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HSE in civil engineering programs and industry expectations

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Abstract

This paper evaluates the expected knowledge, skills and general competence for graduated civil engineers regarding health, safety and environmental (hereafter HSE) in Norway. The research aims at uncovering whether it is a gap between the expectations from the industry and the learning outcomes for the civil engineering program at the university. The research questions are;

1. What level of knowledge, skill and competence do the industry expect from graduated civil engineers regarding HSE?
2. What level of knowledge, skill and competence do the civil engineers actually possess after graduating?

To get an overview of the field of research, the research was initiated by a thorough literature review. The first question is addressed with a survey and analysis of documents related to the contractors own HSE training programs. There were eight respondents to the survey and the documents are gathered from three of the largest contractors in the Norwegian construction industry. The second research question is addressed through an analysis of university study plans and other documents describing learning outcome from the civil engineering program. The Norwegian University of Science and Technology (hereafter NTNU) which is responsible for over 80% of all civil engineers at masters level graduated in Norway was chosen as study object. The findings show that there is a gap between industry expectations regarding HSE knowledge, skill and general competence and the learning outcomes for the civil engineering program at the university. Still, this do not necessarily mean that the graduated civil engineers are not knowledgeable regarding HSE. This paper addresses a topic with little previous research and this study will therefore be a valuable contribution within the field of safety research.

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1. Introduction

Construction projects have been associated with a high risk of injury and fatal accidents from ancient times. However, even though both worker rights- and conditions as well as technology have developed, accidents still happen on construction sites. The construction industry is seen worldwide as one of the most dangerous industries to work within because of the high rate of fatal injuries and accidents [1, 2]. Safety work on the construction site is challenging, in particular due to the complexity of the site and the activities involved [2]. Another reason for its complexity is the use of a multidisciplinary workforce and the challenge of managing the interfaces between the disciplines.

Although the construction industry experiences a high rate of fatal injuries, great improvements have been witnessed over an extended period of time [3]. Nevertheless, the need for improvement regarding safety are identified by both the industry and the academia. A prominent concept emphasized in the health, safety and environmental (hereafter HSE) literature is “the zero accident vision (ZAV)”. The vision is based on an assumption that all serious accidents are preventable [4]. Approximately, the construction industry employs 7% of the workforce worldwide, but is responsible for 30-40% of all fatal injuries [5]. This means that – despite the positive trends over the last period – there is still significant work to do regarding the safety on construction sites, especially for the industry to be anywhere close to achieving the zero accident vision.

A project organisation is usually organized hierarchically, typically with a project manager in one of the highest positions on a project level. This means that the construction project manager is a key person with regards to the success or eventually failure of the project – and his/her attention to safety is crucial. Project managers prioritizing safety has been shown to arrange for safety leadership and potential improvements in safety performance [5].

The literature identifies different factors that may contribute to construction site safety, including policy, process, personnel and incentives [2]. The personnel factor concerns the human condition of the work and activities at the construction site. Controlling this factor is challenging, since people often make mistakes due to a lack of understanding and competence when it comes to understanding safety procedures and how to implement safety measures [6]. To deal with the personnel factor, safety training is of high importance [2]. Thus, the prioritizing carried out by the project manager could have crucial impact on the safety management on the construction site. Furthermore, it is of high importance that the project manager possesses the correct competence in order to understand the concepts of safety and accident prevention.

Graduated civil engineers often quickly fill roles as project managers or closely related roles. It is therefore decisive that the graduated civil engineers possess a satisfying level of knowledge skill and general competence concerning understanding and performing safety work. This study seeks to investigate whether the graduated civil engineers actually possess the necessary level of knowledge, skill and general competence. It addresses the following research questions:

1. What level of knowledge, skill and competence do the industry expect from graduated civil engineers regarding HSE?
2. What level of knowledge, skill and competence do the civil engineers actually possess after graduating?

The subject examined in this study seems little addressed in previous research. It is therefore the ambition of the authors of this paper that the study presented provides a contribution to the research on safety in the construction industry. The study is limited to an investigation of the Norwegian construction industry and The Norwegian University of Science and Technology (hereafter NTNU). The scope is limited to the largest contractors in the Norwegian industry.

The next section provides an overview of the theoretical framework underlying the analysis. Then, a presentation of the research method is presented, followed by the research results from the investigation. The final part consist of a discussion of the findings and the consequence of the gap that was found. The discussion sets the premises for the presented a conclusion and recommendation to further research on this subject.

2. Theoretical framework

The laws and regulations in the most countries maintain that it is every workers' right to feel and be safe at the work place and also get home safe and sound. HSE is meant to take care of the workers health and safety and ensure that environmental impact is kept at a minimum. In this paper it has been chosen to use the definition of Huges and

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