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Learning Outcomes: Safety Education for Comprehensive School Pupils

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Abstract

This paper investigates the learning outcomes of comprehensive school pupils in the context of safety based on a quantitative research design. We considered learning and safety competence here as a combination of knowledge, skills and attitudes. We collected the data using two questionnaires, TUKO I (n=375) and TUKO II (n=272). Teachers and the third sector (NGO´s, non-governmental organizations) external experts carried out safety lessons and drills in four comprehensive schools in between two data collection periods. The results of this study show that about one third of the pupils had the good to excellent level of safety knowledge. A novel finding of this study is that during the intervention, the primary school pupils developed their safety *attitude* whereas the secondary school pupils improved their safety *skills*. Based on this pilot study, we can conclude that experiential learning and safety drills in schools might have an effect especially on safety attitudes and skills. However, there is a need for more research to understand the relations of cause and effect.

Keywords: Learning outcome; safety education; safety competence; school safety.

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1. Introduction

This study investigates whether it is possible to gain better safety competences by providing safety related learning experiences for comprehensive school pupils. Teaching and learning safety belongs essentially to the Finnish school system. The Finnish National Agency for Education (FNAE, 2014) carried out a renewing process of the curriculum for basic education and introduced the new Core Curriculum in 2014. According to FNAE, *"a changing society demands more and more transversal skills and competences."* These skills and competences should be promoted in each school subject. One of the Transversal skills and competences in the core curriculum is entitled *"Taking care of oneself and managing daily life."* This should encourage pupils to develop better skills in their everyday life such as managing daily activities, avoiding dangerous situations, knowing the safety symbols and behaving well in traffic. Transversal competences are taught, studied and assessed as parts of the learning contents of the school subjects (FNAE, 2014). Furthermore, pupils´ right to safety, security and welfare is mandated and mentioned in the Basic Education Act (1998). The education provider must draw up a plan for safeguarding pupils against violence, bullying and harassment (Basic Education Act, 1998). However, based on the research we do not have a clear picture of the learning outcomes of safety. From earlier studies, we know that the safety culture in the school lies solely on principal's shoulders (Waitinen, 2011) and that it is fragmented amongst the variety of the school subjects, the learning environments and the situations (Somerkoski, Kärki, & Lindfors, 2019). On the other hand, research on school safety has primarily focused on the risks, failing to provide a holistic picture of the outcomes of learning (e.g. Lindfors 2018; Somerkoski, 2018; Teperi et al., 2018). There is a clear need to better understand how pupils´ safety competence is constructed.

It is vital to consider a definition for safety. The World Health Organization (1998) defines safety as a condition where factors that are a threat to a society are managed so the welfare and well-being of people are sustained. Yet, in English, the concept is divided into two; *safety* implies a human aspect, the freedom from incidents or injuries, whereas *security* implies being protected from dangers such as self harm, terror or violence (Somerkoski, 2015; Somerkoski & Lillsunde, 2014; Reason, 1997; WHO, 1998). Learning safety is a lifelong process. According to the latest studies, safety and well-being are important and stable values of the society (Helkama, 2015).

Also, the concept of resilience has to be noted in the context of safety. Resilience is a proactive ability to survive during the crisis situations as well as to recover and to cope with threats (Hollnagel, 2011). Being prepared for crisis in everyday life increases survival possibilities.

This study focuses on the safety and learning outcomes in the school context. Safety related learning experiences are useful during the school day and on the way to school but also in everyday

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life later as an adult, in occupational issues as well as in the emergencies. According to Meyer, Reniers and Cozzani (2019) learning of safety consists mainly of three aspects: to gain knowledge and information, to create awareness and the right attitude, and to develop skills and behaviour. In previous studies, a person's safety competence is seen as a combination of attitudes, knowledge, skills and a will to act actively in situations as needed (Somerkoski, Kärki, & Lindfors 2019). According to Puolitaival and Lindfors (2019), the safety competence is seen as an action competence within safety and security. Also, reactive safety actions in the situations that require resilience are considered to be a part of the safety competence.

2. Research questions and Methodology

Using a quantitative research design, we wanted to investigate the learning outcomes of comprehensive school pupils in the context of safety education before and after a safety related intervention. To address the research aim of this study, we raised two research questions as follows:

- What is the outcome of safety competence - attitudes, knowledge and skills - in comprehensive school, in primary as well as in secondary education before the safety intervention?
- Do comprehensive school pupils develop better safety attitudes, knowledge and skills after safety related intervention according to gender or according to primary and secondary education?

3. Safety intervention activities in this research

This study is a part of a larger research and development programme Turvallinen koulu (Safe School) that investigates the learning environments and developed measures for safety education carried out by external experts and teachers.

The concept of intervention is used when the researcher wants to have an overview of the impact (Higgins & Green, 2008; Takala & Kontu, 2010). Here the intervention consisted of safety education lessons that teachers and external experts provided for the comprehensive school pupils during the school day. Based on the contents of the new Core Curriculum (FNAE 2014; POP 2014, 100, 155, 283), the researchers picked up four safety themes: fire safety, water safety, traffic safety and the first aid. Based on the earlier studies, these themes are also important development areas concerning child safety competence (Espelage, Low, & Polanin, 2014; Jones, Pezzi, Rodriquez-Lainz, & Whittle, 2016; Lindfors, Somerkoski, Kärki, & Kokki, 2017). The researcher contacted the external experts and each of them organized special safety lessons as a part of the intervention for the students. This

included activities with special equipment and new learning environments. The lessons contained theoretical teaching, problem-based learning, study discussions and essays. The external experts also carried out hands on activities, for instance, initial extinguishing training at the fire service, water safety activities in the pool area as well as Cardiopulmonary resuscitation (CPR) training. All the experts had study materials tailored for comprehensive school aged pupils. Additionally, the teachers carried out specific safety teaching based on the four themes.

4. Description of the research design

The data for this study was collected using two questionnaires (TUKO I and TUKO II) concerning school safety. These questionnaires were based on the Safety and Traffic questionnaire (Somerkoski, 2012) for Finnish comprehensive school pupils and the European TACTICS questionnaire (European Child Safety Alliance, 2014).

In addition to demographic questions (age, grade, school and gender), theTUKO I questionnaire contained nine items concerning safety attitudes and nine items concerning school well-being measured with 5-point Likert scale (Lindfors, Somerkoski, Kärki, & Kokki, 2017). Safety knowledge was measured with 17 items and safety skills with nine items. These items used a dichotomous scale (yes/no). All the items contained the option "I don't know or I don't understand the question". There were also 13 items about pupils' experiences of teaching and acknowledging safety issues in school and in everyday life. The questionnaire dealt mainly with the themes of first aid, traffic and fire safety. The TUKO II questionnaire was broader than TUKO I containing 27 additional items. The purpose of adding these items was to explore the topics covered by the interventions carried out in each of the participating schools that were public schools as are most of the schools in Finland. Moreover, two skills-related items of the TUKO I were reformulated in the TUKO II questionnaire. The primary school covers grades 1–6 (ages 7–12) and the secondary grades 7–9 (ages 13–16). Pupils from grades 3–8 participated in the study.

The study was carried out in two phases. 375 pupils from four Finnish comprehensive schools answered the TUKO I in autumn 2016 and 272 pupils from the same schools answered TUKO II in spring 2017. Of the respondents of TUKO I, 165 (44%) were boys and 210 (56%) girls, 203 (54%) were primary school pupils and 171 (46%) secondary school pupils. The average age of the respondents was 12 years. Of the respondents of TUKO II, 106 (39%) were boys and 166 (61%) girls, 104 (38%) were primary school pupils and 155 (57%) secondary school pupils. In the latter questionnaire, the average age of the respondents was 13 years. One respondent of TUKO I and 13 respondents of TUKO II did not report their grade. The respondents of both questionnaires come from grades 3–8.

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An intervention activity was carried out by the teachers and by the third sector (NGO's) external experts in the schools during the academic year in between two data collection periods. As the questionnaire was anonymous, the pairwise comparison of the respondents' answers in TUKO I and TUKO II was not possible. Therefore, it was only possible to study the effectiveness of the intervention at a general level. We analysed the safety competence of the pupils with respect to their attitudes, knowledge and skills using IBM SPSS Statistics 25 software. The negatively worded items were reverse-coded, and the composite variables *SAFE_Att (attitudes), SAFE_Know (knowledge)*, and *SAFE_Skill (skills)* were formed for both questionnaires separately.

The variable *SAFE_Att* was calculated as the mean of nine safety attitude items ($\alpha = .66$). The option "I don´t know or I don´t understand the question" was interpreted as a missing value. The variable *SAFE_Know* was formed as a sum of 17 safety knowledge items where the respondent earned one point for each correct answer, one negative point for each wrong answer and zero points when choosing the option "I don´t know or I don´t understand the question". The variable *SAFE_skill* was calculated respectively using nine items about safety skills.

5. Results

In this analysis, we examined the respondents' safety competence - attitudes, knowledge and skills - before and after the intervention. In particular, the values of the respective composite variables *SAFE_Att*, *SAFE_Know* and *SAFE_Skill* in the questionnaires TUKO I and TUKO II are compared. The descriptive statistics of these variables are presented in Table 1.

Table 1. Descriptive statistics of the composite variables SAFE_Att, SAFE_Know and SAFE_Skill in questionnaires TUKO I and TUKO II

	SAFE_Att		**SAFE_Know**		**SAFE_Skill**	
Scale	1–5		-17–+17		-9–9	
Questionnaire	TUKO I	TUKO II	TUKO I	TUKO II	TUKO I	TUKO II
n	324	249	353	247	359	252
Min	2.67	2.44	-9	-4	-5	-3
Max	5	5	17	17	9	9
M (SD)	4.50 (.46)	4.52 (.46)	10.4 (3.38)	11 (3.57)	5.00 (2.49)	5.04 (2.31)
Mo	4.89	4.78	11	11	5	7
Mdn	4.56	4.67	11	11	5	5
Skewness (SE)	-1.309 (.135)	-1.44 (.154)	-1.613 (.130)	-1.501 (.155)	-.917 (.129)	-.756 (.153)
Kurtosis (SE)	1.811 (.270)	2.128 (.307)	6.005 (.259)	4.022 (.309)	1.166 (.257)	.758 (.306)

5.1. Safety Attitudes

In general, the respondents of both questionnaires had a positive safety attitude. According to the independent samples t-test, the mean difference in *SAFE_Att* between the questionnaires (see Table 1) was not statistically significant. In addition to the parametric test, the safety attitude was studied by categorizing the respondents into two groups. If the value of *SAFE_Att* was 3.5 or higher in the 5-point Likert scale, we interpreted that the respondent belonged to the group with the positive safety attitude. Otherwise, the safety attitude was considered non-positive. Based on chi-squared test, the group proportions did not differ significantly statistically between the questionnaires. About 95% of the respondents belonged to the group with the positive safety attitude in both questionnaires. The mean value of each separate item related to the *SAFE_Att* variable was greater than four (positive attitude). There were no statistically significant differences between the mean values of the attitude items of TUKO I and TUKO II except for the item *It is important to memorize the emergency number 112*. There was a positive change from the mean value M = 4.95 (SD = .27) of TUKO I to the value M = 4.99 (SD=.14) of TUKO II, t (576.9) = -2.30, p = .02.

We also examined the safety attitudes with respect to gender and school level. The mean values and standard deviations of the variable *SAFE_Att* for these groups are given in Table 2. Female pupils had a more positive safety attitude compared to male pupils both in TUKO I (t (240.39) = 5.50, p < .001) and in TUKO II (t (145.42) = 4.34, p < .001). No statistically significant changes in *SAFE_Att* were observed within the gender groups between the two questionnaires. The safety attitudes of primary school students improved statistically significantly during the intervention, t (250.50) = -2.65, p = .009. Primary school pupils also had a more positive safety attitude than the secondary school pupils both before (t (304.16) = 3.82, p < .001) and after (t (230.03) = 5.61, p < .001) the intervention. No statistically significant changes were observed within the group of secondary school pupils.

Table 2. Mean values and standard deviations of the variable *SAFE_Att* in TUKO I and TUKO II with respect to gender and school level

Questionnaire		**Gender**		**School level**	
		Female	Male	Primary school	Secondary school
TUKO I	n	180	144	167	157
	M (SD)	4.62 (.35)	4.34 (.53)	4.59 (.41)	4.40 (.49)
TUKO II	n	153	96	98	139
	M (SD)	4.62 (.36)	4.35 (.55)	4.71 (.30)	4.42 (.50)

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5.2. Safety Knowledge

Based on the criteria used by FNAE (Somerkoski, 2012), safety knowledge was considered good if the respondent obtained more than 70% of the maximum scores of the *SAFE_Know* variable (at least 12 points) and excellent if this value was more than 80% of the maximum (at least 14 points). The proportion of pupils with good but not excellent safety knowledge was 23% in TUKO I and 25 % in TUKO II. 13% of pupils posted **excellent** safety knowledge in TUKO I and 20% in TUKO II. The mean difference (0.6) in *Knowledge* variable between the questionnaires shown in Table 1 was statistically significant, t (598) = -2.10, p = .036. As in the case of attitudes, in addition to the parametric t-test, we also analysed the differences in the safety knowledge before and after the intervention using cross tabulation (see Table 3). Based on their scores of the variable *SAFE_Know*, we divided all the respondents (n = 600) into three groups as close to equal proportions as possible. The scores of *SAFE_Know* were at most 9 for the low performing group, in the interval 10–12 for the middle performing group and at least 13 for the high performing group. A statistically significant difference in the proportions of these groups was observed between the questionnaires, $\chi^2(2) = 6.11$, p = .047. The column proportion of the high performing group was statistically significantly greater after the intervention in TUKO II.

Table 3. The number of the respondents in groups with respect to their safety knowledge in TUKO I, in TUKO II and in total

Safety Knowledge	**TUKO I**	**TUKO II**	**Total**
Low performing group	119 (33.7 %)	66 (26.7 %)	185 (30.8 %)
Middle performing group	138 (39.1 %)	92 (37.2 %)	230 (38.3 %)
High performing group	96 (27.2 %)	89 (36.0 %)	185 (30.8 %)
Total	353 (100.0 %)	247 (100.0 %)	600 (100.0 %)

When considering separate items related to *SAFE_Know* variable, we observed statistically significant improvements in several items concerning fire safety. Recall that the scale for these knowledge items was -1 (incorrect answer), 0 (I don't know or I don't understand the question), and 1 (correct answer). There was also a small positive change in the scores of Item 27 concerning the emergency number. However, after the intervention the pupils were less confident what to do during a power outage (Item 31). The mean values and t-test results of these items are described in Table 4. In addition to the parametric t-test, we used cross tabulation between the answer categories (-1, 0, 1) and the two questionnaires in order to confirm the observed changes. The χ^2-test results are also given in Table 4. Note that the χ^2-test result was not statistically significant for item 27, but the proportions of the correct answers did differ significantly from each other at the .05 level.

Table 4. Differences between the results of the questionnaires with respect to the items concerning safety knowledge

Item (no.)		M (SD)	No. of answers			t-test	χ^2-test
			-1 p.	0 p.	1 p.		
There is a small fire on a garbage bin. You may extinguish it using sand. (46)	TUKO I	.26 (.76)	71 (19 %)	135 (36 %)	167 (45 %)	t(638) = -2.05	$\chi^2(2)$ = 6.88
	TUKO II	.38 (.76)	45 (17 %)	75 (28 %)	147 (55 %)	p =.041	p =.032
The most dangerous thing in a fire is the smoke. (53)	TUKO I	.29 (.81)	83 (22 %)	100 (27 %)	190 (51 %)	t(610.87) = -4.64	$\chi^2(2)$ = 25.14
	TUKO II	.57 (.72)	37 (14 %)	42 (16 %)	190 (71 %)	p < .001	p < .001
The firemen are responsible for the safety immediately if a fire breaks out at school. (54)	TUKO I	-.42 (.79)	227 (61 %)	78 (21 %)	69 (18 %)	t(541.87) = -3.16	$\chi^2(2)$ = 10.68
	TUKO II	-.21 (.87)	135 (50 %)	56 (21 %)	78 (29 %)	p = .002	p = .005
You may call the emergency number only if someone has been injured. (27)	TUKO I	.09 (.96)	156 (42 %)	28 (8 %)	189 (51 %)	t(595.29) = -2.30	$\chi^2(2)$ = 5.26
	TUKO II	.26 (.93)	90 (33 %)	21 (8 %)	161 (59 %)	p = .022	p = .072
I know what to do at home during a power outage. (31)	TUKO I	.60 (.72)	52 (14 %)	45 (12 %)	276 (74 %)	t(536.53) = 2.70	$\chi^2(2)$ = 9.01
	TUKO II	.43 (.80)	52 (20 %)	47 (18 %)	168 (63 %)	p = .007	p = .011

Concerning the variable *SAFE_Know*, statistically significant differences were observed neither between the school grades nor between TUKO I and TUKO II within primary school pupils and secondary school pupils respectively. Similarly, there were no significant differences in safety knowledge between genders. Moreover, neither female pupils nor male pupils did improve the scores of *SAFE_Know* statistically significantly during the intervention.

5.3. Safety Skills

Similarly to the case of safety knowledge, respondents' safety skills were considered to be good if the score of the *SAFE_skill* variable was at least 7 (more than 70% of the maximum) and excellent if the score was at least 8 (more than 80% of the maximum). In both questionnaires, the proportion of pupils with good but not excellent safety skills was around 20% and with excellent skills around 10%. The mean difference in *SAFE_Skill* variable between the questionnaires shown in Table 1 was not statistically significant. As in the case of safety knowledge, we also used cross tabulation. For

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this purpose, we divided all the respondents (n = 611) into three groups as close to equal proportions as possible. The scores of *SAFE_Skill* were at most 4 for the low performing group (n = 198), either 5 or 6 for the middle performing group (n = 226), and at least 7 for the high performing group (n = 187). Based on χ^2-test, there were no statistically significant differences in the proportions of these groups between TUKO I and TUKO II. When considering separate items related to safety skills, statistically significant differences between the questionnaires were observed using both t-test and χ^2-test only in two items. Recall that the scale for each item was -1 (negative answer), 0 (I don't know or I don't understand the question), and 1 (positive answer) as in the case of safety knowledge. For the item "I have taken part in an emergency fire extinguishing training", the observed improvement from M = -.20, SD = .95 in TUKO I to M = .17, SD = 96 in TUKO II was statistically significant, t (635) = - 4.84, $p < .001$. The positive change in this item was also clearly shown by cross tabulation, χ^2 (2) = 22.98, $p < .001$. Before the intervention, 37% of the respondents had taken part in an emergency fire extinguishing training, whereas after the intervention this proportion was 56%. Unfortunately, the use of bike helmet had decreased after the intervention. The mean of the item changed from M = .45, SD = .88 in TUKO I to M = .24, SD = .94 in TUKO II, t (554.62) = 2.92, p = .004. The cross tabulation confirmed this negative result, χ^2 (2) = 11.24, p = .004. The proportion of those pupils who usually wear a bike helmet decreased from 71% to 59%.

As in the case of safety attitudes and knowledge, we also examined safety skills with respect to gender and school level. The mean values and standard deviations of *SAFE_Skill* for these groups are given in Table 5. Female pupils had better safety skills compared to male pupils both in the questionnaire TUKO I (t (285.54) = 2.53, p = .012) and in TUKO II (t (250) = 2.62, p = .009). No statistically significant changes in skills were observed within the gender groups between the two questionnaires. However, primary school pupils had better safety skills than the secondary school pupils before the intervention, t (330.70) = 4.40, $p < .001$, but the safety skills of secondary school pupils improved statistically significantly during the intervention, t (308) = -2.00, p = .047. After the intervention, the difference in the measured safety skills between the school grades was not significant anymore, t (237) = 1.68, p = .094. No statistically significant changes were observed within the group of primary school pupils.

6. Conclusion

Pupils' safety competence - attitudes, knowledge and skills - improved after the safety intervention. The findings of the study revealed that in total about 95% of the pupils had a positive attitude toward safety both before and after the intervention. However, statistically significant gender

and school level differences were observed in the results. The female pupils demonstrated a better safety attitude than the male pupils while the primary school pupils showed a more positive attitude than the secondary school pupils. The finding of the gender difference is in line with the earlier study of Somerkoski (2012). Moreover, the safety attitudes of primary school students improved statistically significantly during the intervention.

About one third of the pupils demonstrated good to excellent level of safety knowledge. After the intervention, the figure was 45%. The positive development was statistically significant. The differences in safety knowledge between genders or school levels were not statistically significant.

Concerning the safety skills in general, about one third of the pupils had good to excellent skills both before and after the intervention. As in the case of attitudes, female and primary school pupils had better safety skills than male and secondary school pupils respectively. It has to be noted that some of the knowledge items did not correlate with each other as they concerned different aspects of safety, for instance, the first aid, traffic and fire safety. This was also the case for skills items. However, we interpret these variables as valid constructs describing respondents' levels of safety knowledge and skills in general

A novel finding of this study is that during the intervention, the primary school pupils developed a better safety *attitude* whereas the secondary school pupils improved their safety *skills*. Both of these results were statistically significant. We, as researchers, are well aware of the difficulties of proving causality as the interventions take place in a dynamic context and as it is not evident that the intervention has caused the changes (OECD, 2014). As these are pilot findings, the results demand further investigation. Nevertheless, this result may aid safety educators in creating new and innovative ways to teach safety to the pupils in primary and secondary schools. It has to be noted that it is difficult to gain safety competences only in theory. These skills need to be practiced and experienced in experiential learning contexts. Experiential learning and safety drills in schools provided by external experts can be considered to have positive effects especially on the safety attitudes and safety skills. Therefore, there is a need for more research to understand the relationship of cause and effect in this area.

In addition, we raise some concerns regarding the minority of the pupils, about 5%, who showed a non-positive safety attitude. This issue should be researched more intensively to profile these pupils and to find appropriate learning environments and methods for them.

Moreover, the questionnaire developed in this pilot study could be used in future studies. That would allow international studies to compare safety competence in various countries in order to develop safety education in comprehensive schools. External experts, e.g. rescue services might benefit from the results of this study as well while delivering safety education in schools. Integrating

external experts working together with teachers and pupils fulfills the new requirements of the National Basic Education Curriculum (2014) in Finland.

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