

Green Cross: Collecting injury data at schools

Brita Somerkoski
National Institute for Health and Welfare, University of Turku
Finland
brita.somerkoski@utu.fi

Abstract: Unintentional injuries are a major cause of health losses and untimely deaths among children and adolescents, both globally and nationally. The information about injuries at Finnish schools is not routinely collected. The aim of this study is to present a web-based tool to collect unintentional and injuries at school environment and to analyze the injuries at collected at three Finnish comprehensive schools. The Green-Cross application was co-designed with the end-users and the aim was to design a tool for safety promotion, problem solving, practical actions and risk management.

In general the risks reported with the Green Cross application were injuries, incidents, dangers and violence. In the sample 42 % of the reported cases indicated unpredictable human behavior or acting against norms or regulations. Findings presented here indicate that injuries in the school can be reported with the help of application that contains visualized elements for quick reporting, yet some more design should be considered for research purposes, like possibility to choose gender or age of the persons involved. Because the injuries in schools are assumed to remain under-reported and to engage and motivate teachers for reporting more actively, more gamification characteristics could be added to the application such as personal scoring or pictures.

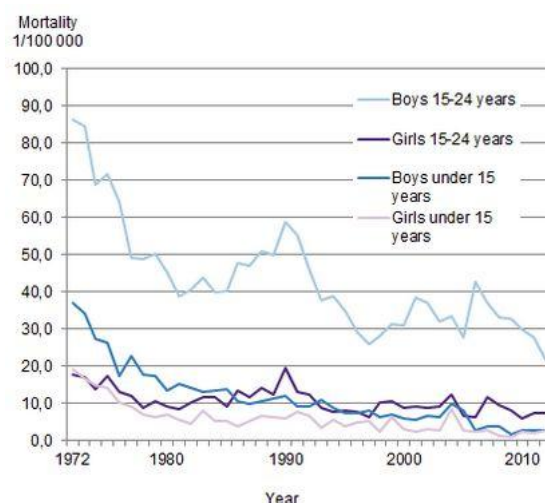
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1. Background

In Finland pupil's right to a physically, psychologically and socially safe and secure learning environment is assured by laws and guidelines governing all the education stages as well as by the new National Core Curriculum for Basic Education (Basic Education Act, POPS2014). Unintentional injuries are a major cause of health losses and untimely deaths among children and adolescents, both globally and nationally.

The information about injuries at Finnish schools is not routinely collected. This is why the picture of the injury and risk situation at schools remains somewhat weak. The aim of this study is to present a web-based tool to collect unintentional and intentional injuries at school environment and to analyze the injuries collected at three Finnish comprehensive schools. The paper discusses the Green-Cross application and its gamification possibilities to enhance data collection for injury prevention purposes in the school context.

Recent decades have seen a decrease in deaths from unintentional injury among Finnish children (Fig. 1) and young people. This trend shows that serious injuries can be prevented.



Source: THL Injury Database, Official Statistics of Finland (OSF) - Causes of Death

Figure 1. Mortality due to unintentional injuries in under 25 year-olds in Finland between 1972–2012 by age group and sex.

Despite the decreasing number of injuries in Finland, the recent studies show that neither the incidents nor the near-miss cases are systematically recorded or monitored at schools, also the studies from European countries (see for instance; Stark, Wright, Shiroyama & Lee 1997; Williams, Latif & Cater 2003) show that injuries in schools remain under-reported, even those requiring hospital treatment. This can be one reason why preventive actions are not carried out precisely. To enhance injury prevention, the process that leads to an injury needs to be studied. We need to know exactly where, when and to whom these injuries happen. (Somerkoski & Impinen, 2014) Effective injury prevention efforts at school should address several factors: the environment, individual behavior, social norms, legislation and policy. To tackle the challenges, attention should be paid to both organizational and everyday routine practices in schools. (Salminen, Kurenniemi, Råback, Markkula & Lounamaa, 2014).

Finnish society and especially the schools are getting rapidly digitalized and concepts like *smart learning*, *E-learning* and virtual classrooms have arisen (Gore, 2016). The new Core Curriculum for Basic Education sets new challenges, because the learning environment is not as stable as it used to be earlier. The new curriculum encourages pupils to move freely in the classroom and the classroom settings and groups are changing in innovative pedagogic ways.

Accident is an event in which a person dies, is severely injured or sustains a less serious injury. The concept contains two components: the event and the injury (Reason, 1997; Andersson & Menckel, 1995.) In general, school is a safe place for children and adolescents and most of the injuries are less serious. As mentioned earlier, there are no nation-wide statistical system that would cover the school injuries and near-miss cases. The study question is to find out what kind of information statistics can be collected with The Green Cross application tool and to present the characteristics of this application. The main aim is to make the injuries and near-miss cases more visible at the school context.

The Green-Cross application was co-designed with the end-users and the aim was to design a tool for safety promotion, problem solving, practical actions and risk management in such way that the safety and risk information could be visually shared at the school context. The software was designed in co-operation with school authorities as a part of regional quality assurance. Classic ways of gathering data on human behavior are in general time-consuming, costly, and are subject to limited participant pools (Dergousoff & Mandryk, 2014). In the school context the new demands on teacher-home connections set new challenges for teachers. Teachers have, more than before, time-consuming demands from homes and from school administration to communicate and report. To design an injury reporting tool that does not need deep understanding of statistics and is easy and useful for every-day use was needed.

When developing risk analysis solutions for learning environments, a special attention was paid to usability. The end-user usability study (Somerkoski, 2015) of this application indicated that the Green Cross quick incident report system was useful, whereas very basic abilities such as memorizing the

password was considered challenging due to the nature of teachers' practical tasks during the day. The usability study indicated that Green Cross software works quite well for solving physical or structural risks at the school context. Yet the software was not very useful when reporting repeatedly happening cases. The end-users expected the product to be developed further to make the usability better. This could be done for instance adding content with gamification features.

The use of serious games in the areas of community development and organizational learning has grown dramatically and relatively new concept of gamification was created. The more developed concept of gamification means the use of game design elements for non-entertainment purposes (Deterding, Dixon, Khaled & Nacke, 2011). Another and important benefit of gamified tools is the immediate feedback on the users' performance. In this study the gamification is seen from a approach where some visual elements of games are used for injury monitoring by motivating and engaging the school personnel to report and react for injuries. This is essential, because safety as a concept is not visible and that is why therefore injury prevention and safety promotion are seen as working with "non-events". While absence of an injury, "*non-event*" is not visible, the dramatic and expensive consequences of an injury are.

Affordance is a concept that is used in the field of human computer interaction to describe the functional properties of objects or environments, action possibilities of a material object in relationship to a potential user. The digital medium itself has four properties that are useful for representation: It is procedural, participatory, encyclopedic, and spatial (Murray, 2011). These dimensions can be seen when using the Green Cross application that is presented and analyzed in this study. The injury reports are processed at the local stage (procedurality), the application's aim is to involve school staff for injury prevention (participatority) and to decrease the knowledge of injuries at the local level (encyclopedity). A major application area of computer graphics is visualization, where computer-generated images are used to help people understand both spatial and non-spatial data. Visualizations such as animations are able to provide for a more exhaustive understanding of abstract and dynamic entities, since changes and states can be animated step by step (Olsson, Mozelius & Collin 2015). Green Cross visualizes the incidents of one calendar month in an easily interpretable format.

There are three basic phases in Green Cross safety improvement process: incident reporting; cause analyses and problem solving. The screen indicates one calendar month at a time divided into 30/31 units (days). This view is made available to all users so that the whole community can easily see the safety situation in one view. If no incidents have happened, the units in Green Cross remain green. When an incident has occurred and is reported, the units change color according to the classification of the incident. The color will turn red if the reported case is an actualized event such as an injury or accident, or alternatively yellow in a near miss case. This color-symbolized visual form provides a picture of the safety situation in one glimpse (Fig. 2).

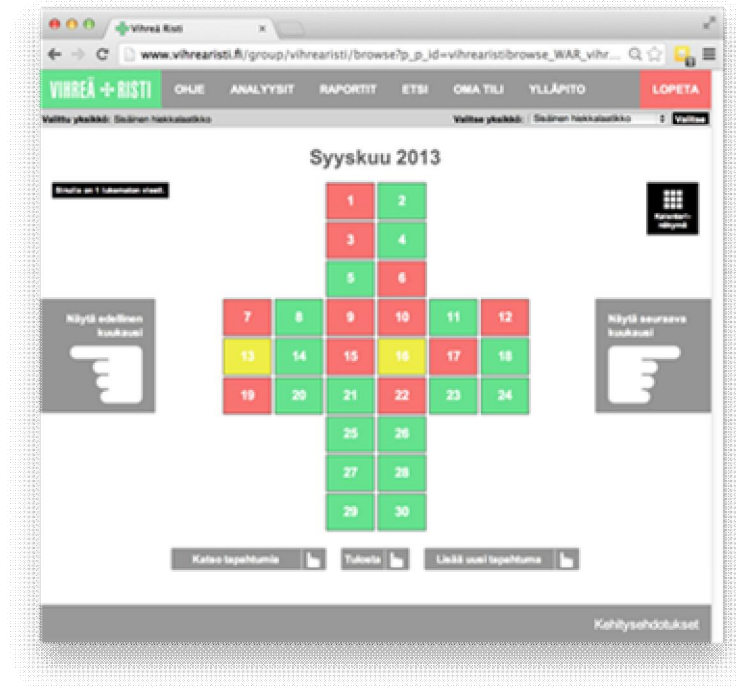


Figure2. Screenshot of the basic Green Cross screen.

During the cause and risk analysis phase the working methods, people, machines and other physical environment, material and knowledge matters are discussed and analyzed in order to understand how the event happened (Fig 3). Once the reported incident has been analyzed and the agreed safety improvement measures implemented, the analysis is marked complete. The software also provides injury reporting capabilities of all the school units in one municipality (Somerkoski, 2016). The quick incident reporting phase takes approximately 2–3 minutes, in which a basic description of the case is noted.

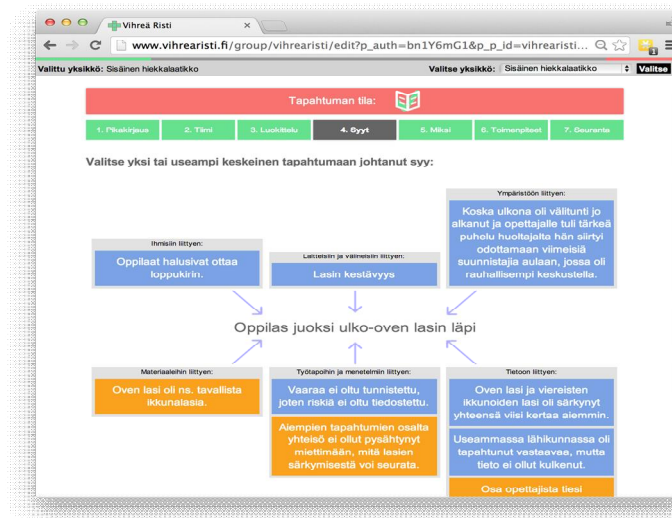


Figure3. Screenshot for cause and risk analysis of the Green Cross tool.

2. Methods and sample

The Aim of this study was to examine the data collection on school injuries. The sample consisted of injury reports in three (3) Finnish comprehensive schools, one of the schools providing also second grade education. The schools in this study provided education for 2200 students. The first phase in the study was content based analysis, where an overall picture of the data was created. The former content analysis of the same application was utilized as basic information on injury risks at school context. In the earlier study of the Green Cross application and the usefulness of the tool, the injuries, accident and near-miss cases were structured in groups as follows: slips and falls; aggressive behavior; structure or property; illness and traffic.

3. Results

The total number of reports in this study was 102 (N=102). Of those 14 (14%) near-miss cases were reported, total amount of injuries reported being 88 (n=88). In general the risks reported with the Green Cross application were near-miss cases, injuries, incidents, dangers and violence. In the sample 42 % of the cases indicated unpredictable human behavior or acting against norms or regulations. This number includes also injuries with intentional causes, like violence and acting against norms or using a product, structure or building, in an abnormal way typical for children and adolescents, for instance climbing on the roof of the school building, throwing objects or breaking products. Half of the injury reports (f=44; 50 %) were about physical learning environment, 16 % (f=14) of the reports included social factors and 20 % (f=18) included pedagogical factors. Pedagogical in this study means that the injury happened during a school lesson. Most of the reported injuries with pedagogical factors happened during physical education lessons. Four (5 %) of the reported cases were traffic injuries, mostly happening when bicycling.

Table 1. Some general characteristics of the reported injuries (n=88).

Risk or injury type description	f	% injuries in total (n=88)
acting against norms or regulations	37	42
physical education injuries	16	18
during recess	29	33
one person involved	34	39
two or more involved	34	39
environment: physical learning environment	44	50
environment: social learning environment	14	16
environment: pedagogical learning environment	18	20
environment: psychological learning environment	7	8
traffic	4	5
more serious injuries	7	8

In total injured *persons* were reported in 88 (86%) of the total 102 (n=102) reports (Table 1). Of these about one fourth (f=21; 24%) reported of head injuries, yet these were mostly less serious types of injuries. The injury report was considered as more serious if hospital, sick leave or symptoms until the next day were reported. About one fourth (24 %) were injuries in limbs (mostly hands). The back was reported hurt in slips and falls, both unintentional (accidentally) and intentional cases (caused on purpose) in 7 (8 %) cases. It has to be noted that the injury frequency compared to the amount of pupils and staff was not analyzed in this study, because it was not ensured that all the injuries were reported. At this state the gender of the injured person remains unknown as well as the age of injured person.

In the overall analysis of the injuries it has to be noted that the end-users used the software to report the incidents and near-miss cases where pupils were in risk rather than the risks, where teacher or other staff member was injured. In general the willingness to report the injuries with this software was not very high and the staff was reminded and encouraged repeatedly to make the reports. To enhance the use of the Green Cross software more features could be added, for instance a possibility to add a photo of the injury. Hamari and Koivisto (2015) state that social factors are found to be associated with continued use and exercise. The Green Cross software has a feature of the one-month-view that enables all the users to see the safety situation at one glimpse. However, the features that enable social influence could be added. For instance providing sharing functions, likes or badges would probably enhance the participatority (see Murray, 2011) and the social involvement in the injury prevention. For instance the user could be awarded with a badge for all the activities of the software: making a report or analyzing an injury (see Hamari, 2017).

4. Discussion

As a conclusion this study examined a novel application of web-based technology to enhance schools in promoting safety and reporting injuries, accidents and near-miss cases; the actions carried out after the risk monitoring process and how the product itself works in reporting injuries, violence and near-miss cases. Findings presented here indicate that injuries in the school can be reported with the help of application that contains visualized elements for quick reporting, yet some further design should be considered for data collection purposes, like possibility to choose gender or age of the persons involved. Because the injuries in school are assumed to remain under-reported and to engage and to motivate teachers for reporting more actively, more gamification characteristics could be added to the application such as personal scoring or pictures. This study is a pilot research for the bigger data to be followed as the research project Safe School (Finnish: Turvallinen koulu) continues, however the reliability of this study as it is presented here, can't be considered good, neither does the study give a holistic picture of all the incidents or near-miss cases in the school context. Firstly not all the staff members are prepared to report the incidents with the given Green Cross application and secondly, there might be some user intensity issues to be considered. This study did not emphasize the features of gamification in the Green Cross application, hence these could be developed further. For instance to enhance the user intensity of reporting the incidents and near-miss cases more additional content, such as interactive fragments or rewarding mechanisms would probably make the usability better. This could be done by providing experience points, badges or unlocking achievements for the software users. Also providing some interactive elements for the software would enhance the participatority (as mentioned earlier in Murray, 2011) and finally make safety culture more visible. Despite of some weaknesses in the reliability of this study, the Green Cross application presented here provides unique information on the school injuries, incidents and near-miss cases and provides a software template for developing the gamification features.

The research project is carried out in University of Turku, Rauma Unit. Findings presented here indicate that many risks at schools were unpredictable, connected to human factor issues, caused by pupils acting against norms and regulations or using structures or products in a way they are not supposed to be used. This makes predicting the risks challenging. The study raises some concerns about injuries caused by violation or aggressive behavior. More specific information should be available of the big number of head injuries that were represented about in one fourth of all the injury cases. Using ice-hockey helmet and other protective sports equipment both during physical education lessons and providing clear rules for the recesses to avoid head injuries should be taken under consideration.

Green Cross solution provided equally and efficiently a documentation model of the whole safety situation in the learning environment, hence by gamification, for instance adding visualization or interactive elements for the product, it would be possible to make the injuries in the school even more visible.

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