Ideate, Evaluate and Share
- An Innovation Process Model for Educators

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ABSTRACT
The Innokas Network encourages schools to develop innovative approaches for teaching their students 21st century skills, by arranging training, providing consultation and hosting events in different parts of Finland. At the FabLearn conference, we would like to introduce our innovation process, which is a semi-structured maker-activity model, designed for use in cross-disciplinary maker-projects geared towards classrooms with a wide range of ages and ability levels. We will describe how teachers were trained to use the model and provide a few examples of how the innovation process was used to increase environmental and communal responsibility in the classroom.

Keywords
21st Century skills; curriculum; innovation process; maker-culture.

1. DESCRIPTION

1.1 Innovations in Finnish Basic Education
Innokas Network is a community of educators, stakeholders, teachers, principals and members from other fields who are interested in education. Innokas Network is an independent and non-profit organization, under the Faculty of Educational Sciences at the University of Helsinki, which provides both in-teacher preparation and in-service education. Innokas Network aims to add technology to education in a meaningful way, by engaging students to be more involved with their own learning, by supporting teachers to use technology pedagogically, and by encouraging both teachers and students to understand the educational needs in this ever-changing world. Participating educators in the Innokas Network are forerunners in teachers' in-service-training in Finland. The training modules developed through the Innokas Network are based on ongoing research [1,2,3,4]. Their primary goal is to develop and share the Innovation Education with a larger audience. The Innovation Education is a cross-disciplinary approach combining Finnish traditions in science, technology, engineering, arts, and mathematics (STEAM), crafts, and other subjects with the methods of digital fabrication, hands-on learning, and technology education. The Innovation Education is closely related to 'maker-culture', and it relies on assumption of students becoming innovators who envision and design something new in the projects where both knowledge and skills are developed [1,2].

The new National Curriculum [5] was introduced into the Finnish Basic Education program in 2016 (Image 1). It was first introduced for grades 1 – 6 (primary school) and later expanded to grades 7 – 9 (secondary school). Education providers have drawn up their own local curricula based on the National Curriculum. The reform is about rethinking learning and learning environments. It is about giving active roles to students and respecting their own questions, ideas and experiences. It is about giving teachers flexibility in how they teach. There have been many debates and reactions to the reform, both for and against it. For example, using phenomenon based learning and running interdisciplinary learning modules twice during the school year have raised discussion [6,7,8].

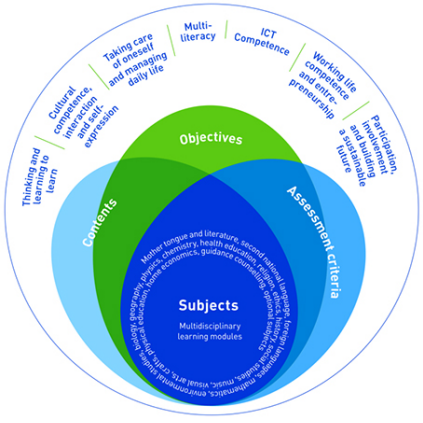

Image 1. Transversal competences [9]

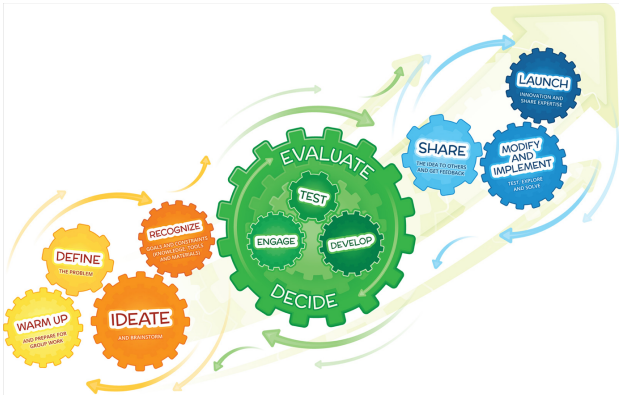

Image 2. Innovation process

Innokas Network has worked diligently with Finnish teachers to promote the concept of the Innovation Education and to educate them on how to adopt the demands of the new curriculum. The Innovation Education adheres to the Finnish model for maker activities used in an educational context [10], because it is carried out according to the Finnish Curriculum, where students learn transversal competences, as well as content knowledge and skills in different subjects, through collaborative maker activities. The Innovation Education promotes curious and critical thinking, strengthens the understanding of the built environment and the technology that exists there, and encourages the use of creative and innovative working methods, as well as the use of technology.

The Innovation Education is carried out through the innovation process (Image 2). It combines evidence-based teaching and learning strategies for knowledge-creation [11], collaborative designing [12], creative problem-solving in science and technology education [13], and support for learning [14]. The innovation process begins with a warm-up phase during which students engage in group work. In case the teacher wants students to use specific technological tools, the basics should be thought at this point. Next the problem for which students begin to innovate solutions is defined. Students brainstorm and ideate as many different ideas as possible. Different approaches can be used at this phase. The ideas are then reviewed by recognizing goals and constraints such as available technological tools or materials. Also, curricular goals (both knowledge and skills) should be introduced to students. Next the selected ideas are evaluated by testing and developing, and the best idea is chosen for further work. This chosen idea is shared to other groups or experts for feedback. Different approaches can be used in this. Based on received feedback the group starts to make prototypes, in other words modifying and implementing the innovation. In the implementation phase one may notice that the chosen solution did not work which guides the group to go back to ideate new solutions. Finally, the designs or products are presented to larger audience and published. It is noteworthy that often the innovation process does not progress linearly from the beginning to the end following the presented phases.

1.2 'New creative interdisciplinary projects' course

Innokas Network has already trained over 100 teachers in adopting the new curriculum's way of thinking, teaching and learning. The "four C's" of 21st Century skills—critical thinking, collaboration, communication and creativity—were taken into account during the course planning process. The transversal competencies of Finland's new curriculum were at the heart of the course planning. For the purposes of this ongoing project, maker culture training was seen as a way to create something new, together; in a way, it is a philosophical approach to learning. The idea of learning from each other, and of understanding the value of bringing technology into the innovative process, was both useful and eye-opening. For some teachers, there was also a degree of uncertainty that comes with learning new things.

The innovation process was introduced to 107 teachers (Image 3) from 44 compulsory schools from all around Finland during the 2017-2018 school year. The course, which was titled 'New creative interdisciplinary projects' (Image 4) included theoretical lectures and hands-on activities related to the innovation process and to learning across subject boundaries (e.g., the pedagogical use of digital technology, creative problem solving, evaluation, and teachers' roles in different parts of the process). As part of the course, individual teachers, or teacher teams, designed an interdisciplinary learning module for their school, following the innovation process design structure. Although there are certain structures to follow, the process itself is always different. In the end, the processes developed for each of the 44 schools were scalable, innovative and meaningful.

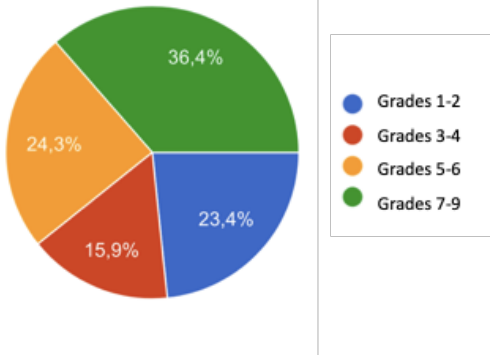

Image 3. Participating teachers' grades (n=107)

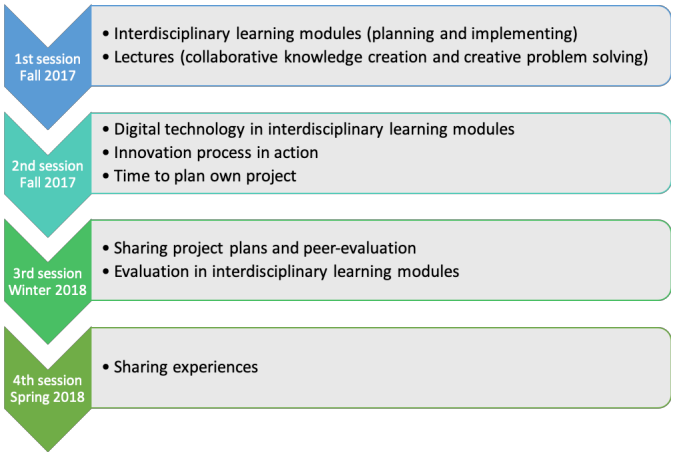

Image 4. Structure of the course

2. CONCLUSION

2.1 Results

Every single school met the goals for Basic Education as set by the National Curriculum. These goals include: thinking and learning to learn; taking care of oneself and others, managing daily activities, and safety; cultural competence, interaction and expression; multiliteracy; ICT-Competence; competence for the world of work and entrepreneurship; participation and influence, building the sustainable future; development as a human being and as a citizen. An example of how the goals were taken into consideration include having students work in teams and/or with older/younger students, to teach them new skills (e.g., how to clean a fish, how to use the iMovie-application, how to design a 3D-model). The innovation process was applied to the Basic Education program, and students created products, such as documents,

videos, games, posters, portfolios and 3D-models. Most of the projects ended with some kind of festival or exhibition, where the final products were shown to others. Students exchanged feedback with their teachers and fellow team members throughout the process, and were asked to do self-evaluations, as well.

Local and global awareness. Feedback collected from teachers and students at all participating schools indicates that all schools met their curriculum goals. Having experts visit the school, and having students and teachers visit other communities where they were able to learn and share in other environments, was seen as meaningful. Students visited actual dairy farms to see, first hand, how cows were milked. When they visited a recycling center, "sustainable development" became more than just two words in textbook. Students felt they were given more responsibility for their own learning and they also realized how much they were able to do to expand their own understanding. Students were challenged to pose questions and to find answers to them, by working together. Students saw documents related to their school's interdisciplinary theme, and they organized events, not only for their own community, but also for the other communities around their school. Local newspapers published articles about school projects. The multidimensional nature of involvement was noticed by all participants, at home and at school, in different classes and in the neighborhood around the schools.

Students' perspective/views. Students were carefully informed about the interdisciplinary learning module: what kind of timetable they would have; what kind of visits they would do; how they would work during the theme week; what aims and targets they should gain; and what kind of evaluation they would have during and after the process. At some schools, teachers shared the structure of the innovation process with their students. Some of the themes explored by the students in their projects included: geographical themes from the curriculum (e.g., Europe, Baltic countries, Stone age, my home city); science-based themes (e.g., light, environment, human, energy) and themes concentrated on learning different applications, devices and technology. Learning modules with interdisciplinary themes definitely promoted competence building. Some students said that they learned how to make compromises and how to respect opinions that were different from their own. Students liked the new way of working; learning-by-doing still works! The courage to try new things, the trips the students made and the huge steps they took during the project, were amazing.

Teachers' perspective/views. Teachers were satisfied with their project planning, team teaching, collaboration, engagement and commitment, and the flexibility of their own role as a teacher. Some teachers felt they had the courage to allow more freedom to their students, but many teachers were also hesitant about the role they had to take during the project. They were unsure of what methods they should have used with students who were not motivated or whose independent learning skills were not as strong as the other team members. Teachers also complained about the lack of time and how the planning work or time was not divided fairly among the teachers. Technical problems, large student groups, evaluations and ability grouping were seen as problematic. However, teachers felt that they had also learned a lot during the project. They appreciated the importance of a well-structured plan, and how much time it takes to make it work for a wide range of learners. Teachers also thought that both the goals and how they would be evaluated must be clear, so that students know what they are supposed to evaluate and how. Smart scheduling also helped a lot. If there are students from different age groups, there also has to be technology suitable for younger and older students. Without a doubt, confidence in using the innovation process grows by an experience.

3.2 Broader Value

There is much to be learned from this experience. Based on our experience, the innovation process model supports teachers and schools in putting the new curriculum´s aims and goals into practice. The innovation process steps mirrored the schools' processes and, therefore, they were easy to follow, track, interpret and adjust, as needed. The underlying values and the concept of learning in the Finnish curriculum is noticeable when students are encouraged to work to solve real-life problems. It encourages them to get more involved in activities affecting their own lives and, through that involvement, they become more aware of their potential impact on our world. Sharing good practices, not being afraid to make mistakes, inventing new ideas by working with many different communities, all work together to expand the maker-centered culture. The idea of a student being a passive knowledge collector is gone. There have been many debates about the role of teachers at school. Some people say that teachers should be more like coaches or facilitators. In this project, we saw that teachers are still needed and that they are the conductors of the whole student orchestra. While there needs to be a structure to follow, there also needs to be some flexibility to that structure.

In this exercise, the Innokas Network training course, itself, became an example of an innovative process. From our perspective, based on this course, we are more able to support teachers in the field. For future courses, we plan to better identify the more challenging phases of the process and focus on supporting teachers during those phases. For example, in the next course we will focus more on how to support a wide variety of different learners during the interdisciplinary learning module, by giving models of structuration, examples of differentiation, and knowledge of how to build a productive group. We believe that the Innokas Network model is scalable for any country and for any community.

4. BIOS

Raini Sipilä (M.Ed.) has close to 25 years of experience teaching and in the field of education. She is skilled in eLearning, 21st Century skills, lecturing, international relationships, and participatory design. Raini is a strong education professional and a passionate Future Classroom Ambassador, focused on developing the learning environment and working culture of both primary and secondary schools in Finland, and elsewhere. Raini is a panel member.

Kati Sormunen (M.Ed.) is a coordinator for the Innokas Network (www.innokas.fi/en) and doctoral student at the University of Helsinki. Kati has extensive experience working with pre-school and K-12 students, both in the mainstream and with special educational needs. She has developed The Innovation Education-related pedagogical approaches to computational thinking and coding skills in interdisciplinary projects, in cooperation with representatives from schools, universities and companies. Kati's professional academic interest span the wide landscape of 21st Century learning, especially as it pertains to inclusive pedagogy and ICT-supported learning, as well as methodological issues for learning in collaborative innovation processes.

Tiina Korhonen (PhD) is the head of the Innokas Network (www.innokas.fi/en), responsible for coordinating nationwide the Innovation Education activities for over 650 schools in Finland. Her research work, including the Innovative School framework, has been published in peer-reviewed publications and research textbooks. In her dissertation, Dr. Korhonen expanded the existing home-school collaboration model with novel ways to use digital technology to support a digital partnership between home and school. In her academic work, she collaborates with several international partners, including the FabLearn Lab at Stanford University. Dr. Korhonen's professional interests lay in the wide landscape of 21st Century learning and the development of school practice in the context of the digital society, with a special focus on the practical opportunities available through digital tools and processes, including digital learning environments, coding, and robotics. Through her national and international collaborative network, she develops and shares innovative school practices in learning, professional teaching and in school leadership and school partnerships.

5. ACKNOWLEDGMENTS

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