CHALLENGES IN INTEGRATING ENGINEERING INTO SCIENCE EDUCATION IN FINLAND

Jesse Hietala // *Mikko H. P. Kesonen* // *Kirsi Ikonen* // *Mervi A. Asikainen* // *Pekka E. Hirvonen*
Department of Physics and Mathematics, P.O. Box 111, FI-80101 Joensuu, Finland

Introduction

Integrating engineering into science education has many benefits but it seems to be difficult to implement[1].

Benefits
- Increases learning motivation[2]
- Improves students' learning[3,4]
- Develops problem solving and teamwork skills[5]

Implementation difficulties[1]
- Lack of appropriate resources
- Teaching science content via engineering activities

The present study aims to better understand how to integrate engineering into science education. The aim is approached in a context of Finnish comprehensive education.

In Finland engineering design
- became an explicit part of science education in 2016[6] and
- has not previously been a part of science teaching tradition, textbooks, or teacher training.

Research questions:

RQ1. How does the new Finnish national core curriculum[6] describe the objectives and implementation of engineering in science education?

RQ2. How should Finnish science teachers be supported in implementing engineering in a science class?

Methods

To answer RQ1, we evaluated the new curriculum[6] in terms of engineering. To answer RQ2, we reviewed STEM education literature to find out the challenges faced by teachers and what type of support has been provided for them. The answer was then formed by taking into account the Finnish science education tradition and the curriculum objectives.

Results

RQ1. An objective related to engineering in physics and chemistry is *to inspire the pupil to participate in forming ideas for simple technological solutions and designing, developing and applying them in cooperation with others* (p. 419, Ref. 6). A more detailed definition for engineering or descriptions of its implementation are not given.

RQ2. Teachers most likely have a lack of
- knowledge about engineering,
- quality teaching materials and
- time to plan science lessons with engineering integration.

Due to these challenges, many science teachers do not implement engineering at all or the learning of science content is mainly ignored in the implementation. They may also have negative attitudes towards the integration. However, teachers can be supported by offering proper training and teaching materials.

Conclusions

Finnish science teachers need both pre- and in-service training. For the successful implementation of the engineering, teachers need more knowledge about engineering and the pedagogical practices of the integration. Teachers' awareness of the benefits of engineering integration would increase their motivation to apply it in their teaching. Quality teaching materials need to be offered to help them tackle time issues.

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CONTACT INFORMATION
jesse.hietala@uef.fi

LUMA CENTRE FINLAND
Ministry of Education and Culture
UNIVERSITY OF EASTERN FINLAND