

# Safety Culture in Craft, Design and Technology Workshops

## An Analysis of Safety Documents in Teacher Education

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*The teaching and learning of craft, design and technology (CDT) subject is carried out in materially and technologically rich learning and working environments. The importance and role of safety culture in experiential learning in CDT education is essential for all members of an educational organization to endorse. The safety culture of workshops should include inspection and maintenance of facilities, monitoring safety incidents and safety training as part of occupational safety to avoid near-misses, accidents and injuries. The aim of this study is to consider the safety culture of the learning and working environments of CDT education based on written safety documents (N = 3) in order to generate a better understanding of safety culture. The study question is: What categories and subcategories of safety culture can be recognised in CDT education learning and working environments in teacher education? The study was based on data from three safety and security documents: University Campus Rescue Plan, Safety Management Document in CDT Education and External Safety Audit Report of CDT Education. The data were gathered from these documents and categorized according to the Edusafe model's main categories: preparedness and prevention, incident management, recovery and safety management. The data were further divided into ten subcategories, and the final results were formed on this basis. The results reveal that, in general, safety issues are well identified, and many key measures are documented thoroughly. However, at the same time, recovery isn't considered at all. It seems that the safety culture of CDT education needs reconsideration: What are the roles and procedures of recovery?*

Keywords: safety culture, self-preparedness and prevention, craft design and technology education, management, recovery, teacher education, safety incidents

### Introduction

The teaching and learning of craft, design and technology (CDT) subject is carried out in materially and technologically rich learning environments that consist of various workshops. Since CDT learning assignments presuppose the use of tools and machines, various materials and chemicals (e.g. a forge) in experiential learning processes (Kolb, 2015), the learning environments are also working environments, not just for teachers but also for students (Lindfors et al., in press). For this reason, CDT education is a safety-critical subject (Lindfors & Somerkoski, 2018), and there is a serious concern about the occupational safety of students and teachers in order to identify and monitor hazards and assess risks to prevent safety incidents, such as near-miss cases, accidents and injuries (Lindfors, 2018, 2020). Highlighting occupational safety by promoting a high-level safety culture in teacher education is of special importance since student teachers will experience it during their studies. At the same time, they will have an example for their future work: how to maintain and develop a safety culture of CDT education in practice.

Although safety culture, as a phenomenon, is somewhat unseen, it is nevertheless vital and cannot be forced (Arezes & Miguel, 2003). Good safety culture is achieved through persevering work and the commitment of every participant in the organization. The importance and role of safety culture in experiential learning in CDT education are essential for all levels of an educational organization, from principals to students, to endorse. Earlier studies have revealed that most of the reported safety incidents

in CDT were moderate injuries that needed first aid at school and doctoral aid at health centres (Lindfors, 2020). In addition, small fires were monitored in workshops (Leino & Vainionpää, 2015). Safety and security in an organization is seen as a culture of committing to understanding them as a part of one's everyday practice and a will to work and act safely to enhance preventive actions in cooperation with all members of an organization (Lindfors, 2020) by identifying and recognizing the actual hazards and risks of activities (Arezes & Miguel, 2003; Geller, 2011; Guldenmund, 2000; Lindfors & Somerkoski, 2018.) From a physical point of view, a space and equipment can be safe. However, without an understanding of proactive actions, it can be an unsafe and hazardous environment (Lindfors and Somerkoski, 2016). In teacher education, safety culture can be seen as collaborative actions of the staff and student teachers as well as the implementation of procedures that develop and promote a safe and secure learning and working environment. In CDT education, the safety culture of the workshops should include the inspection and maintenance of facilities and the monitoring of everyday safety incidents as well as safety training as part of occupational safety to avoid near-misses, accidents and injuries. This means that in a practical teaching and learning situation, teachers and students should consider safety and prevention measures together as part of learning assignments and practical work to avoid near-misses and injuries (e.g. slipping with a knife or receiving an electric shock).

The EduSafe model (Figure 1) was developed to provide a tool for educational organizations to consider and assess the safety culture (Teperi et al., 2018). The model considers safety culture in four dimensions. The shared understanding of a current safety culture (e.g. a safety plan) and safety drills, as well as procedures for identifying hazards and near-miss cases and assessing the risks, are means of prevention and preparedness. A second dimension, the management of safety incidents that happened despite prevention measures, requires understanding and recognition of what the safety incidents are and how they should be reported and monitored. This is of special importance since to prevent further similar incidents and learn lessons, there is a need to analyse the root cause and develop prevention and preparedness measures on this basis. The third dimension is recovery; procedures are needed to return to normal after a safety incident. The incident might be an internal one (i.e. an emergency or an accident inside an organization) or an external one, such as a chemical disaster or a threatening person. There is a need for methods and procedures to inform, communicate and debrief as part of the recovery process. Fourth, the ultimate precondition for implementing the safety culture dimensions as part of everyday practice is the management of safety and security. Safety management should guarantee that, in an organization, there are communal procedures and practices in everyday actions as well as a collaborative learning and development of safety culture.

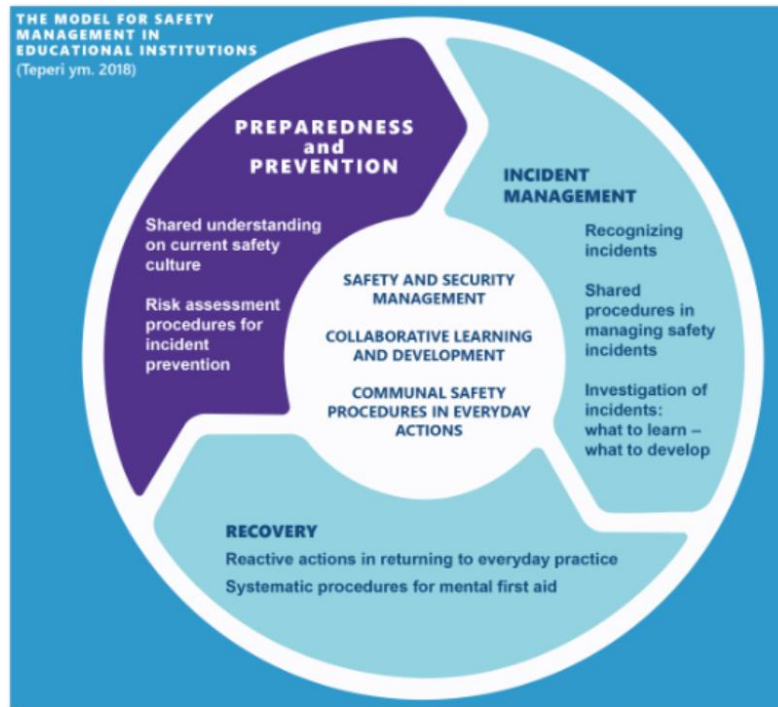


Figure 1. The EduSafe model. Developed and translated on the basis of Teperi et al. (2018, 85).

On the basis of previous studies (Lindfors et al., 2020; Lindfors & Teperi, 2018; Martikainen, 2016; Teperi et al., 2018; Lindfors, 2018; Waitinen, 2011), there are seldom systematic procedures in regular use to manage safety and security in educational organizations (e.g. collecting incident data even if injuries are usually reported to insurance companies). To maintain and develop a safety culture, there is a need to understand the current situation. The Edusafe model (Teperi et al., 2018) presents a theoretical structure that helps to consider and investigate the safety culture of an organization. Even though there was a recent study on self-preparedness in the Finnish teacher education departments of various universities based on audit data (Lindfors et al., 2020), there are no studies on safety culture in the learning and working environments of CDT education in teacher education. Based on the results of Lindfors and others (2020), particular attention should be paid in teacher education departments to self-monitoring and safety education and their adoption. It was found that teacher education staff and students need to be actively involved in promoting and maintaining their organization's safety culture.

The aim of this study is to consider the safety culture of a CDT education learning and working environment based on written safety documents in order to generate a better understanding of the categories of safety culture promotion in the everyday work of staff and student teachers. The study question is: What categories and subcategories of safety culture can be recognized in CDT teacher education learning and working environment safety culture documentation?

## Methods

### Study context

The learning and working environment in CDT teacher education includes various workshops that allow working with different material technologies, such as woodwork, plastics, electronics and robotics, sewing, knitting, printing, digital modelling and fabrication. There are basic workshops for working mainly with hand tools and hand-held electrical tools and separate workshops for machinery work. The basic workshops have workstations for each student according to the main materials used and, if needed, separate workshops that allow for controlling noise, dust, fire or humidity. Some workshops combine these into one space if the noise level stays under 80 db. at all times, such as a sewing space. There are

some workshops for specific kinds of work, such as sanding and gluing, painting and finishing, forging, laser cutting and engraving, 3D printing and weaving.

Yearly, over 400 student teachers from three different teacher education programs (pre-primary, primary and subject teachers) study and work in these workshops during demonstration lessons and in self-oriented studies. To be able to work independently at the workshops outside lesson hours and carry out self-oriented work, student teachers have to participate in a strict safety protocol seminar in advance.

### Research data and analysis

This study is based on data from three safety and security documents: University Campus Rescue Plan (UCRP), Safety Management Document in CDT Education (SMD) and External Safety Audit Report of CDT Education building (ESAR). The data consist of 44 A4-sized pages with 1.5-point spacing. A thematic content analysis was implemented, and the documents were thoroughly read several times. Content related to the main categories of the Edusafe model was recognized based on the know-how of the authors in this field as well as in accordance with the model's subcategories. When carrying out this kind of content analysis, human intelligence is a key factor, and the data collected should be able to recall at all times (Krippendorf, 2013). Next, the data were categorized under preparedness and prevention, incident management, recovery, and safety management according to the chosen framework of the Edusafe model. The gathered data were then analysed and further divided into 10 subcategories based on repetitive themes that arose from the initial sorting (Table 1). Repetitive themes in this context refer to themes with a minimum of two separate mentions. These turned out to be safety instructions and guides, self-monitoring, structural safety, security systems at premises, safety equipment, safety training, safety competence of the organization members, risk acknowledgement and assessment, risk classification and recognition, and predefined levels of safety management. The final results were derived from the themed data.

Table 1. Example of the data analysis and categorization

Original expression	Category	Subcategory
The principle of exit safety is that all spaces of the building must have <b>at least two exit routes</b> at all times that do not require keys or other tools to open. (UCRP)	Preparedness and prevention	Structural safety
<b>Safety competence</b> in accident situations was evaluated to be adequate. (ESAR)	Incident management	Safety competence of the organization members
(Assistant security chief) advances safety competence of the whole educational community and <b>executes safety-related drills</b> in cooperation with staff and student members. (SDM)	Safety management	Safety training

### Results

From the data, 141 mentions related to the Edusafe model's framework were identified. From these, 63% (89 mentions) were included in preparedness and prevention. Altogether 9% of the mentions (13) were included in incident management and 28% (39) in safety management. There were zero mentions in the category of recovery. The results are presented in Figure 2.



Figure 2. Elements of safety management in CDT teacher education.

The category of preparedness and prevention was further divided into five subcategories. These were safety instructions and guides (21%,  $n = 31$  of the total  $N = 141$ ), self-monitoring (10%,  $n = 14$ ), structural safety at premises (13%,  $n = 18$ ), security systems at premises (6%,  $n = 8$ ), and hazard identification and assessment (6%,  $n = 9$ ). Typical mentions in the safety instructions and guides subcategory were *'instructions for alerting help'* (URCP) and *'out-of-order-signs especially for machines'* (ESAR), as well as safe use instructions for every machine. This was the largest subcategory.

Typical mentions in the self-monitoring subcategory were *'learning and working environment self-monitoring: hazard evaluation, risk recognition and documentation'* (SMD) and *'daily self-monitoring by student supervisor in CDT workshops'* (ESAR). Typical mentions in the structural safety at premises subcategory were *'fire compartmentalization'* (URCP) and *'signs of ATEX-certified spaces'* (ESAR). Typical mentions in the security systems at premises subcategory were *'fire alarm system'* (URCP) and *'safety sign lighting battery checks done periodically'* (ESAR). In addition, typical mentions in the hazard identification and assessment subcategory were *'radiation or gas hazard'* (URCP) and *'safety walks for students contain accident prevention measures (e.g. risks of working in ATEX spaces)'* (ESAR).

The main category of incident management was further divided into two subcategories. These were safety equipment (9%,  $n = 12$ ) and the safety competence of the organization members (3%,  $n = 4$ ). The typical mentions in the safety equipment subcategory were *'fire extinguishers'* (URCP) and *'separate CO2 extinguishers for laser works station and electric workshop'* (ESAR). The typical mentions in the safety competence of organization members subcategory were *'the readiness for other crisis situations is covered by the competence of the safety organization'* (ESAR) and *'acts as a safety supervisor of CDT education building in a hazard or accident situation'* (SMD).

CDT teacher education workshop safety culture management contains a variety of protocols. The category of safety management was further divided into three subcategories. These were safety training (9%,  $n = 12$ ), predefined safety responsibilities in the organization (8%,  $n = 11$ ), and risk monitoring (14%,  $n = 20$ ). Typical mentions in the safety training subcategory were *'part of new student training includes a safety walk and an extinguisher drill'* (ESAR) and *'planning and execution of safety drills in the educational premises'* (SMD), as well as *'formal introduction protocol for safe use of every machine'* and *'safety-oriented study module named "Safety culture in experiential learning"'* (ESAR). Typical mentions in the predefined safety responsibilities in organization subcategory were *'safety-related*

*responsibilities are recognized, and sharing them with different parties is clear*' (ESAR) and *'the head and vice head of the department of teacher education are responsible for strategic safety*' (SMD). Typical mentions in the risk monitoring subcategory were *'safe working area markings and a document collection of the chemicals in use*' (SMD).

## **Conclusion and discussion**

This pilot study considered occupational safety through safety culture of the CDT education learning and working environment in one university teacher education context on the basis of three written safety documents: the rescue plan, the safety management document and the external safety audit report. As an answer to the research question, it can be stated that preparedness and prevention, incident management, and safety management are included in the CDT education safety culture according to the written documents. These are the main categories to contributing a good safety culture (Arezes, 2003; Geller, 2011; Guldenmund, 2000; Jones et al., 2007). It can be established that, in general, safety issues are well identified, and many key measures are documented thoroughly, as the subcategories reveal (Figure 1). The next step is to consider this in practice. This generates a new question for research: how safety methods and procedures are implemented in practice by teacher educators and student teachers.

In general, a major part of safety is preventing accidents and incidents in advance and managing risks to a controllable level. In this study, the document analysis explicates that there are many systematic procedures in use to manage safety and security. This differs from the findings of earlier studies (Lindfors et al., 2020; Lindfors & Teperi, 2018; Martikainen, 2016; Teperi et al., 2018; Lindfors, 2018; Waitinen, 2011). Particularly in prevention, numerous methods and procedures were recognized. However, at the same time, one major category of safety culture – recovery – is not considered at all. On this basis, it seems that CDT teacher education safety culture needs reconsideration: what are the roles and procedures of recovery? The recovery methods and procedures are numerous, depending on the incident.

From a study perspective, there is a need to consider the role of the authors in the study, since they are part of the organization of CDT teacher education. An important question is whether the authors were subjective or objective in the analysis. However, the research design, with thematic content analysis (Krippendorf, 2013) and the EduSafe model (Teperi et al., 2018) as its thematic structure, gave a strict frame for the analysis. Additionally, the written documents are stable data that one is able to recall at all times. The number of mentions (N = 141) indicates that there was a reasonable volume of mentions to execute the analysis. Thus, the authors discussed the categorization analytically and critically, and its subcategories were further developed on this basis. The result that recovery is not acknowledged in CDT education is in line with the findings of Puolitaival and Lindfors (2019), who showed that recovery was not a content of safety education in the basic education curriculum either.

The results describe the safety culture of one Finnish teacher education context and as such cannot be generalized outside the Finnish context or even to the national level. However, it is a pilot study, and it gives an example of how it is possible to analyse safety culture in CDT education. It also invites more studies in the future. Additionally, it gives a suggestion of what the subcategories of the EduSafe model could be (Figure 1). The result that the category of recovery is missing from the safety culture according to the documents might indicate that the monitoring of safety incidents (Figure 1) also needs reconsideration, since monitoring, in its final step, includes practically implementing the lessons learnt, and this presupposes procedures of recovery. The category of recovery and its procedures is a topic that warrants further study.

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