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# Oamk\_Highway – New route for young people towards engineering degree in Northern Finland

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## Abstract

The Finland higher education (HE) system is based on the dual system with the Universities and with the Polytechnics also known as Universities of Applied Sciences (UAS). The students pursuing for HE admission can have various routes to acquire their right to study in the Universities or in the UAS's. These options can be e.g., official entrance exams or by the evaluation of grades from the vocational or high school diploma. Oulu University of Applied Sciences (OUAS) is in the northern Finland, in the city of Oulu. OUAS has c.a. 9500 students and around 500 staff members. The School of Engineering and Natural Resources as c.a. 2400 students, and c.a. 150 staff members. This paper introduces a new pathway by the OUAS School of Engineering and Natural Resources to acquire new engineering students from the vocational and high school level in Northern Finland. This is called Oamk\_Highway, in which the students in the vocational or high school studies 15 credit points of specified OUAS HE studies, and together with the vocational of high school degree diploma, the student will get direct admission to engineering degrees in the OUAS. The 15 ECTS constitutes from mathematics (5 ECTS), physics (5 ECTS) and engineering degree subject matter studies (5 ECTS), which can be freely selected by the student from the list of specified Oamk\_Highway courses. The courses are mainly organized by online course and are taught by the OUAS teachers (Senior lecturers or Principal lecturers), however, the mathematics course is organized locally and taught in the high school or in the vocation school by using the materials, exams and support provided by the OUAS. There are totally 5 engineering degrees available for the students to choose from after admission via the Highway concept. These degrees are: Mechanical Engineering degree, Building Services Engineering degree, Electrical and Automation Engineering degree, Energy and Environmental Engineering degree, Construction and Civil Engineering degree.

**Keywords:** Continuous learning; Engineering Education; Pathway; Higher education

## 1 Introduction

The continuous learning is one of the most important strategic guidelines to ensure Finland's future success in higher education. The strategic guidelines have forced universities to develop new ways to support non-degree-oriented education, develop new pathways to higher education and prepare students for working life more quickly. All these goals have supported by the funding model of universities. It has also been agreed in the funding agreements of higher education institutions that higher education institutions will increase their co-operation with the high schools and vocational institutions in order to speed up the young people's transition to higher education. According to Finnish High School Law (2019), students need to have the opportunity to get acquainted various fields and the skills required for studies in higher education during high school studies. A glimpse into higher education facilitates the choice of field and provides information on requirements needed in higher education. (Finnish Ministry of Education and Culture 2019.)

Higher education (HE) system in Finland is based on the dual system with the Universities and with the Polytechnics also known as Universities of Applied Sciences (UAS). (Figure 1) The universities conduct scientific research and the scientific bachelor, master and doctoral degrees. UAS task is to teach and conduct development projects that meet the needs of working life. Studying the Bachelor degree at the UAS lasts from 3.5 to 4.5 years. The Master degree can be completed after two years of work experience.

The students pursuing for HE admission can have various routes to acquire their right to study in the Universities or in the UAS. After comprehensive school adolescents can apply to secondary education: general upper secondary schools (later called high schools) or vocational institutions. The secondary education is free of charge. High schools provide general education and in the end of studies students have matriculation examinations. The vocational institutions provide basic skills in professional qualifications and occupations.

After secondary education students can apply to study right to university or UAS by official entrance exams or by the evaluation of grades from the vocational or high school diploma. (Figure 1.)

In the field the engineering, universities are competing for new students and thinking new ways to get students. In northern Finland, new engineers will still be needed in the coming years to replace the engineering workforce which is retiring, also the digitalization that is emerging in all fields of engineering requires new engineering approaches to many business areas.

## EDUCATION SYSTEM IN FINLAND

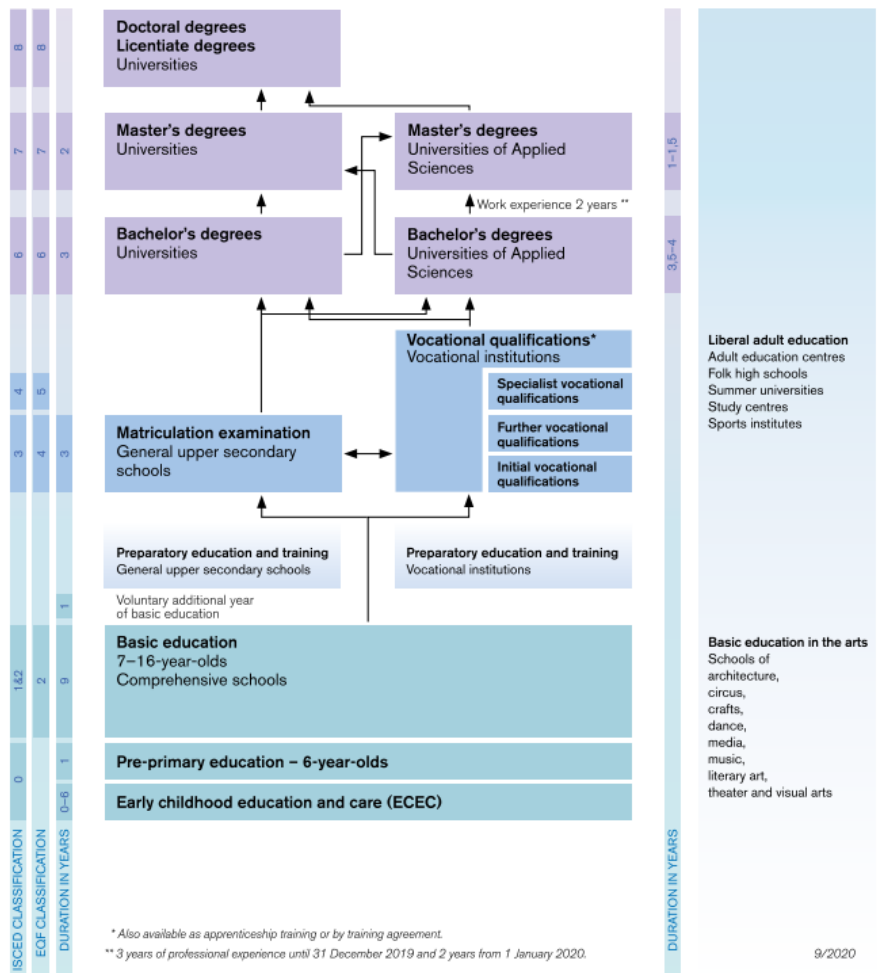


Figure 1. The Finnish Education System: Dual Model (Ministry of Education and Culture, Finland 2021.)

## 2 Aim

This paper introduces a new pathway by the Oulu UAS School of Engineering and Natural Resources to acquire new engineering students from the vocational and high school level in Northern Finland. We discuss the concept, deployment and early findings of the new approach in following chapters. Firstly, we discuss the research approach (method) for design, development and piloting of the Oamk\_Highway model. Then in the following chapter we discuss the early results of the new pathway, and we conclude by discussion and conclusions chapters.

## 3 Methods

### 3.1 Design

A descriptive study design was used to describe the development and piloting of the new pathway for young people towards an engineering degree in Northern Finland.

### 3.2 Development

Oamk\_Highway is a new pathway from the vocational and high school level to higher education (university of applied sciences) developed by the Oulu University of Applied Sciences (OUAS), School of Engineering and Natural Resources. OUAS is located in the northern Finland, in the city of Oulu. It has c.a. 9500 students and 500 staff members. The School of Engineering and Natural Resources has c.a. 2400 students, and c.a. 150 staff members.

The aim of a pathway development was to acquire new engineering students and to shorten education paths and speed up the transition from education to working life. The new pathway was developed in close collaboration with the vocational institutions and high schools. Teachers in the field of mathematics, physics and engineering from vocational and high schools and university of applied sciences compared the curricula of vocational, high school and higher education levels. The similarities in the field of mathematics and physics were found. Based on that the new pathway from vocational and high schools to university of applied sciences was designed. The student recruitment process for the pathway was developed in collaboration with experts of student counsellors and student services.

In the Oamk\_Highway the students in the vocational or high school study 15 credit points of specified OUAS higher education studies, and together with the vocational or high school degree diploma, the student will get direct admission to engineering degrees in the OUAS. The 15 credit points include mathematics (5 ECTS), physics (5 ECTS) and engineering degree subject matter studies (5 ECTS) that can be freely selected by the student from the list of specified Oamk\_Highway courses. The courses are mainly organized by online course and are taught by the OUAS teachers (Senior lecturers or Principal lecturers). However, the mathematics course is organized locally and taught in the high school or in the vocational institution by using the materials, exams and support provided by the OUAS. There are totally 5 engineering degrees available for the students to choose from after admission via the Oamk\_Highway. These degrees are: Mechanical Engineering degree, Building Services Engineering degree, Electrical and Automation Engineering degree, Energy and Environmental Engineering degree, Construction and Civil Engineering degree.

The recommendation is to start studying for a mathematics course (5 ECTS) that will give the student sufficient skills to complete the course for others. Engineering is mainly based on mathematical materials. Studying mathematics in high school makes it easier to cope with mathematics at the University of Applied Sciences. A student at a vocational school, on the other hand, can study the additional courses offered and thus make it easier for them to cope at the University of Applied Sciences.

Since studying physics requires a certain level of mathematical competence, it has been agreed that physics (5 ECTS) will be completed after a course in mathematics. The goal of the first course in physics is to develop the student's mathematical, engineering-like mindset, which is a very important skill for later studies. The themes of physics mainly deal with mechanics and thermal science with tasks related to the field of technology. The physics studies in vocational institutions and high schools meet the objectives of the first physics course in OUAS.

The purpose of the engineering courses is to provide basic information on studies in the field. The student can choose one course (5 ECTS) in energy technology, building technology, mechanical engineering or building technology. The course served as an introduction type or "sneak-peek course" for higher engineering field education. This means that students can get to know higher education during secondary education, and their selection can be based on their interest for a specific engineering field.

Once the student has completed the entire Oamk\_Highway studies (15 ECTS) and completed a secondary degree, the student will get direct admission to engineering degrees in the OUAS. The admission needs to be

requested via the spring semester annual application process to HE which is organized in Finland via central national level application system called Opintopolku ([www.opintopolku.fi](http://www.opintopolku.fi)) . The application process is organized via special admission track.

### 3.3 Piloting

Oamk\_Highway pilot started in August 2020. The students from six high schools and two vocational institutions in Northern Finland were invited to participated in the pilot. The institutions were chosen based on their location and interest. All the selected high schools and vocational schools locate in Northern Finland and less than 200 km from OUAS Linnanmaa Campus. Also, strategic partnerships with regional large vocational schools such as OSAO and JEDU impacted the selection. For example, OUAS has a long cooperation with Educational Consortium OSAO (Oulu), so they were chosen because of the cooperation pattern. In student recruitment, co-operation was established with the staff of the partner high schools and vocational institutions. In addition, Oamk\_Highway sparked interest in the news and got a lot of publicity through it. The eligibility criteria for the participants were as follows: studying in high school or vocational institution on the semester when the pilot started, studies have progressed as planned in the curriculum at least one year, the basics of mathematics have progressed.

Before starting the pilot, an online meeting was held with each pilot partners' school principal, study counselors and teacher of mathematics and physics. The aim was to engage the institutions and go through all the necessary information needed to counsel the students to apply and progress in the Oamk\_Highway.

The application for Oamk\_Highway and Frequently Asked Questions (FAQ) took place on the website ([www.oamk.fi/highway](http://www.oamk.fi/highway)) and all eligibility criteria fulfilled participants were sent the acceptance letter by email and guides to the sign in the Moodle online learning environment. After signing the Moodle, the students were able to start their studies regardless of time and place. The studies were recommended to start in mathematics to get routine to count more difficult studies. All guides for studying and all courses were in online learning environment. The tutor helped students in online learning environment if needed. After passing studies in Oamk\_Highway, the student will get a diploma from OUAS that is needed to apply to OUAS.

## 4 Results

A total of 93 students started in pilot. 83 % (n=78) them were men and 17 % (n=15) women. 23 % (n=21) were from high school and 77 % (n=72) from vocational institutions.

Total of 255 ECTS were completed between September 2020 and May 2021. The semester continues until end of May. The average of completed studies was 3 ECTS per student. The results of completed courses are shown in Table 1.

In spring 2021, a total of 9 Oamk\_Highway students who completed the Oamk\_Highway path applied to Oamk, and they applied for a study-place in OUAS.

Table 1. Completed courses between September 2020 and May 2021 (the results updated 05/2021)

	Started the course % (n)	Completed the course % (n)	Ongoing
Mathematics	25% (23)	96% (22)	4% (1)
Physics	26% (24)	54% (13)	46% (11)
Oamk_Highway – module (Selected Engineering Degree Course)	100% (93)	18% (17)	82% (76)

## 5 Discussion

The new pathway opens a faster and easier route for students to apply to the university and at the same time utilizes the knowledge learned at the secondary education. For students, the pathway also opens a faster route to study and graduation with HE degree. It also gives the student the opportunity to get acquainted with university studies already during the second year and at the same time see the level of requirements for university studies. An important consideration is also that the student may find in the second degree that college studies are not the right route for them.

Through Oamk\_Highway, OAUŠ gets new, motivated students who have already committed to the university during their secondary education. OAUŠ can reduce the number of students coming through regular annual entrance exams and at the same time raise funding for its own activities through continuous learning points which are credited by the Finland Ministry of Education funding model for HE.

Students will always give feedback after the completion of Oamk\_Highway studies. They will be asked about the progress, completion and development issues of the studies. This data provides an opportunity to examine factors affected in higher education. Oamk\_Highway will also open the door to other co-operation with secondary education schools and institutions.

The number of girls (17%) in the first-year pilot is low and the goal is to increase this number as well. In the marketing of Oamk Highway, schools have also emphasized the possibility for girls to participate in education. OAUŠ is also coordinating the Girls and Technology -project, which has 9<sup>th</sup> graders in the main target group. In addition, girls' interest in technology has been strongly marketed on social media.

The success of Oamk\_Highway requires close cooperation between the university and the secondary school. Commitment to collaboration is needed from management, study counselors, and teachers of mathematics and physics. In addition, communication between mathematics and physics teachers is important because teachers in secondary education see the level of requirements of higher education and gain new practical ideas for their own teaching. In these discussions, it has also been estimated that Oamk\_Highway brings more motivation to study at the 2<sup>nd</sup> degree and may increase the study of mathematics at the secondary level. Also, the collaboration by the Vocation Schools and High Schools with OAUŠ can be important factor when young students are considering their selection for High School or Vocational School because the strategic partnership with OAUŠ brings direct admission possibility via Oamk\_Highway to their students, which offers them competitive advantage over other vocational schools or high schools.

## 6 Conclusion

Oamk\_Highway is a new pathway for students from the vocational and high school level to higher education Bachelor level engineering degree studies developed by the Oulu University of Applied Sciences (OAUŠ) School of Engineering and Natural Resources. The new pathway project has been introduced as a pilot project to selected High Schools and Vocational Schools in Northern Finland.

The early findings from the discussion with the High School and Vocational School representatives, and application results of students to Highway studies as presented the results chapter, suggest that Oamk\_Highway is considered as feasible concept for a new type of pathway towards engineering degrees. The pilot approach and the value offered by the Highway studies are perceived as highly attractive both from the High Schools and Vocational Schools point of view, and most importantly, the pilot is well received by the students as it builds direct linkage to acquiring admission to OAUŠ engineering degree programs. The admission can be required by completing the pre-defined Oamk\_Highway courses during the High School or Vocational School study, and thus e.g., the pressure of the spring semester admission exams can be avoided by the students as they have already secured their engineering degree program admission to OAUŠ.

We plan to continue to observe the progress of Oamk\_Highway for coming years as the pilot project progresses forward, and we get more direct student feedback from their studies. Also, in the pilot stage all the Highway - courses were traditional classroom courses or online courses, but new learning approaches will be used in the

future. Our vision is to establish Oamk\_Highway as recognized and well-known concept for student towards engineering degree in Northern Finland and improve the timely graduation of engineering students.

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