaire, we mapped what TE looks like in 4th grade primary schools in Czechia. We received 644 responses from primary school teachers. According to their reports, the practical part of TE is mainly implemented in traffic playgrounds (86%). Schools also implement TE through lectures/lectures with outsiders, e.g. police officers (38%) and organize TE project days (30%). The emphasis on safe behaviour of pupils in traffic is evident in the TE. We recommend more intensive integration of environmental and lifestyle topics and experiential learning, as well as further research on the effectiveness of TE to determine students' actual skills and knowledge.

KEY WORDS: Traffic education; Preventive programme; Traffic safety and children

1. INTRODUCTION

Transportation is an inseparable part of our lives. From childhood, we become participants in traffic – starting as pedestrians, then cyclists, and eventually drivers of motor vehicles. The functioning of transportation relies on adhering to rules and being considerate. It brings benefits, such as fulfilling transportation needs and providing recreational opportunities, but also has drawbacks, including noise, stress, and environmental damage (Stojan, 2011). Traffic participants face significant demands, which is why traffic education is essential.

Traffic education is a preventive program and a lifelong process that begins with a child's first steps (Stojan, 2011; Volný, 1983). Children aged 5–14 are among the most vulnerable road users, making traffic education a crucial part of primary education (Lavoie et al., 2014; WHO, 2015). This article focuses on traffic education among 4th-grade primary school pupils (International Standard Classification of Education – ISCED – 1) in Czechia. It explores how traffic education should ideally be conducted and how it is implemented in practice. The findings are based on responses from an online survey of primary school teachers in Czechia.

2. LITERATURE SURVEY

Traffic education is an important component of basic education, as early education influences the future social behavior of traffic participants, a need highlighted by Rothengatter (1981). First, TE aims to ensure higher safety for children by instilling 1) knowledge of traffic regulations, 2) proper habits and skills, and 3) the prevention of risky behavior (e.g., substance abuse while driving, aggression) (Fyhri et al., 2003; Hooshmand et al., 2014; Lachapelle et al., 2011; Olšan & Konečný, 2008; Riaz et al., 2019). Road safety is an international concern due to the economic and social consequences of accidents. Children aged 5–14 are particularly vulnerable, with road accidents ranking among the four leading causes of death in this age group globally (Lavoie et al., 2014; WHO, 2015).

Second, another goal of TE is to support environmental sustainability (Bakhtari Aghdam et al., 2020; DiMaggio et al., 2016). Traffic significantly impacts the environment through CO2 emissions, contributing to climate change. Transportation accounts for 23% of global greenhouse gas emissions (IPCC 2014; WHO, 2018), similarly in the U. S. (U.S. EPA, 2015). Other negative effects include land use for infrastructure, fatalities and injuries, public health issues (e.g., noise, reduced physical activity, stress), and economic costs of accidents and infrastructure (Conley, 2016; Kirschner, 2022; McCarthy et al., 2018). Psychological approaches are essential to influence car usage behavior (Abrahamse et al., 2009; WHO, 2018).

Reducing car dependency (a car-dependent society is a term used by Newman & Kenworthy as early as 1989), a key issue in today's society, is crucial for increasing mobility and reducing environmental impacts. Sustainable transportation includes active modes (walking, cycling) and passive modes (public transport) (EEA 2020). However, active mobility among children is declining in regions like Scandinavia and Great Britain (Fyhri et al., 2011). Similarly, Scheiner et al. (2019) highlighted, 32% of German children are driven to school, while 38% walk, and fewer than 12% cycle (n = 1064). In contrast, 42% of Brazilian adolescents (n = 921) commute actively to school (Nunes de Oliviera et al., 2020). Reducing car usage and promoting sustainable transport improves micromobility, quality of life, safety, and environmental conditions (Baehler & Rérat, 2020a). New transport modes like electric scooters and segways are also emerging, requiring proper education for safe use. Traffic education addresses sustainability and safety challenges simultaneously.

The third goal of TE is to promote healthy lifestyles among students (Bakhtari Aghdam et al., 2020), including the development of physical activity (Holčík, 2011). Regular physical activity reduces the likelihood of cardiovascular disease in children, whereas inactive children are significantly more at

risk of high blood pressure, obesity and cancer, and it becomes a global cause of death (Vaisto et al., 2019; Donaire-Gonzales et al. 2015). Active modes of transport improve children's cognitive ability, self-esteem, emotional well-being and reduce the risk of depression and anxiety (NHS, 2016). Active mobility (e.g. walking, cycling) promotes both sustainability and exercise, thus meeting the two aforementioned TE goals (Lau et al., 2017), and is a simple, regular and low-cost way of increasing physical activity (Public Health England, 2015). Studies show that cyclists aged 7-9 years get more exercise during the day and are more likely to then choose outdoor activities than those using passive transport, which was not influenced by gender or BMI (De Jesus et al, 2021). Parental attitudes also play a role in transport mode choice, with children perceived to be competent by their parents are more likely to transport themselves than those driven by car (Scheiner et al., 2019). A meta-analysis by Jones et al. (2019) showed that educational strategies increase physical activity, with the authors also recommending practical elements such as a "walking school bus." A Brazilian study reported that active mobility is positively correlated with improved physical fitness, feelings of safety, and peer presence (Nunes de Oliviera et al., 2020).

2.1 Traffic education as an effective prevention programme

Rothengatter (1981) stressed the importance of traffic education and its effectiveness. TE as a specific prevention programme should meet the following criteria: prevention is clearly defined in time and space, planned according to known needs, systematic, targeted and evaluated (Miovský et al, 2015). Evaluation is crucial to verify the accuracy of the goals and the functionality of the education, which helps to identify success factors (Bakhtari Aghdam et al., 2020; Ellis, 2014; Konsbul, 2011; Miovský et al., 2015). Catchpole & DiPietro (2003) summarized the principles of successful traffic education: 1) do not increase children's exposure to risky situations, 2) reduce the risk of injury by using safety features, 3) develop skills in safe, realistic places, 4) do not build children's overconfidence, 5) motivate children to behave safely, and 6) explain the meaningfulness of traffic rules and use personal experience.

The content of TE includes traffic rules, signs, mandatory bicycle equipment, use of protective equipment (helmet, seat belts), safe road crossing (Bakhtari Aghdam et al., 2020; Hooshmand et al., 2014) and training on anger suppression, aggressiveness and loss of self-control (Stojan, 2011; Volny, 1983). Traffic education also includes training on dealing with risky situations (Riaz et al., 2019) and prevention of substance abuse. It includes teaching first aid and environmental protection, promoting sustainable mobility (DiMaggio et al., 2016; Stojan, 2011). TE should also reflect children's fears. Children aged 6-12 who experience more fear when crossing the road act more safely in challenging traffic situations. On the other hand, such children behaved excessively cautious when crossing the road in non-challenging situations and paradoxically made more mistakes (Wang et al., 2021).

Methods to convey the aforementioned content are games, visualised stories, simulations and the use of toys (dolls and cars) (Zare et al., 2018). Riaz et al. (2019) highlight gamification and the use of videos and photographs of real places. Rothengatter (1981) and Bakhtari Aghdam et al. (2020) agree and add that the use of audio-visual methods, hands-on practice and imitation are the main methods of traffic education. The oral method has limited results and does not lead to behavioural change. Repeated demonstrations are a good way to instil traffic rules in children (Rothengatter, 1981). The authors disagree on the amount of time. The optimal duration of TE varies among authors, ranging from 8 weeks (Zare et al., 2018) to 5 weeks (Riaz et al., 2019) or just 1.5 hours (Morrongiello et al., 2018). Weekly intervals between sessions are ideal. TE should be part of health education and implemented across subjects to achieve long-term results (Catchpole & DiPietro, 2003).

The environment affects teaching effectiveness. Familiar classroom settings are suitable for memorizing rules but less effective for behavior changes, which are better supported by real-world practice (Rothengatter, 1981; Morrongiello et al., 2018; Zare et al., 2018). The best outcomes come from a combination of theory and practice, covering both rule learning and the development of desired behavior.

2.2 Research on traffic education programmes

Lachapelle et al. (2013) examined the effectiveness of two educational programs for children 8-12 years of age (n = 699). The first, a structured programme without practical training, was conducted in schools, the second with practical training in cycling in summer camps. Both programmes enhanced children's safe behaviour: 55% of children improved significantly in the posttest. There was no significant improvement for children who cycled with their parents (they already scored post-test than their peers in the pre-test) or experienced a fall from a bicycle.

Hooshmand et al. (2014) validated a program for cyclists (n = 193, ages 11-14). Improvements in knowledge ($p<0.01$) were evident in five schools, excluding the school with the lowest socioeconomic status. A safe street crossing program for seven-year-old boys in Iran was also effective. Groups with active learning, especially with parental participation, achieved significant improvement that persisted for six months (Zare et al., 2018).

A traffic prevention programme to promote safe street crossing among seven-year-old boys in Iran has proven effective. The study compared three groups: active teaching (n = 52), active teaching with parental participation (n = 51), and a control group without intervention (n = 46). Evaluation was conducted after teaching and at two and six months intervals. The authors assessed the responses of the children, their parents, and assessed the children's ability to cross the street in real-world settings and in the presence of distractions. There was no improvement in the control group, while there was significant improvement in the experimental groups in car following, attention to danger and crossing from a safe place. The effect lasted for six months, with a linear strengthening in the group with parents (car tracking: $p<0.001$; crossing: $p<0.0001$). The study confirmed the positive influence of parents in learning (Zare et al., 2018). Similarly, Morrongiello et al. (2018) investigated the effect of 1.5 hours of virtual reality training in children aged 7-10 years. Results showed improvements in the ability to safely cross the road and generalization of knowledge. Riaz et al. (2019) tested gamified e-learning in Belgium (n = 44, age 9-13 years). The program improved the ability to detect risks and deal with risky situations, although children were better at knowledge than practical skills.

2.3 Children in traffic in Czechia

As in other countries, Czech children in transport are a specific group requiring special attention and protection. Their ability to perceive and react to traffic situations is still developing, which makes them more vulnerable than adults. In 2019, there were 5 346 accidents involving a child on Czech roads. Sixteen children were killed (3% of the total number of fatalities) and 113 were seriously injured (5% of the total number of seriously injured). The figures are more favourable than in 2018 (-16% for fatalities, -25% for seriously injured), but the objectives of the National Road Safety Strategy 2011-2020 were not met (BESIP & CDV, 2019). The year 2020 produced

the lowest number of fatalities ever (8 killed, 102 seriously injured), but again did not meet the NSBSP assumptions (CDV, 2021). In 2023, there was a 42% decrease in child fatalities (Safe Transportation, 2024).

The Road Traffic Act 361/2000 defines children as road users. Each participant must act in a considerate and disciplined manner so as not to endanger the life, health or property of others or his/her own (Road Traffic Act No. 361/2000, § 4). A child on a bicycle is the driver of a non-motorised vehicle and must comply with traffic regulations. A child under 10 years of age may only ride on the road under the supervision of a person over 15 years of age, and may ride independently on a pavement, cycle path or pedestrian zone. The law obliges persons under 18 to wear a helmet, regardless of where they are moving (Road Traffic Act No 361/2000 Coll., Section 58).

Awareness of road safety began to build in Czechia in 1932. Traffic education was included in the school curriculum in 1935. In the 1960s, BESIP (Czech Road Safety Program) was founded, which sought to introduce a lifelong system of traffic education. The Young Cyclist Pass program is available for 4th grade pupils. In order to obtain the licence, pupils must complete 5 hours of theoretical training and 5 hours of practical training on the traffic playground. The programme ends with an exam that includes both knowledge and skills testing (centrum-semafor.cz). Since 2013, it has been part of compulsory education according to the Framework Education Plan (RVP ZV), which emphasises the importance of "pupils' own experience" (Ministry of Education, 2023, 45). BESIP, under the Ministry of Transport, provides transport safety education.

2.4 Research results of Czech School Inspectorate (CSI, 2016)

Evaluation of the quality of education in Czechia is the responsibility of the Czech School Inspectorate (CSI), which evaluated traffic education in 2016. Data were collected online from school principals registered in 2015. Traffic education was part of the curriculum in more than 97% of primary schools, of which 94% included it in subjects such as primary education, history or civics. Many schools organised traffic drills on playgrounds, talks or competitions. A separate subject of traffic education is rarely implemented.

Traffic education is part of the curriculum in 67 % of primary schools (ISCED 1). During teachers´ undergraduate studies (ISCED 6 - 7), 60% of teachers had traffic education, but 35% did not have it in their education. In the last two years, 58.8% of teachers had not received any training. Training was most often organised by BESIP. Worksheets, traffic signs, interactive programmes and videos are used in teaching. Teaching materials are provided online by 90.6% of schools and 62.3% of teachers create their own teaching aids. Half of the schools consider the tools to be sufficient, 6.7% consider them to be inadequate. In the area of TE, schools most often cooperate with the Police (70.9%) and BESIP (59.3%).

Practical training on traffic playgrounds is used by 79.1% of primary schools with first grade and 85% of fully organized primary schools. Schools also reported discussions with experts (80.4%) and teacher interpretation (78.8%) as the main TE methods. First aid training is part of TE in 78.6% of primary schools. 62.5% of schools participated in traffic competitions, with young cyclists' competitions being implemented in 54.7% of fully organised schools and 22% of schools with Level I. According to 96% of schools, pupils acquire the knowledge and skills needed for safety. Schools combine theoretical teaching with practical training and routinely work with external partners. Despite the lack of innovation in aids, traffic education fulfils its purpose in terms of knowledge and practical skills.

3. AIMS OF THE STUDY

As can be seen from the above, traffic education not only for children is an important part of not only Western societies, as it has the potential to promote both the safety and health of the population and to maintain/improve the environment. Society needs effective traffic education for children that achieves such goals. The effectiveness of traffic prevention programmes has been addressed, e.g., by Lachapelle et al. (2013); Morrongiello et al. (2018); Riaz et al. (2019); Zare et al. (2018). In Czechia , the results are mainly known from investigations by the Czech School Inspectorate (CSI, 2016). These and similar investigations are necessary because they provide a basic overview. However, given the speed of change in transport (e.g. the influx of electric scooters on the streets of many cities), we see the need for more up-to-date research in this area. This paper attempts to fill this research gap.

The aim of this article is to provide an up-to-date picture of traffic education for children in the 4th grade of primary schools in Czechia and a basic reflection on whether such traffic education can be effective. We define the research question as follows **What does traffic education in 4th grade primary schools in Czechia look like according to teachers?** In order to answer the research question and fulfil the research aim, the Results section attempts to describe the form of traffic education in the 4th grade of primary schools (9-10 year old children) in Czechia according to the teachers' testimonies. Furthermore, in the Discussion section it puts the current form of traffic education in the 4th grade of primary schools in Czechia in the context of the ideal form of effective TE for children.

4. METHODS AND PROCEDURE

Since the research gap and research problem have been described in Section *3 Aims of the Study*, this is not dealt with again in the Methodology section.

4.1 Research population, sample and sample selection

According to the Ministry of Education, Youth and Sports as of 23 August 2024, there were 4296 primary schools in Czechia, the largest number in the Central Bohemia Region (585) and the smallest number in the Karlovy Vary Region (110).

We combined probabilistic and non-probabilistic methods to select respondents. In the first stage, we approached all primary schools with first grade through the National Pedagogical Institute of the Czech Republic (NPI CR which is responsible for the development, support, and coordination of education in Czechia) and the regional BESIP (Czech Road Safety Program) coordinator, thus aiming for a total sample. All primary schools in Czechia were contacted by e-mail through these institutions and thus had the opportunity to participate in the questionnaire survey. It was also up to each school to decide freely whether to participate in the survey. This ensured the conditions for random selection. After several months, schools from underrepresented regions were approached by e-mail again in order to create a stratified sample and avoid sample distortion.

Due to the voluntary participation, we are talking about a rather self-selecting sample, which is a common non-probability method in psychological research and carries the risk of biasing the results.

We used sampling methods to ensure the representativeness of the sample, which consists of 644 responses (n = 644). The data were adjusted for 1 respondent who completed only 2 items from 8. The sample includes approximately 591 primary schools, though there are 644 responses. Some schools provided multiple responses The exact number of schools in the sample cannot be determined because 25 respondents

did not provide the name of the school, only the region or municipality. The sample also includes 6 special schools (e.g. speech therapy, hearing impaired) from different regions. These schools were retained as they make up only 1% of the sample and are based on the Framework Curriculum (RVP ZV). Traffic education is also part of special schools, but its form is adapted to the conditions and needs of the pupils.

There are 4296 primary schools in Czechia, and the research sample (n = 591schools) represents 13.8% of this population. Shen et al. (2011) point out that small samples can produce inconsistent results, while larger samples are more revealing of the variables of interest. Based on an analysis of samples from the Journal of Applied Psychology (1995-2008), where the average sample size was 173 respondents, we consider our sample (n = 644 responses from 591 schools) to be adequate.

Table 1 shows the frequencies and percentage distribution of respondents by region. We consider the sample to be homogeneous in terms of profession because it includes elementary school teachers (principals, traffic education teachers, first grade teachers, and guidance counselors). Shen et al. (2011) support homogeneous samples, but McNemar (1940) argues that complete homogeneity is unattainable in humans. However, occupational homogeneity is crucial for our research, while we do not consider other sociodemographic data (age, gender).

4.2 Data collection and its analysis

The method of data collection was an online questionnaire survey. We decided to analyse the current situation because we wanted to base our analysis on the answers of the teachers themselves who are actually in contact with traffic education. We refused to analyse the school curricula (SCP) of individual schools because, as is well known, the content of the documents and the practice may not be the same. The online questionnaire as a method of data generation was chosen for the possibility of a large reach of the questionnaire in a relatively short time and the convenience of the method for the contemporary respondent.

The questionnaire of its own creation has a mapping character and was created on the basis of content analysis of documents and expert experience of lecturers of the Semafor for Transport Centre in Olomouc. The items are shown in Table 2: Items of the questionnaire. It was pilot tested on 3 respondents and the final version was launched on the platform vyplnto.cz in spring 2023. The questionnaire includes closed questions where the respondent can choose multiple options. Similarly, there are open questions in the questionnaire that allow respondents to add to their previous choices. With regard to the ethical aspect of the research, the respondent did not have to answer all items as the questionnaire was not a forced-choice item. The questionnaire was not time-consuming to complete, with most respondents completing it within 5 minutes. Due to the busy and oversubscribed nature of the schools, we deliberately tried to keep the questionnaire short, while still yielding key information. Data collection took place from spring to fall 2023.

Data were collected on the platform vyplnto.cz, where the data are directly stored in a data matrix in Microsoft Excel. The data were manually cleaned in the same program. We respected the respondent's right not to answer all items, so the questionnaire was not set up with a forced response option. For this reason, we kept questionnaires that answered at least 2 items from 8 in the dataset. Since we worked with descriptive statistics tools, data analysis was also done in Microsoft Excel. For qualitative responses, manual coding was done using MS Excel filters. The coded qualitative responses were then counted in the previous categories or new categories were created. In order to fulfil the first research objective, i.e. to map the current state of TE in 4th grade primary schools in Czechia, we describe the form of TE primarily using frequencies and percentages.

4.3 Ethical principles

Respondents were shown a cover letter before completing the questionnaire. This made respondents aware of the purpose of the survey. They were informed that participation in the research was voluntary, anonymous and that the data collected was used only for the purpose of the aforementioned research design. Respondents were not deceived. Respondents were advised that due to data processing, it was not possible to withdraw from the research after 31 December 2023. Respondents were informed of the expected length of the questionnaire. Respondents did not have to answer all

Region	Number of schools in regions (n = 4296; According to the Ministry of Education)	Percentage of schools by region (100% = 4296; According to the Ministry of Education)	Absolute frequencies of responses by region	Absolute frequencies of responding schools by region	Percentage of responses by region (100% = 591)
Středočeský	585	13,6 %	137	123	20,8 %
Jihomoravský	495	11,5 %	83	72	12,2 %
Vysočina	274	6,4 %	49	43	7,3 %
Pardubický	254	5,9 %	45	44	7,4 %
Moravskoslezský	447	10,4 %	44	42	7,1 %
Královéhradecký	275	6,4 %	39	35	5,9 %
Ústecký	286	6,7 %	37	35	5,9 %
Hlavní město Praha	295	6,9 %	37	34	5,8 %
Olomoucký	307	7,1 %	33	31	5,2 %
Jihočeský	274	6,4 %	31	30	5,1 %
Zlínský	267	6,2 %	31	29	4,9 %
Liberecký	203	4,7 %	30	29	4,9 %
Plzeňský	225	5,2 %	24	21	3,6 %
Karlovarský	110	2,6 %	16	15	2,5 %
Did not specify the region	---	---	8	8	1,2 %

Table 1: Number of schools by regions and frequencies of responses by region

1.	**How do you implement traffic education in the 4th grade?** - Traffic education is conducted by external instructors at a traffic playground and concludes with the "Young Cyclist License" exam. - Children attend a discussion with a police officer at school. - We implement traffic education through project days. - We organize a cycling skills competition at school (e.g., slalom between cones; the slowest ride in the schoolyard). - Other: …… (please specify).	Multi-choice and open-ended response
2.	**If pupils do not attend the traffic playground, please describe how you implement traffic education.**	Open-ended response
3.	**Which topics are covered in traffic education in the 4th grade?** - Traffic signs - Traffic rules - Compulsory bike equipment - Important phone numbers - Accident behaviour (e.g. Calling for help) - Sustainable transport - Healthy lifestyle	Multi-choice
4.	**Has any teacher from your school attended a methodological seminar focused on traffic education?** - Yes - No - I do not know.	Only one option could be selected
5.	**In which subjects is traffic education implemented?** - list of subjects	Multi-choice
6.	**If you implement traffic education on your own (without the participation of an external instructor), what methods do you use?** - Verbal method (explanation/lecture) - Demonstrations (drawings, videos, photographs) - Discussion - Experience (simulation of traffic situations, practicing cycling skills, experiments with braking distance, etc.) - Other (please specify)	Multi-choice and open-ended response
7.	**Do you use methodological worksheets or textbooks for traffic education (e.g., from BESIP, Safe Roads, Marketa's Traffic Education)?** - Yes - No	Only one option could be selected
8.	**If you use methodological support, please specify which one.** Please write the name of your elementary school where you work. Please write the name of the town where is the elementary school where you work. Select the region in which the elementary school where you work is located.	open-ended response

Table 2: Items of the questionnaire

items in the questionnaire as the online questionnaire was not set up to be forced choice, just to comply with ethical guidelines. The contact details of the principal investigator were included in the cover letter.

5. RESULTS

In this part, we concentrate on the results of the survey to answer the research question: What does traffic education in 4th grade primary schools in Czechia look like according to teachers?

5.1 How is traffic education implemented?

Our survey shows that traffic education is often implemented in traffic playgrounds, with a total of 86% (533) of respondents saying that they go to traffic playgrounds with their pupils to learn traffic rules and safe behaviour. The percentage of responses by region ranged from 74% (South Bohemia) to 100% (Zlín). In second place, 38% (242) of the respondents used a discussion with the police and 30% (195) of our sample chose a project day as a way of teaching traffic education. Completing a bicycle skills competition emerged as the least chosen option, 19% (121) of all respondents. It should be noted that these results show the most common forms of traffic education instruction, but these forms can be combined as respondents could choose multiple options. However, we have not evaluated individual combinations as this is sufficient to get an idea of what traffic education looks like. Respondents were always allowed to add their own comments to the choices offered, and we present such a quote to complete the data: *"Pupils learn about the rules and traffic signs in the classroom during history lessons, we have them enshrined in the school curriculum. On the traffic playground we have on the school site, they learn how to ride their bikes in traffic, go on a bike trip and try their hand at riding skills in preparation for the young cyclists' traffic competition."* As a side note, only 10 respondents mentioned the option of teaching

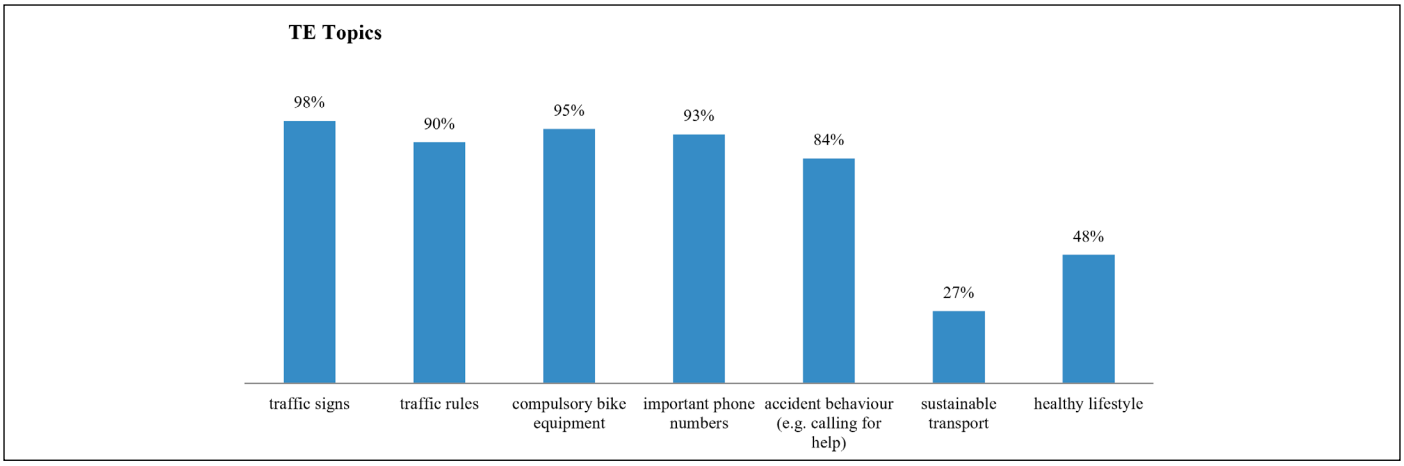

Figure 1: Representation of TE topics in the whole Czech Republic

traffic education in the form of a club or in the school's after-school club. The fact that traffic education is a cross-cutting topic and rarely is a whole subject or club devoted to traffic education is also evident from the other results. Respondents most often reported that traffic education is taught in physical education, science, health education and in grades 1-3 in primary school.

5.2 Traffic education topics

The most frequent topics covered during the TE are: traffic signs (98%, 633), traffic rules (90%, 581), compulsory bicycle equipment (95%, 611), important telephone numbers (93%, 596), how to behave in an accident. Figure 1 also shows that the topics most closely related to the TE are represented and the least space is devoted to healthy lifestyle and sustainability.

5.3 Teacher education in TE and TE teaching methods

A third of the teachers (36%; 233) reported that either themselves or a colleague had attended a methodological seminar on TE. A quarter (26%; 167) of the respondents had not received any training and 38% (243) of the respondents did not know if any of their colleagues had received training in traffic education. The majority of respondents (78%; 505) use some methodological support when teaching TE, most often materials from BESIP, Margaret's Traffic Education, Safe Roads and materials from the Police of Czechia. Figure 2 shows that the most frequent method used in teaching TE is the demonstration method and the least used is the experiential method (i.e. simulating traffic situations, practicing driving skills, experiments with braking).

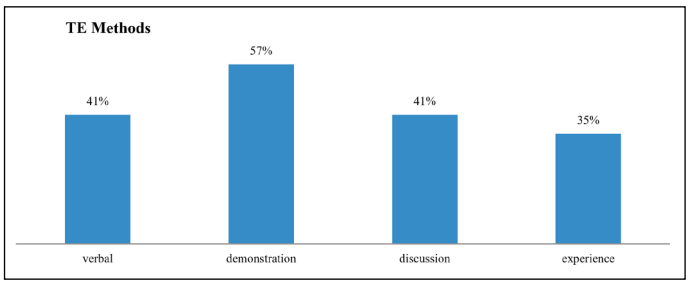

Figure 2: TE teaching methods - the whole Czech Republic

6. DISCUSSION

This article deals with traffic education (TE) for 4th grade pupils in primary schools in Czechia . It aims to describe the current form of TE in 4th grade primary schools in Czechia and to provide a basic reflection on whether such TE can be effective. In Section *2 Literature Survey*, we described effective TE. TE aims to 1) increase children's safety in traffic (Fyhri et al., 2003; Hooshmand et al., 2014; Lachapelle et al., 2011; Olšan & Konečný, 2008; Riaz et al., 2019), 2) promote environmental sustainability (Bakhtari Aghdam et al., 2020; DiMaggio et al, 2016), and 3) promote healthy lifestyles (Bakhtari Aghdam et al., 2020; Holčík, 2011; Lau et al., 2017; Public Health England, 2015). Effective IP that meets such goals is temporally and spatially bounded, planned, systematic, targeted and evaluated (Miovský et al., 2015). The content of TE includes safety topics (e.g., traffic rules and signs, mandatory bicycle equipment), hazard management, and emotional experience education (e.g., anger management training, fear work) (Bakhtari Aghdam et al, 2020; Hooshmand et al, 2014; Riaz et al, 2019; Stojan, 2011; Volný, 1983; Wang et al, 2021). Content is mediated interactively, with experience being the main focus: gamification, visualised stories, simulations, hands-on training (Rothengatter, 1981; Zare et al, 2018). TE should be incorporated comprehensively into health education, thus meeting the requirement for systematicity and long-term (Catchpole & DiPietro, 2003). TE is effective even when it takes place in a variety of settings, with the most effective setting for skill acquisition and behaviour change appearing to be one that is familiar and very close to the real-life transport environment (Riaz et al. 2019; Rothengatter, 1981; Zare et al., 2018).

How does traffic education in the 4th grade of primary schools in Czechia look according to teachers? The practical part of TE takes place mostly on traffic playgrounds (86%, 533), which is in line with CSI (2016). Stojan et al. (2008) pointed out the lack of methodological support for teachers at the second level of primary school. Our results are in line with the findings of CSI (2016): 1) methodological support for 4th grade students is (often freely) available to teachers and ¾ of respondents use some methodological support (mainly that from BESIP), 2) at least one third of the teachers surveyed have attended some kind of TE-oriented seminar, whereas one quarter of the respondents have not attended any training.

Respondents reported identical TE objectives as defined in the introduction. The greatest emphasis is placed on road rules, road signs, compulsory bicycle equipment and important telephone numbers to encourage safe behaviour in traffic. Sustainability in transport was the least represented of the topics offered (27%), although DiMaggio et al. (2016) define modern TE as teaching that also reflects the needs of environmental sustainability. TE should also lead pupils to practice crisis management (Riaz et al., 2019). Respondents

did not refer to practicing crisis management. This may have been due to the fact that this concept was not made explicit in the selection. However, educators were given the opportunity to complete their answer if the items offered did not suit them. Therefore, we conclude that training in crisis management will be under-represented in the TE for 4th grade students in Czechia.

Based on a comparison of information from the *2 Literature Survey* and our research, we consider the effectiveness of TE in Czechia. Teachers' statements indicate a fairly satisfactory state of TE in 4th grade primary schools. TE meets the criteria for an effective prevention program. In most cases, practical training takes place in an environment close to the real traffic environment (traffic playground). TE is a cross-curricular subject that is taught from 1st to 3rd grade in primary education and in 4th grade in physical education or health education. This fulfils the requirement for systematicity, focus, time and space. There is also a noticeable effort to evaluate TE: about one-fifth of respondents reported that their pupils participate in a cycling skills competition where transport knowledge and skills are tested. These aspects point to the effectiveness of TE for 4th grade Czech pupils. An unclear indicator of the effectiveness of TE in Czechia is the year-over-year decreases in accidents involving children (Safe Transport, 2024; CDV, 2021).

The limitations of our research are the online data collection, where it is not possible to ensure identical conditions for respondents. Another limitation may be that some of the schools included may already emphasize traffic education, which may not make them representative of all schools. Next, some schools may have received an incentive to complete the questionnaire more than once. We have commented extensively on this in Section *4.1 Research population, sample and sample selection* and do not anticipate significant bias in the results.

We consider the strengths of the research to be the effort to use probability sampling methods and the size of the sample (644 respondents from about 591 schools), which represents 15% of all primary schools in Czechia (4296). We also consider the sample to be representative in terms of the distribution of schools by region: the percentage of schools by region of Czechia in the sample corresponds to the percentage of schools in the regions (with the exception that 13% of all schools in Czechia are located in the Central Bohemian Region and the respondent schools in the Central Bohemian Region represent 20% of the research sample) (see Table 1). The contribution of the research is the mapping of TE in 4th grade primary schools from the perspective of teachers and thus creating a baseline for further research. Furthermore, the effectiveness of TE, i.e. what pupils actually take away from TE and what they remember, needs to be addressed (similarly Zare et al., 2018). A clearer indicator of the effectiveness of TE would be a research validation of the knowledge and skills of pupils of a selected age category across Czechia. A successful prevention programme is long-term and continuity is ensured (Miovský et al., 2015). Another topic for research is to investigate how TE is implemented in secondary schools in Czechia. Similarly, the success of TE in older pupils should be examined, e.g. by means of an experiment. Research could also provide concrete recommendations on how to do traffic education more effectively.

There are some implications for practice. To enhance the effectiveness of traffic education, it is essential to incorporate more interactive teaching methods that actively engage students. Schools can implement practical activities such as traffic playgrounds, real-life traffic simulations, and outdoor lessons where students can experience traffic situations firsthand. Another effective approach is gamification, which integrates game-like elements into learning. Mobile applications, interactive quizzes, and educational games can make traffic education more engaging and improve students' retention of key safety concepts. Virtual reality (VR) or video-based decision-making scenarios can provide a safe yet realistic environment where children learn to recognize and react to potential dangers on the road. These innovative methods would not only make traffic education more engaging but also better prepare students for real-world traffic challenges.

7. CONCLUSIONS

The article focuses on the transport education (TE) of pupils in the 4th grade of primary schools in Czechia and its effectiveness. Effective TE is the focus of 2 Literature Survey, while other sections describe the research and its results. A total of 644 respondents from approximately 591 schools were surveyed, representing 15% of all primary schools in Czechia. The results show that the practical part of TE takes place predominantly in traffic playgrounds (86%). Most emphasis is placed on safety - rules of the road, road signs, compulsory bicycle equipment and important telephone numbers. Methodological support is available to teachers, with ¾ of them using it, especially the BESIP materials. Approximately one third of the teachers have attended a seminar on TE, but a quarter have not had any training. Environmental sustainability topics were represented in only 27% of cases. Based on a comparison of the research findings and information from the literature, we conclude that TE is systematic, cross-cutting and involves practical training, which meets the criteria for an effective prevention programme. About one-fifth of the schools participate in bicycle skills competitions where transport knowledge and skills are tested, which can be seen as an evaluation effort. Experiential methods, considered key to effective teaching, are used by only 35% of respondents. The research shows that the main weaknesses are the low representation of sustainability topics and the limited use of experiential methods.

According our results, our recommendations for more effective TE are: 1) strengthening sustainability themes appears to be an area for improvement of TE in Czechia. It is important to mention that environmental education in Czechia is a separate preventive area anchored in the RVP ZV. The question remains to what extent environmental education is intertwined with transport education and to what extent together they can influence sustainable behaviour in transport. 2) Similarly, healthy lifestyle should be promoted more. Schools can engage in campaigns that encourage both the use of active modes of transport and exercise. Municipalities are recommended to organize long-term campaigns. 3) Another recommendation is to strengthen the effectiveness of TE by promoting methods that enable experiential learning. Based on our research results, this method is the least used (35%). According to the RVP ZV, experience should be the main method mediating transport education, with which e.g. Zare et al. (2018) agree. 4) As we have said, 5 hours are often devoted to practical training on the traffic playground in Czechia. Reinforcing practical training in the school surroundings could greatly increase the effectiveness of TE.

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