Incident data in enhancing school safety: An example from Finland

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Abstract. Safety and security is a multi-faced phenomenon that is an essential part of students' and staff's well-being at school, which is well documented as the main issue in a good learning environment. However, very little is known about incidents that happen at schools, but a catalogue of these incidents could serve as a learning tool for proactive management of the safety culture. Incidents occur in relation to physical, social, psychological and pedagogical factors. To develop a safety culture, there is need to record, monitor and analyse incidents (near-misses, accidents and injuries). There are no systematic procedures in regular use that would allow schools as organizations to learn from incidents and implement alterations to develop their safety culture. In the study of 168 incidents from three comprehensive schools in Finland, data were collected and monitored in a digital system. The incidents were categorized into physical, social, psychological and pedagogical categories. This paper gives prior knowledge of incidents in pedagogical category regarding what happened, where and to whom.

Keywords: Incident analysis; near-miss case; injury; accident; safety management; school safety; proactive learning; safety culture; learning environment

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1 Introduction

Safety and security is a multi-faced phenomenon that plays a key role in students' and staff's well-being at school, but changes in society are challenging the safety and security of schools. The challenges are safety incidents, accidents like school fires, bullying, violence, various kinds of near-miss cases, unintentional injuries, and even intentional injuries caused by school shootings. Safety is the most important factor when considering criteria for a good learning environment (Piispanen, 2008). Principals and teachers are ultimately responsible for student safety (Somerkoski, 2017a). Safety is a culture of inspection and maintenance of facilities and monitoring everyday incidents. School safety includes a comprehensive crisis preparedness, response and recovery plans (Jones, Fisher, Greene, Hertz and Pritzl, 2007). School safety is a question of what schools know about their safety, how they recognise safety incidents, and how they understand their holistic safety culture to develop it proactively. Global and societal development refers strongly to the increase of safety and security issues also in schools in future, which is one reason safety and security issues have to be considered in a framework of safety culture in schools.

We cannot say that schools as learning and working environments wouldn't be safe and secure for staff and students on the most basic level (Jukarainen, Syrjäläinen and Värri, 2012; Syrjäläinen, Jukarainen, Kiilakoski and Yrjänäinen, 2015). According to Varjas, Henrich and Meyers (2009), the procedures that schools use to enhance safety and the commitment of staff seems to have an effect on how safe students perceive their schools. To be able to create a safe learning environment for students and working environment for staff, schools should promote a positive atmosphere and interaction between staff and students and also implement procedures that enhance safe practices (Jones et al., 2007) However, the current understanding of safety culture in schools varies. For example, teachers may experience the safety of their school as fairly good, while the safety culture is shown to be fragmented and unequal, without any comprehensive safety management model or tools in use to improve safety systemically and proactively (Teperi, Lindfors, Kurki, Somerkoski,

Ratilainen, Tiikkaja, Uusitalo, Lantto and Pajala, 2018; Somerkoski, Waitinen and Lindfors, 2018; Waitinen, 2011).

Safety culture in a learning environment can be considered in physical, social, psychological and pedagogical dimensions. The physical dimension includes the spaces and facilities with tools, materials, machines and equipment and their condition. The social dimension refers to socially acknowledged values, attitudes and behaviour and the interaction and action based on them. The psychological dimension includes students' and staffs' personal values, attitudes, personalities, motivations, knowledge and skills as well as experiences that are the basis for individual actions. The pedagogical dimension concerns the organization of teaching, content and learning opportunities, participation, affection, rules, justice, responsibilities and peer support (Lindfors, 2012; Lindfors and Somerkoski 2018).

The aim of this study was to collect data on school safety incidents in order to generate a better understanding of everyday risks and to provide leverage for risk management as a part of developing a safety culture. The paper presents a model for considering school safety, the EduSafe-model (Teperi et. al., 2018), and gives an example of how to collect incident data as a part of monitoring safety and security of schools. The paper focuses on incidents that happened in pedagogical learning environments, especially during lessons; teachers were either preparing lessons or teaching, and students were joining in these activities. Finally, incident monitoring will be discussed as a part of safety culture promotion in schools on the basis of the EduSafe-model. Incident monitoring in the Finnish primary and secondary education context provides a practical example the incidents that happen during lessons.

2 Incident data in the focus of school safety culture

2.1 Safety culture of a learning environment

The basic idea is that schools as learning environments should be safe and secure. A learning environment is a place, space, community and/or culture for learning that includes tools, materials, equipment and services, for example, school buildings, classrooms, schoolyards, sports fields,

school trips and visits (Lindfors and Somerkoski, 2018). Some subjects in primary and secondary education, like sports, home economics, crafts, design and technology education and physics and chemistry are all considered safety-critical ones (Lindfors and Somerkoski, 2016) since in these subjects students exercise and work in an experiential way in varying learning environments.

Safety and security in an organization is a culture of committing to understand them as a part of everyday practice and a will to work and act safely to enhance preventive actions in interaction with all members of the organization. This all has to be based on recognizing the current situation: what are hazards and risks of activities? (see Arezes and Miguel, 2003; Geller, 2011; Guldenmund, 2000; Lindfors and Somerkoski, 2018; Reiman, Pietikäinen andOedewald, 2008.)

In learning environments, there are hazards and risks that require proactive procedures and preventive measures. These are, for example, risks of unintentional injuries, broken facilities, use of drugs, hazardous behaviour of students, bullying, vandalism and littering (see Lindfors and Teperi, 2018; Näsi, Virtanen and Tanskanen, 2016). Somerkoski (2017b) points out that some risks at schools are unpredictable, connected to human factors and caused by students acting against norms and regulations or using structures or products in a way they are not intended to be used. This refers to social and psychological safety culture points of view and concerns of schools. The space and equipment can be safe from a physical point of view, but without comprehension of proactive actions in lessons, it can be an unsafe and hazardous learning environment (Lindfors and Somerkoski, 2016).

The definition of school safety culture recognizes the diversity of actors. A school is an organization that includes staff, students and service companies. Members vary from very young learners who are trying to figure out the world to mature education experts who should know and notice safety and security issues of schools. On this basis, the safety culture is seen as collaborative actions of staff and students as well as implementation of procedures that develop and promote safe and secure learning and working environment (see Lindfors and Somerkoski, 2016; 2018). The definition means that all members of a school, as an organisation, must understand the importance of their active roles in promoting safety based on their responsibilities.

2.2 Incident management as a dimension of safety culture

The EduSafe research and development project, safety promotion in education 2016-2018, was carried out by the Finnish Institute of Occupational Health and the Department of Teacher Education, University of Turku, and gathered data in schools with an initial and a final survey during the implementation of interventions like the Change Workshop (developing proactive practices), Green Cross and Stop Violence (situation management), and Mental First Aid (peer-based support after incidents) interventions (Teperi et. al., 2018). A comprehensive model of enhancing school safety was developed based on intervention data and the theoretical models of management of safety culture (see e.g., Hollnagel, 2012; Teperi, 2012). The EduSafe-model (Teperi et. al., 2018, p.85) considers school safety and safety culture management from three dimensions (Figure 1). In the circle model, the first dimension is preparedness and prevention.

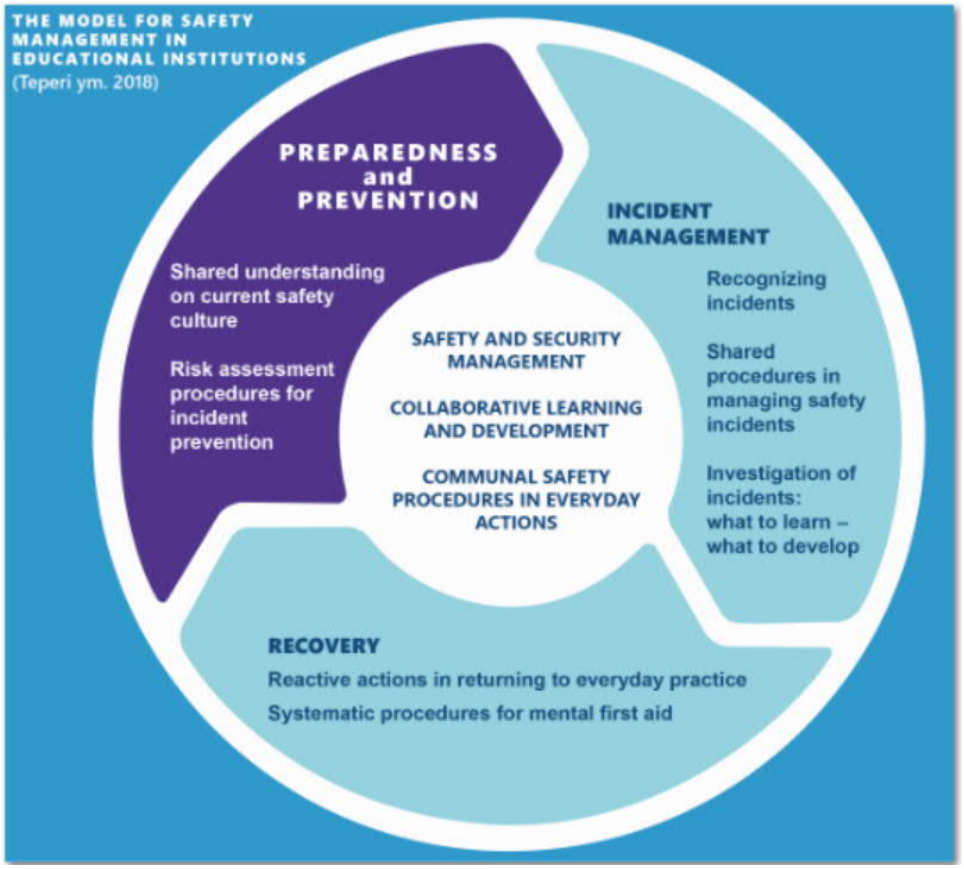

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Figure 1. The EduSafe-model (Teperi et. al. 2018, 85). The model was translated by the author.

The staff should have a shared understanding of how teaching and school work is continually changing and be aware of the developing procedures when incidents happen at school. The management of incidents as a second dimension requires understanding and recognition of what the safety incidents are and how they should be recorded, reported and monitored to be able to prevent further incidents and learn the lessons that need to be learned. The third dimension is recovery in which the support and methods are needed to return to normal as quickly as possible after an incident. The ultimate precondition for implementing the dimensions as everyday practice to enhance safety culture is the management of safety and a shared learning, development work and practices in the school organization.

The recognition, recording and monitoring of safety incidents is a precondition in prevention and preparedness as well as in learning and developing incident management. However, there are hardly any systematic procedures in regular use to collect incident data. Besides injuries that are usually reported to the insurance companies, there are no systematic procedures to report any other safety incidents. Principals can tell that their school is safe without any incidents. Based on earlier research (e.g., Geller, 2011; Reason, 2000), we know that it is more a question of not knowing what kind of incidents happen than recognizing dimensions of safety culture and preventing incidents proactively based on evidence. If there are no incidents reported, it usually indicates that incidents are not recognized at all. On this basis, there is no relevant risk assessment, monitoring or analysis that would serve as a basis to learn prevention of incidents and preparedness and proactive actions to develop safety culture (Lindfors, 2018).

Based on the safety paradigm that calls for human factors behind the incidents and emphasizes resilience (Hollnagel, 2012; Norros, 2004), it can be understood that near-miss cases and accidents are in relation to several physical, social, psychological and pedagogical factors (Lindfors and Teperi, 2018). This safety paradigm requires recording, monitoring and reporting the incidents including near-miss cases systematically, learning from them and making changes based on evidence. To be able to identify and understand the risks, factors and reasons behind incidents and

accidents, there is a need to analyse these on a level that is meaningful for schools, staff and students (Kjellen and Albrechtsen, 2017). The first step is to gain knowledge of what happens, where and to whom to be able to develop and use methods that can provide more detailed reasons behind incidents in the future.

2.3 Safety in the Finnish school context

According to the Finnish Basic Education Act (628/1998), safety is a norm that schools guarantee for students. Safety at work is also the norm for teachers according to Occupational Safety and Health Act (738/2002). The latest National Core Curriculum for Basic Education 2014 (grades 1–9, students from 7 to 16 years old) in Finland points out safety procedures for learning environments. From previous research, we know that most of the injuries happen during sports activities and when students are on breaks from classes (Luopa, Kivimäki, Matikka, Vilkki, Jokela, Laukkarinen and Paananen, 2014). Since the data was gathered at schools by a questionnaire survey, the original incidents were not reported precisely to be monitored and analysed. The only mandatory procedure for schools is documenting injuries that need medical treatment to get the insurance to cover for the costs. These injuries are registered on the national level, thus minor injuries and near-misses are not documented or monitored systemically either in schools or nationally.

3 Materials and methods

3.1 Data and Study Context

This paper presents a study of in-school incidents—near-miss cases, accidents and injuries—in three basic education schools with elementary (grades 1–6, pupils age 7–12) and lower secondary (grades 7–9, pupils age 13–16) education. Altogether, 168 incidents were reported by teachers and principals. The sample was purposive since the schools were not selected randomly. All the schools were comprehensive education public schools (there are very few private schools in Finland). In two schools, there was also a pre-school (6-year-old children). School I had 110 staff members and 940 students; School II had 40 staff and 370 students; and School III had 140 staff and 1050 students. Two of the schools represent multicultural city schools, and one is a town school with mainly Finnish students. The schools were university schools that organise training for

student teachers and for this reason, the staff in each school was familiar with research and development projects. The motivation for the schools to participate in the study arose from a need to notify the current situation of incidents in schools to improve safety culture based on evidence.

A school safety tool, Green Cross (Cloubi, 2018), was used in reporting the incidents. It is a digital web-based application to be used in quick incident documentation to make it easy for school staff, teachers and principals to report incidents as a part of everyday practice. It is not an application that teachers and principals would have used normally as a daily practice. The application was offered to schools as a part of the Safe School and EduSafe research and development projects (OPTUKE, 2018).

On a school level, it was possible to see all the reported incidents in a monthly view (Figure 2).

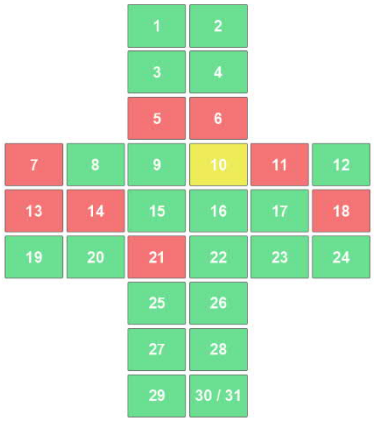

Figure 2. A monthly view of the reported incidents on a school level – Green Cross: School II, October 2016. A green day is a day without reported incidents, yellow colour is a near-miss case day and a red one informs of injuries or accidents.

To be able to report incidents, the staff members of the schools had to log in to the system with a password. While reporting, a short 2- to 3-minute description of an accident, injury or a near-miss case was written into the system. The researchers of the projects encouraged school staff to first understand and notify what an incident is and second, to recognise that even a near-miss case is worthy of a report. A school safety team or staff responsible for safety had an opportunity to analyse the reports and implement actions and alterations needed in order to reduce future incidents at their school. Almost all the reports were written in Finnish.

3.2 The analysis

The reports were analysed using qualitative thematic content analysis. The incidents were gathered into a table and coded as a near-miss case, an accident or an injury. For example, the incident tagged to the code II/32-NM tells that the incident is report 32 from School II and a near-miss case (Table 1). From all the reported incidents (N=168), 20% were near-misses (n=33), and 80% were accidents and injuries (n=135). The seriousness of the injuries varied from light scratches, and/or bruises (minor injury=MI) to accidents in which students or teachers needed an ambulance and doctor and hospital visits (serious injury= SI).

After several readings, the incidents were organized according to themes. Thematic content analysis was used to be able to make replicable and valid inferences by coding and interpreting the incidents systemically (see Krippendorff, 2013). The sub-categories were formed under the themes through careful consideration. During this process some incidents were reconsidered and moved to a better fitting category. After all were finalized, the categories were formed and named (Table 1).

Based on the analysis, four main categories were formulated. These were 1) risks and incidents in physical learning environments (28% of all incidents), 2) risks and incidents in social learning environments (36%), 3) risks and incidents in psychological learning environments (16%) and 4) risks and incidents in pedagogical learning environments, especially related to lessons (20%). The main category, risks and incidents in pedagogical learning environments, included the incidents directly related to lessons; teachers were either preparing lessons or teaching, and students were participating.

4 Results

The main category, risks and incidents in pedagogical learning environments, was made up of three sub-categories: injuries to teachers while teaching and preparing, injuries to students during lessons, and 3) risk management in teaching (Table 1).

3.1 Injuries to teachers while teaching and preparing

Analysis revealed incidents that were reported from teachers' part in relation to their own work, either preparing lessons or teaching (Table 1). Although there was variation, the most typical incidents in this category happened as teachers were preparing their lessons and were due to take materials needed using ladders or somehow climbing to reach out to material boxes. In these incidents teachers either fell down or were hit by falling boxes or other kinds of falling materials. Also, falls were reported when teachers were carrying teaching materials or equipment in their arms in a way that they could not see their legs. In one report, the teacher said, 'I had a pile of iPads in my arms on my way to next lesson and could not see my legs properly. That's why I fell down and my ankle was hurt' (III8-MI, Table 1). These incidents caused minor injuries.

The other sub-category was about injuries to sports teachers during lessons. One report said, 'A teacher fell down while skating during a sports lesson. The arm was hurt' (I/49-MI). The incident of a teacher falling and being hurt represents a typical description of an incident in the category.

Table 1 Examples of risks and incidents in pedagogical learning environments in lessons in primary and lower secondary education in comprehensive schools

3.2 Injuries, accidents and near-misses to pupils during lessons

The category injuries, accidents and near-misses to pupils during lessons was formed of four sub-categories: injuries in craft, design and technology education lessons, injuries in home economics lessons and injuries to pupils during sports lessons. The fourth sub-category was incidents and injuries caused by things falling from shelfs that was not subject teaching specific.

The reported incidents in craft, design and technology were moderate injuries that only needed a visit to the health centre. These incidents were kind of slips and slaps in using hand tools: 'A pupil sawed with a metal saw in a CDT lesson. He wounded his hand. There was a need for first aid at the school and doctoral aid at health centre' (I/67-MOI).

In home economics, a small fire in the oven was reported as the baking paper caught fire. This was a near-miss case and did not cause any injury. However, the near-miss case is one example of the fire risks that can occur in schools.

Incidents relating to pupils during sports lessons were the largest sub-category. The incidents were unintentional and happened while doing various exercises. The incidents were near-misses or minor and moderate injuries. An example of a moderate injury is the following: 'In the Finnish baseball, Pupil A caught a ball in his hands while Pupil B was trying to hit it. He hit the wrist of Pupil A. The wrist was fractured' (I/25-MOI).

3.3 Risk management in teaching

The third category in the analysis of incidents in pedagogical learning environment was risk management in teaching (Table 1). These reports to the Green Cross system were near-misses. The teachers reported incidents that they recognised as risks to pupils and teachers. The incidents were related to preparedness, for example, for first aid outside the school building. Also the large number of students in certain learning environments was seen as a risk and as a prevention of accidents and injuries.

5 Discussion and conclusions

The holistic safety culture of schools is a combination of prevention and preparedness, incident management and recovery using various procedures and sharing a comprehensive understanding how safety culture is managed and implemented in schools (Teperi et. al., 2018). The data for this pilot study was gathered from the three different schools during EduSafe and Safe School projects in 2016–2017 indicates that a holistic safety culture does not exist in schools yet. In the following critical observations considering the experiences in data collection (three observations) and to how to implement the results in schools (three observations) are presented.

The first observation is that teachers should be encouraged by principals and school management to promote school safety culture by committing to recognizing and reporting incidents (see Teperi et. al., 2018). The researchers cannot determine what incidents will be reported and what won't. According to the earlier research, all teachers are not committed to

safety promotion as a part of their work (Waitinen, 2011). The execution of this pilot study showed that the incident collection was totally new for schools and for teachers. This was recognized at the beginning of the study since very few incidents were on record. The schools had no previous system to collect incidents, not even for the injuries that had been documented for insurance companies. The concept of an incident was understood first as an injury, not as a near-miss case or an accident. The researches discussed the concept and content more deeply with the staff members and many more incidents were reported into the Green Cross system. The individual teachers might have considered differently what was worth reporting and what was not. Some teachers reported several incidents while others never logged in the Green Cross system after practicing how to make a short 2- to 3-minute reports.

In the future, the following questions should be investigated: How do teachers understand incident management? On what basis do they report incidents? How do they change their behaviour and work on the basis of incident monitoring and analysis? It is impossible to learn from near-misses, injuries and accidents if they are never reported. Thus, the numerus incidents (168) from three schools within the year and a half is low (290 staff members and 2,360 students in the schools).

The second observation compared to the school safety culture definition (Lindfors and Somerkoski, 2016; 2018) states that students have to take an active part in incident reporting in future research designs, and reporting needs to be an everyday practice of schools and parents if possible. In this pilot study reporting by using Green Cross was not possible for students.

The third observation is that there is an absolute need for a simpler digital and mobile application in incident collection and monitoring. This leads to the discussion of usability of an application schools collect incident data. To report to the Green Cross system, one needs to log in with a username and a password, which was separate from the system teachers usually use (Somerkoski, 2017b). This was too complicated. Also, the data protection and anonymity came into the discussion. The application should be mobile and easily usable without any extra log in.

The fourth observation is that the incidents to students happened mainly in safety critical subjects (see Lindfors and Somerkoski, 2016), like sports, home economics and craft, design and technology education (Table 1).

There is no previous research on incidents according to safety critical subjects. The number of incidents was the largest in sports, which is consistent with earlier research (Luopa et. al., 2014). The new information was that in craft, design and technology education, incidents reported were moderate injuries, not near-misses or minor injuries. It might be that minor injuries went unreported since these might be quite common while working with hand-tools and machines in workshops. A future study could monitor more closely near-misses and also take into consideration whether certain students or groups of students were subjects of incidents (e.g., risk behaviour) more or less often than others. One explanation on incidents might be students' behaviour to act against norms and regulations or use structures or products in a way they are not supposed to be used (see Somerkoski, 2017b). In developing safety culture, teachers and students could collect incidents as a campaign in safety critical subjects to minimise risks together. Yet there is no research on how teachers use or could use incidents as topics of safety education and examples of recovery in developing safety culture in the way that is stated in Figure 1.

The fifth observation is that in the data, incidents for sports teachers formed a separate category of injuries to sports teachers during lessons as the other teachers fitted in the category of injuries to teachers in preparing lessons. On this basis, teachers should be advised that there seems to be some kind of probability for incidents depending on their subject and that the solutions to avoid them could be very simple, for example, to have baskets for equipment needed in lessons to avoid fallings when carrying the equipment into classrooms (Table 1).

The sixth observation is that at least some teachers consider school safety from the preparedness and prevention point of view (Figure 1) since they notice and report near-miss cases. The category of risk management in teaching is very interesting from safety culture development and the risk assessment point of view. The near-misses give teachers concrete examples of how reporting, monitoring and practical actions could prevent incidents or enable reactive actions when needed. For example, breaks during the school day could be re-scheduled to avoid having too many students in one place at a time.

In conclusion, based on the analysis, we know more about incidents in schools than before. The incidents from the pedagogical learning environment point of view with teachers and students were partly different and partly the same, for example, things falling from shelves in

classrooms (Table 1). The categorisation might work as a basis for future research. Schools could report incidents that happen to students and staff. The study result could be a topic of staff meetings when considering well-being at school and discussing developing of safety culture and managing incidents. In this, the most important question would be: What happens to incident reports and how the effort of reporting will be rewarded? This is the basic idea of incident recording and reporting. How the information will be handled and the incidents monitored. In this pilot study, the researchers gave information about incidents for schools. Even the safety team of the school could see all incidents of their schools the incidents were treated as separate cases and no school level 'big picture' was created. The next challenge with incident reporting is how to engage the schools' safety teams to a deeper level of monitoring, analysis and actions on the basis of reports to diminish and cut risks at schools and in this way to develop the safety culture.

According to earlier research (Geller, 2011; Teperi et. al., 2018; Lindfors and Somerkoski, 2018), recording, reporting and monitoring safety incidents is the most important procedure in acknowledging the current level of safety culture of an organization. Schools cannot be considered unsafe even if many different incidents happen there, but there is an obvious need to develop methods of reporting incidents in schools as well as the motivation to report to be able to develop the safety culture by lessons learnt from incidents. In research, there is also a need to understand more deeply the mechanisms of incidents and human factors around them (Kjellen and Albrechtsen, 2017; Norros, 2004) If incidents are not recognised in schools, how would it be possible to learn from them and minimise risks in daily practice.

Safety culture in schools is a multifaceted phenomenon that has to be implemented intentionally by using various procedures. Since schools are very unique organisations, diversity with students and staff and altering learning environments make some of the risks unpredictable. However, according to EduSafe-model (Figure 1), incident management is one of the key dimensions in developing the safety culture of schools.

6 Limitations and future research

The result of the analysis is not generalizable due the nature of the pilot case study and the number of incidents (168) as well as the number of schools (3) even though the schools represented town and city schools and students

with multi-cultural backgrounds. The aim of the study was not to find statistically random schools or to compare the schools nor the incidents. The aim was to organise the incidents by thematic content analysis to gain an understanding of what kind of incidents happen in schools. On this basis, the study at hand is a case study. However, the result of the thematic analysis, the three categories of incidents during lessons (injuries to teachers while teaching and preparing, injuries, accidents and near-misses to pupils during lessons and risk management in teaching) enables the design of a questionnaire to in randomly chosen schools either to create, for example, a national or international ‘big picture’ of incidents in schools or compile a comparison of incidents, for example, in elementary and secondary schools.

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FIGURES and TABLES

Figure 1 The EduSafe-model (Teperi et. al. 2018, p.85). The model was translated by the author.

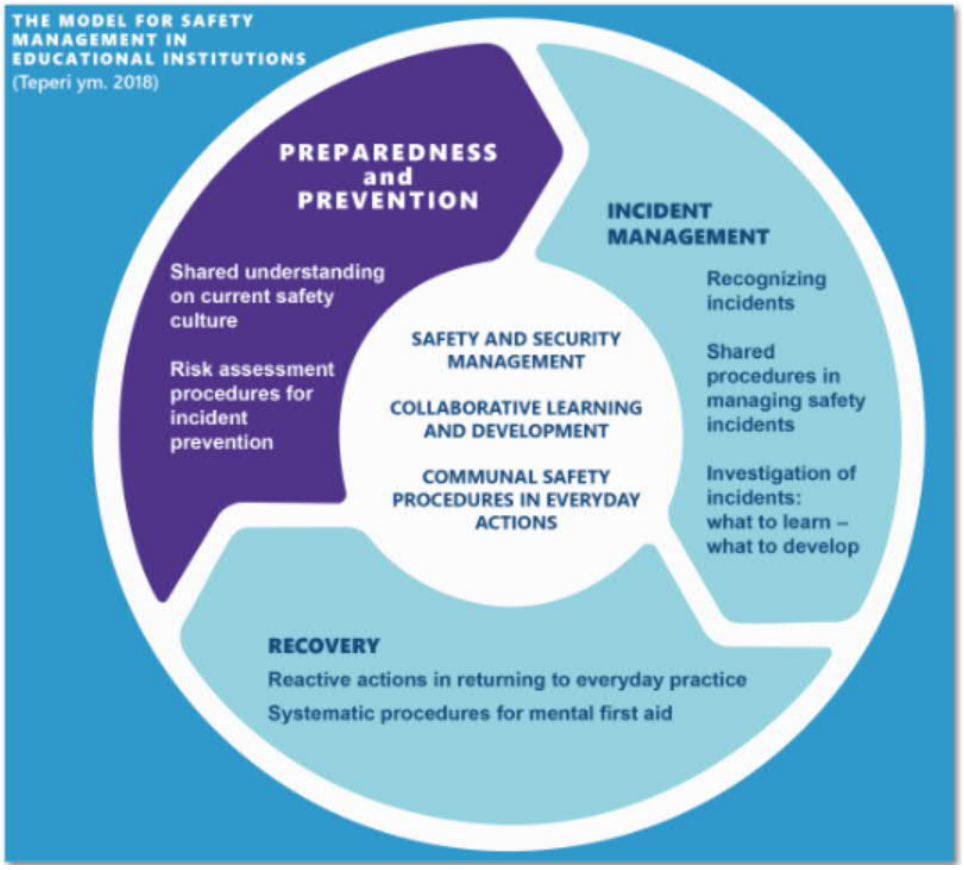

Figure 2. A monthly view of the reported incidents on a school level – Green Cross: School II, October 2016

Author

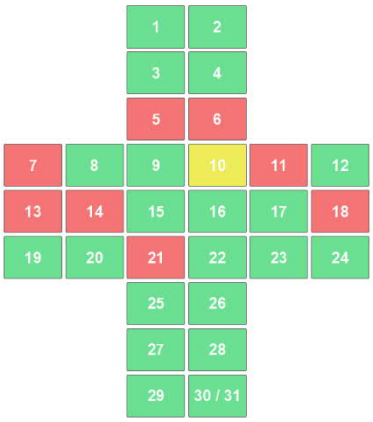

Table 1 Examples of risks and incidents in pedagogical learning environments in lessons in primary and lower secondary education in comprehensive schools

Incident	Authentic example of an incident in categorization	Sub-category	Category	Main category
I/8-MI	A teacher got a cut from a knife while emptying a dish machine before a home economics lesson.	Injuries to teachers in preparing lessons	Injuries to teachers while teaching and preparing (6)	Risks and incidents in pedagogical learning environments in lessons
I/24-MI	A teacher reached out to some material from a material box on the upper part of a cupboard. He fell and hit his mouth and teeth on the material box.			
III8-MI	A teacher had a pile of iPads in his arms on his way to the next lesson and could not see his legs properly. That's why he fell, and his ankle was hurt.			
I/49-MI	A teacher fell while skating during a sports lesson. The arm was hurt.	Injuries to sports teachers during lessons		
I/67-MOI	A pupil sawed with a metal saw in CDT lesson. He wounded his hand. There was a need for first aid at the school and doctoral aid at health center.	Injuries in craft, design and technology education lessons	Injuries, accidents and near-misses to pupils during lessons (23)	
II18-MOI	A pupil cut a piece of his finger while cutting with scissors and talking with mates at the same time in CDT lesson. First aid was needed and a health center visit after the pupil passed out.			
II/14-NM	A pupil put a baking tray into an oven. The baking paper was too close to a heating resistor and the paper caught on fire.	Incidents in home economics lessons		
II/12-MI	Two pupils collided and fell in sports lesson.			

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I/25-MOI	In Finnish baseball, Pupil A caught a ball in his hands while the pupil B was trying to hit it. He hit the wrist of Pupil A. The wrist was fractured.	Incidents to pupils during sports lessons		
I/13-MI	A basket fell from a shelf while pupils were reaching for something from a shelf.	Incidents and injuries with things falling from shelfs		
II/60 - NM	Not enough first aid bags for the pupils visiting a forest	Preparedness for incidents	Risk manage-ment in teaching (2)	
III/16-NM	Too many pupils in one area at the same time	Prevention of incidents		