KNORK

Promoting Knowledge Work Practices in Education

Final Report   Public Part

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Executive Summary

The KNORK project (Promoting Knowledge Work Practices in Education) was aimed at developing secondary and tertiary education towards ensuring that students' learn knowledge work and digital competences that are relevant for their future studies and life in general. The pedagogical project objectives included supporting teachers in partner organizations to implement collaborative knowledge creation pedagogies in their courses. Special emphasis was given to collaboration and cross-fertilization between secondary and higher education institutions as well as between higher education institutions and work life organizations. The sophisticated use of mainstream digital technologies and cloud services in collaborative knowledge work was the central element of all promoted practices.

Other central objectives addressed the advancement of the pedagogical change widely through teacher training workshops organized during the project as well as through publishing good support models and materials for educational practitioners in secondary and tertiary levels. Teacher networking and ""Europeanization" was targeted through national and international teacher meetings. One important objective was to produce theory-informed and research-based models and guidelines about how to promote students' knowledge work and digital competencies as well as about the effectiveness of related teacher training.

The project partners represented various educational contexts: vocational schools, upper secondary schools, medical, technical and science universities as well as universities of applied sciences. The partnership combined expertise in technical and pedagogical research as well as strong practical experience about teaching and managing EU-project activities.

Educational development was theoretically based on the Trialogical Learning Approach and its pedagogical design principles that explicate sophisticated collaborative knowledge creation practices for educational settings. The teachers were educated to the pedagogical approach in practical, hands-on teacher training workshops. A large number of courses, re-designed and implemented by the trained teachers, were followed and investigated by the researchers. Pedagogical examples and guidelines were written and published based on the experiences. A self-reflection questionnaire for students and teachers was develop to measure the competence development during the implemented courses, and the results were reported in project reports and scientific publications.

The main products of the project are the online Re-use Library including pedagogical examples, guidelines and materials for TLA pedagogy, the Online Teacher Training Package for teacher trainers, EdX platform for creating web-materials as well as research reports summarising the results of pedagogical development and students' learning of knowledge work and digital competences. All information and published materials can be reached through the project website, including project blog, list of publications as well as links to the products. The material will be openly available for educational practitioners worldwide. Also the project partners will use the material in forthcoming teacher training occasions, educational development work, and international scientific publications.

Table of Contents

1. Project Objectives

The KNORK project aimed at supporting teachers to develop pedagogical practices in the participating institutions to promote students' knowledge work and digital competencies following the trialogical learning approach (TLA), which emphasises collaborative knowledge creation. Based on these experiences and results, we aimed, further, to disseminate the outcomes wider to educational practitioners in various institutions. The aim was also to develop the use of meaningful digital tools in educational settings. In addition, we aimed to create such materials which can be used also after the project to support teachers, and we aimed to produce relevant research results about teachers' pedagogical practices and students' knowledge work competencies, based on the trialogical approach. The main target group of the project are teachers in upper secondary schools and higher education institutions as well as principals and other educational staff working for pedagogical development.

In the following, the original objectives are reflected, one by one, based on the results of the project.

The first objective of the project was to develop the pedagogical practices in the participating institutions by two ways: by promoting students' knowledge work and digital competencies following the trialogical learning approach, and by supporting teachers in re-designing their teaching using trialogical design principles and modern digital technology.

In the project, partner organisation organised various types of support to teachers in order to create or improve courses which followed the trialogical approach. The new or improved courses and study units were based on pedagogical practices which enhance the development of knowledge work and digital competencies. In all, 71 courses and study units, with 227 teachers and 3170 students participating in them, were implemented and investigated during the project.

The results of students' improved competencies were investigated by the Collaborative Knowledge Practices questionnaire (CKP). The results show that students in most courses evaluated that they had learnt new competencies. The research results are described in the summary of surveys, available at http://knork.info/website/wp-content/uploads/2014/05/FinalscientificM24report.pdf.

In addition, the partners organised workshops at several educational institutions which collaborated with the KNORK partners. Teachers in these institutions also started to use the trialogical approach and the design principles for re-organising their courses. Examples of such collaboration are the following contacts of the University of Helsinki (UH), the Technical University of Sofia (TUS) and the University of Rome Sapienza:

- UH collaborators: Vantaa Vocational School Varia - Vantaa, Tapiola and Olari Upper secondary schools - Espoo, Finland.

- TUS collaborators: Faculty of Electronics and Automation, Plovdiv branch to TUS, Technical College by Plovdiv University "Paisiy Hilendarski" - Smolyan, Technical University - Gabrovo, Technical University - Varna, Bulgaria.

- UR collaborators: University School for Ostheopaths C.E.R.D.O. of Rome, High School Labriola of Ostia - Rome, High School Montessori of Rome, Vocational School Jannuzzi of Andria - Barletta – Trani

The second objective was to enhance cross-fertilization contacts between secondary and higher education institutions as well as between higher education institutions and work life organizations in teaching practices. As a matter of fact, the promotion of cross-fertilization is one of the trialogical design principles and thus it was seriously taken into account in various course designs. The following examples of courses with cross fertilization show that the aim was well fulfilled:

- Helsinki Media Arts Upper Secondary School: In the integrated courses about Energy (physics, chemistry, biology), a visitor from solar energy company gave an expert lecture. The voluntary work course was planned around visits and collaboration with external partners. The Finnish language course included a virtual session with an active reader; students talked with the lady about reading habits. During a joint course of Finnish language and history, students collaborated with the Metropolia University of Applied Sciences in programming.

- University of Helsinki: Project members participated in the network which aims at developing university courses that promote students' project work competences. Collaboration between the researchers and university lecturers resulted in co-authoring a guide book for students about project work as well as in designing, implementing and investigating two project work courses in the Department of Agriculture. In the courses, students practiced various working life skills and collaborated with external experts.

- Technology school "Electronic systems" (TUES): All modified and implemented courses were transformed with close cooperation between the school and Technical University of Sofia. "CAD in Electronics" course was delivered by teachers both from school and university. The course "Networking Technology", transformed as project based, was conducted in close cooperation with industry experts as external teachers and for project guidance.

- Metropolia University of Applied Sciences: A multidisciplinary project course was organised to design mobile applications based on open data. The open data was provided by the Helsinki Region Infoshare (HRI) initiative of the City of Helsinki. The students collaborated with several experts from HRI staff throughout the course, e.g., in design, brainstorming and steering group sessions. Another example is a course with the Helsinki Media Arts Upper Secondary School, where students attended the university level course to design and construct a board game. The teacher of the UAS operated as a moderator and facilitator during the development process.

- UR Sapienza: A professional university course on e-Learning for work psychologists was redesigned together with e-Learning companies evolved in the course. In particular, trialogical objects were defined together with the companies and proposed to their clients at the end of the course. Moreover, during the collaborative construction, companies participated in the definition via ongoing feedback and comments, which were useful for a long-term advancement of knowledge.

The third objective was to promote the use of open online environments and cloud services as well as test the MOOC and flipped classroom approaches. The use of digital tools is also one of the trialogical design principles; therefore, it was promoted in all pedagogical development work as well as in all project management. The new digital tools were actively in use in the daily practices of the project and discussed in the meetings. Partners also wrote 17 tool use suggestions

in the Re-Use Library created in the project. From the first project workshop, the use of new technologies was an essential issue, and the participants were taught how to use various tools; e.g. the Intranet that was implemented in WordPress and later the EdX platform.

The MOOC approach was tested in creating the Online Teacher Training Package (see http://knork.info/website/teacher-training-package/) which consists of material to be used when conducting training for teachers about the trialogical approach and other themes close to the KNORK project. However, any true course following the MOOC approach was not possible to create because the partner organisations (namely the universities) did not have the resources required for MOOC development. Similarly, the flipped classroom approach was somewhat tested but for the participating teachers, applying and implementing the trialogical approach was the main issue. The flipped classroom approach is probably based more on individual learning and requires somewhat different planning than courses that follow collaborative knowledge work practices.

The fourth objective was to produce cost-effective models for supporting teachers' professional development in secondary and higher education institutions. Some models of teacher training and tutoring are described in the items of the Re-use library. Concrete training took place in the 52 teacher workshops organised by the partners, and in the large amount of small-scale tutoring in schools. Many of the workshops were organised by colleagues in the participants' own schools and institutions; thus, they were very close to the "end-user", the ordinary teacher. From our experience (as well as from research) we know that practices are best learnt when situated in ordinary and authentic contexts. The main principle of KNORK training was that teachers apply the new models directly in their own teaching, either when creating new courses or improving existing ones. The same models of working with teachers were also used in the consortium-level face-to-face meetings and training occasions (in Helsinki, in Bulgaria and in Italy).

Pictures from the first project meeting in Helsinki.

A central method to support teachers' professional development was to encourage teachers to present and share their experiences and results in various events, national as well as international. Examples of these are e.g.: Teachers from TUES participated in many scientific national and international conferences (SAUM 2014, in Nish, Serbia; Electronics 2014, 2015 in Bulgaria; ICEST 2016 in Ohrid, Macedonia), where they disseminated their experiences about the collaborative learning approach in secondary education. Project participation contributed also in

enhancing TUES teachers' qualification and to their academic achievement: one teacher started her PhD thesis, and the principal obtained academic degree as Associate Professor during the project period. The TUES principal was an invited speaker at a wide National forum on e-Education (http://events.idg.bg/en/2015/education//speakers) especially to share KNORK experiences. The picture below is from Finland, from a large national conference Interactive technology in education. The ladies are from Helsinki Media Arts Upper Secondary School, Metropolia University of Applied Sciences and from the Vantaa Vocational College Varia, presenting their courses in a joint stand.

At the Salvemini school, a small group of teachers (seven) were at first involved in the project and used the trialogical approach in their own practices. After a joint reflection with the researchers on the various activities, the TLA package was illustrated and proposed to all the teachers of the institute. Many of them volunteered to used it in their own practices. In this way a scaling up was possible and the TLA it has become a shared practice for the entire institute.

In addition, starting from this training package the trialogical approach has been introduced in other 5 schools in the Apulia region; and after a brief introduction of the model, almost a hundred teachers decided to get the dedicated training. Next year (2017) some of these teachers will try to apply the model.

The fifth objective was to create an online Re-use Library for teachers, educators and researchers to share and further develop pedagogical scenarios, experiences and other materials. The consortium worked on this objective from the beginning of the project; altogether, partners created 110 items for the library. The Re-use Library is available at http://knork.info/website/reuselibrary/.

The sixth objective was the "Europeanization" of teachers and education: supporting a European network of teachers so that practices can be exchanged and teachers

can learn from each other. This was achieved in consortium meetings, which created a "shared space" for the participants. This was especially well achieved in the Final conference when teachers presented their posters to each other about their applications of the common pedagogical approach (see pictures below). As a result of the "Europeanization", participating schools have acquired competence for European-level projects, e.g., Helsinki Media Arts Upper Secondary School has started as a partner in a new European project.
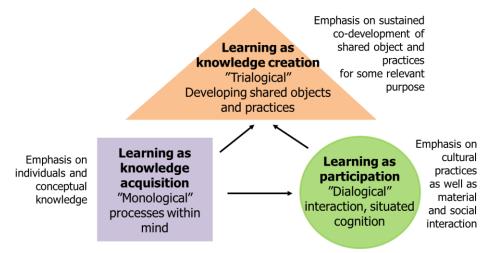

Pictures from the Final conference in Rome, January 2016.

The seventh objective was to produce research-based knowledge of the appropriateness of the tested pedagogical methods for promoting students' knowledge work and digital competencies as well as the effectiveness of the new models for educating teachers in adopting knowledge work practices and digital technology in their teaching.

This objective is related to the first objective, but more from the research point of view. The research partners collaborated very actively and produced several conference papers and article drafts. In addition, several partners continue working on joint articles, several of which are planned to be included in a special issue about knowledge work competences. Besides the educational research partners, also technology researchers have been active in conferences and in preparing articles about pedagogical approaches in their field. Altogether, more than 40 articles have been published in journals, books, conference proceedings and online journals, addressing researchers, teachers and educational experts. In addition, the KNORK partners have attended or organized more than 140 events, such as workshops, conferences, and seminars, giving presentations, lessons and speeches on the project results and activities.

2. Project Approach

The project was based on the trialogical learning approach (TLA; Paavola & Hakkarainen, 2005; 2009), a theory-driven approach that emphasizes collaborative knowledge creation and the use of modern digital technologies as pedagogical methods to educate present-day students to learn relevant competences for the future. Pedagogy emphasising collaborative knowledge creation is represented by the *knowledge creation metaphor of learning*, complementing *the acquisition and participation metaphors* introduced by Sfard (1998): learning is not only individual knowledge acquisition or participation in existing social and professional activities, but also the creation of new knowledge and practices in collaboration with others.

The trialogical learning approach has been concretized into pedagogical design principles that define sophisticated knowledge creation practices (see http://knork.info/website/reuselibrary/trialogical-design-principles/; Paavola et al., 2011) - however, they require understanding and creativity from teachers when applying in practice. One starting point for the project was to test the design principles in various educational settings and receive concrete experiences of them for further use. In the discussions between the partners, starting from the meeting in Sofia in January 2015, the concretisation resulted in creating *educational design patterns*: observations of pedagogical solutions that have been successful, documented in a systematic fashion to make them usable in various contexts. We decided to add a category for publishing the created design patterns in the Re-use Library (see http://knork.info/website/reuselibrary_category/design-pattern/). Altogether, the partners produced 32 design patterns. An examples of created patterns is, e.g., "Add small-scale collaborative knowledge creation activities in a course emphasizing individual work" and "External experts in schools".

Teacher training for the trialogical pedagogy was supported by organizing, first, a training workshop for the project partners; it worked as a model for training teachers locally. The workshop consisted of short introductory lectures about knowledge work competences, and TLA and design principles, but the main emphasis was on the participants' own course design. It started by writing, in a template, ideas about how to apply the trialogical design principles in one's own teaching, and then making a concrete schedule and description of the methods. The plans were shared

and commented on through social media applications. An openly available Online Teacher Training Package (see http://knork.info/website/teacher-training-package) was created for educators and trainers wishing to run similar workshops.

The practical work of designing and improving courses was accompanied by research efforts. To support the practical work and to construct "lessons learnt" summaries and guidelines, a large number of cases were followed and investigated. Surveys were administered by the partners to collect data from practices that had similar foci in different educational contexts. First, teachers' goals, expectations and plans for developing pedagogical practices promoting students' digital and knowledge work competencies were addressed. Second, once the cases had been implemented, the focus moved to the teachers' descriptions and experiences of the modified and implemented courses. Third, when courses had been conducted, interest was directed to the participating students' self-reflections concerning their learning of knowledge work competences during courses. Data about students' self-reflections were especially collected using the CKP" questionnaire, an instrument designed to investigate collaborative knowledge work practices in education.

The technology adopted for online learning platform is Open edX, which is open source platform for interactive online courses and MOOCs (https://open.edx.org/). It was installed on the project's own server, adapted to the project's needs and maintained throughout the project (http://edx.knork.info). The edX was also used for the open Online Teacher Training Package. The edX Studio, the course authoring tool of edX, for the project is available at: http://studio.edx.mw.metropolia.fi/. The collaborative knowledge creation tools used in the project were mainly free cloud services because only seldom schools and other educational institutions can afford buying multiple applications. We also wanted to avoid sticking too much on some single environment or tool which might not be available for the partners after the project (the only exception was Adobe Connect which we used for virtual meetings). The tools are described in the Re-Use Library (altogether 17; see http://knork.info/website/reuselibrary_category/tool).

The collaborative workspace for project partners, called "intranet", (http://knork.metropolia.fi/intra2/) was implemented using the WordPress content management system (https://wordpress.org/). The public project website is also running on WordPress, which allowed project partners to publish documents, blog posts etc. using the same familiar user interface and tools as for the intranet. In practice, the intranet and the public website are separate instances of WordPress, giving a clearer border and finer access control of the private/protected content from the public one. With both instances using the same CMS, it was easy to migrate content from one place to the other; for example, a document under editing could be moved from the protected space to the public website once reviewed.

The web repository for the Re-use Library (http://knork.info/website/re-use-library/) allows the storing of specifically structured and formatted documents. The web repository is implemented with WordPress. The Re-use Library documents were collaboratively produced using custom Google Docs template and stored in a shared Google Drive folder. From there they were parsed and transferred to the library in WordPress, with a link back to the full Google document or a PDF version

of it. To ease this process and to provide a stable place for the library content after the project, it was decided to develop software that transfers the items from Google Drive to GitHub repository (http://tla-reuse-lib.github.io/knork/reuselib.html) and processes them to standard format, which can then be used for publication on any platform, including WordPress. Another advantage on storing content to GutHub compared to Google Drive is that it is indexed by search engines.

Technology partners Metropolia and TUS provided user training as needed and organised a help-service in case of problems with technology. Help was mainly needed at the beginning of the project with the Intranet.

In order to support the project implementation through its different phases and steps, an Evaluation and Monitoring system was developed together with a dedicated set of tools to collect information and data for the analysis, assessment and control of the project activities. These were used also for interim and final internal evaluations, considering different aspects of the project.

In order to make all project outputs and results available and accessible to widest possible audience, and to favour pedagogical approaches supporting novel knowledge work and digital competencies, the KNORK partners defined a detailed Dissemination strategy, including ad hoc communication tools and activities: The web portal http://knork.info/website and the blog http://knork.info/website/blog/ represented the main communication tools, and provided free access to all project outcomes and results. They have been promoted by all partners through social networks such as Twitter and Facebook (www.facebook.com/knorkproject). Furthermore, according to the agreed strategy and the project objectives, the KNORK partners have undertaken a wide range of dissemination activities, such as participation in and organization of events (workshops, conferences, etc.), publication of articles and book chapters as well as creation of contacts and synergies with other projects and networks.

Exploitation was based on collaboratively created plans, but also national plans were needed because partners can best continue the dissemination of the results nationally and locally, except the research outcomes which are international. The purpose of the exploitation plan is to make our results available and widely used after the project. In various social media tools, the participants will inform about the project outcomes. The TLA, Re-use Library contents, Online Teacher Training Package, and the design principles will be used and presented in training events organised in schools, school administration or university training organisations. The TLA will be introduced and implemented in many new courses in the universities and schools in partner countries. The same approach will be used to renew the university curricula in Finland and Bulgaria, which are going to be changed to emphasise work life competences. Making the outcomes of the project widely known is predicted in 4 article published in local press releases, 30 papers at external conferences and scientific journals (all partners) and 10 master theses and one PhD thesis (in Italy) soon after the project end. In addition, the research data collected from the KNORK cased during the project (CKP questionnaire data, qualitative data) will be further analysed and published in various conferences and international scientific journals.

3. Project Outcomes & Results

The concrete outcomes and results of the project are described below.

Re-use Library is a web repository of re-usable examples and material supporting teachers in implementing collaborative knowledge creation pedagogies and use of digital technologies in educational settings. At the end of the project, the library includes 110 items consisting of Pedagogical cases (27), Tool suggestions (27), Educational design patterns (32) and Educational resources (34). Most items are in English (72), but there is also material in Finnish (23), Italian (10), Bulgarian (3) and Swedish (2). Re-Use Library is available at http://knork.info/website/reuselibrary/.

Online Teacher Training Package is meant as support material for teacher trainers in carrying out national and international teacher training workshops about knowledge creation pedagogy and the TLA. The package includes an example scenario for organizing a four-hour teacher training workshop. All sections of the package include two parts: 1) instructions for the trainers conducting the teacher training, and 2) example content to be used when creating the working spaces for the participants of the training. The package is implemented using the EdX platform of the Metropolia UAS, but the material can be copied also to other digital platforms. The package is available both in English and in Finnish. Further information and links are available at http://knork.info/website/teacher-training-package/.

Teacher training workshops about the TLA were organized widely by all project partners locally in their own countries. At the end of the project, the partners had arranged 52 workshops with total of 1153 participants. The aim of the workshops was, in general, to teach teachers how to support the new knowledge work competencies during their courses. In addition, two international workshops were arranged in Finland and Bulgaria connected to the project meetings. We had more workshops throughout the project than was originally planned. Most of them were from 2 to 4 hours. Some workshops were part of a longer training process with multiple meetings and a blended learning approach for the same participants. The total number of participants in the various individual teacher training occasions was counted to be about 1150.

Open online learning platform was implemented using the Open edX platform (http://edx.knork.info). It allows teachers to create open online learning environments for their courses and combine them with advanced tools for collaborative knowledge creation. The Online Teacher Training Package is hosted on this edX server. The course authoring tool edX Studio is available at http://studio.edx.mw.metropolia.fi/. All edX services of the project will be maintained free of charge for the partners for minimum of two years after the project end.

Collaborative knowledge creation tools used in the project were mainly free cloud services. The tool descriptions and usage guidelines are available in the Tools category of the Re-use Library (http://knork.info/website/reuselibrary_category/tool).

Web repository for Re-use Library (http://knork.info/website/re-use-library/) was implemented using a combination of WordPress, Google Drive, GitHub repository

and custom software developed in the project. The repository provides storage and publishing of the Re-use Library documents. A stable place for the Re-use library content after the project is at GitHub (http://tla-reuse-lib.github.io/knork/reuselib.html), where the content can be transferred to other publishing platforms as well.

Collaborative workspaces for project partners was provided as intranet service implemented on WordPress platform (http://knork.metropolia.fi/intra2/).The public website of the project is also running on WordPress, providing a unified communication channel for the project.

The instrument for collecting students' and teachers' reflections of the learnt knowledge work and digital competences, *the Collaborative Knowledge Practices questionnaire (CKP)*, was an important research achievement in the project. It was developed on the basis of theory originally in Finnish, but was translated and adapted into English in a systematic fashion. The first scientific publications of the structure and validity of the instrument are under construction at the end of the project.

Also the *Educational design patterns*, published in the Re-use Library, were an intentional result of the research endeavours. The formulation of pattern contributions was made to concretize and refine the theory about collaborative knowledge-creation and especially the trialogical design principles. The researchers of the project have plans to start preparing scientific publications about the pattern approach.

Empirical results of the pedagogical case and survey studies of the project have been summarized in two public *Research reports* available through the project website. Research results have also been published in several conference presentations and proceedings articles; in addition, multiple proceedings articles, book chapters and journal articles are in press or under construction.

Besides the KNORK website, the *outcomes of the dissemination* can be summarised as follows:

- Final International conference (Rome, IT 12/01/2016), 5 national dissemination events (IT, BG, FI, SE) and about 140 events attended or organised by partners in schools, as well as within congresses, conferences and workshops, globally involving more than 7000 key stakeholders in education in partner countries and at international level. More than 40 articles published in specialised magazines, scientific books and journals, conference proceedings, etc., with a potential audience of about 20.000 users reached.

- All such deliverables, as special kind of outcomes, which are public are available in the KNORK website in http://knork.info/website/publications/.

- One special kind of outcome is the blog (http://knork.info/website/blog/), in which various people in partner organisations wrote, telling about their ideas, experiences, outcomes, and news. It was probably a good tool even within the consortium for the informal communication although it was primarily aimed for the external stakeholders.

4.   Partnerships

The project partnerships were founded on the basis of the following starting points:

- Partners had previous experience of collaborating with some other partners.

- To create good school - higher education contacts so that every participating school had an experienced higher education institution to support them in conducting the project activities.

- To have a balance between pedagogical practice, research and technology development.

- To include partners from various European areas.

- To have high level partners who have competence in running the project as well as possible, and to conduct it with good local and national networks.

The expectations of the partnership were nicely fulfilled. Partners represented pedagogical practice (three upper secondary schools and five higher education institutions with teaching responsibilities), high-level technology development and research (two higher education institutions) and educational research (three higher education institutions). In addition, one partner had wide expertise in project administration, dissemination and evaluation. As such, the combination was good. All partners had their specialties, but there was also enough shared understanding for effective collaboration. The consortium worked smoothly and in a motivated way. In the face-to-face consortium meetings and in the Final conference, the strength of the consortium was apparent: the discussions created new ideas and approaches, the atmosphere was good and productive, and new contacts were created.

One of the signs of the satisfaction with the consortium and its work is that partners have plans for further collaboration, especially all the higher education institutions will continue writing articles and proposals together. Researchers had also a face-to-face meeting during the EARLI 2015 conference and researchers from University of Helsinki and Karolinska Institutet met in Helsinki in June 2016.

The partner schools received more experience of European level projects, and, e.g., Helsinki Media Arts Upper Secondary School has started as a partner in a new European project. It was also nice to see how motivated all the participating teachers were in the consortium meetings and in their own schools.

TUES teachers participated in many workshop and teacher training activities, and, as a result, several courses were transformed by applying the trialogical approach. The greatest benefit from school participation was the competences obtained by the TUES students, educated in new collaborative approaches. As a result, they won national and international competitions: Computer Networking, Hackatons, and the largest global line trace type robot competition "Renesas MCU Car Rally 2016" in Germany, which all required strong teamwork and digital competences.

For many teachers, KNORK project was the first experience of this kind of collaboration; e.g., giving presentations in the Final conference (as well as in the national conferences) was a challenge which the teachers managed well. The project certainly opened new perspectives to these teachers also for their further

teacher work. Researchers have naturally had European level collaboration even before the project, but new contacts were created and mutual collaboration was increased and will continue after the project. A researcher from UH will have a research visit in UR in autumn 2016, funded by the Finnish Academy.

The partners have created also new national contacts and networks. The huge amount of dissemination activities and synergies as well as teacher workshops are good proofs of this. The trialogical approach as well as the knowledge work competencies are a very central issue in education, but also a new issue; for this reason, practical examples and experiences are much needed in the field. E.g., in Finland, the KNORK researchers have had requests for lectures also after the project especially because the Finnish National Board of Education has accepted new curriculum in which work life competencies, digital competence and integrated learning entities are core emphases. The examples and experiences of KNORK bring something concrete to schools and teachers about these new requirements.

In general, the partners have conducted their responsibilities well and in time. The consortium had no such problems or delays which had consequences to the project work. As expected, the schools have had some difficulties with the administrative tasks, but mid-reporting helped them in practicing the final reporting. Minor deviations of the work plan (postponing a research report and organising the Final conference earlier than planned) were together agreed on for practical reasons.

There was somewhat less tasks related to the development of digital technology than planned, but the two technology partners, both higher education institutions, worked also in pedagogical development and research, and they disseminated the outcomes of the project widely, within their own institution and in their field of expertise (see the dissemination results).

The consortium relied strongly on the virtual tools in running the project, mainly the intranet which was tailored for the project by Metropolia and Technical University of Sofia. In the intranet, all the essential materials of the project were available. In addition, we used Adobe Connect for virtual meetings and, naturally, email. Also the periodical calls helped the internal communication and strengthened the partnership Email was mainly used for 1) guiding the financial issues since in many partner organisations the administrative staff did not use the intranet, and 2) for many practical and small-group communication, and 3) also sometimes for being sure that every partner gets the information. One more tool for sharing experiences was blog, which was used also for external dissemination. At the beginning of the project, some partners probably had difficulties to start using the tools, but little by little people got used to them. The learning of using the virtual tools by the members is one internal, small scale outcome of the project.

The management was organised through seven work packages which worked closely with each other because of the small size of the project. Work package leaders formed the co-ordination committee, which had meetings when necessary. In addition, work packages "Developing knowledge work practices in education" and "Investigating knowledge work practices in education" which represented educational practice and research, had joint meetings and collaborated regularly because their work was about the same phenomena.

5. Plans for the Future

The project results will be exploited and further developed after the project lifetime both locally inside participating institutions, nationally to educational policy makers and authorities and internationally through virtual forums, social media channels and scientific publications. As outcomes, the project produces new teaching methods and inter-institutional collaboration practices for the participating institutions as well as pedagogical examples, materials and digital tools to be re-used widely by educators in secondary and tertiary education in Europe. The KNORK Consortium has discussed and made plans for exploitation in D7.1. Exploitation plan & National exploitation plans.

Exploitation will concern the main outcomes: the Online Teacher Training Package (http://knork.info/website/teacher-training-package/), pedagogical guidelines and examples in the Re-use library (http://knork.info/website/re-use-library/), technology application (EdX platform in Metropolia server), and research results. The Metropolia server will work for two years after the project, till summer 2018.

The Online Teacher Training Package and pedagogical support material are openly available to promote the re-use of project outcomes among educators, researchers and other stakeholders for advancing the learning of knowledge work and digital competencies in educational settings.

The following means will be used for reaching the target groups after the project:

1) In the partner organizations, participating teachers and researchers will further exploit and disseminate the results through collegial tutoring and peer-support practices to get sustainable effects. Partners have created national exploitation plans for an effective exploitation and to ensure sustainability of the project's outcomes and greater concreteness in their future use.

2) In partner schools as well as in other collaborating schools, the focus is on supporting school level changes instead of training individual teachers to promote collaborative improvements.

3) We will incorporate the Online Teacher Training Package and the Re-use Library materials in established national and European level repositories (e.g., Scientix or Resources of the Open Education Europe portal) to ensure their availability also after the project.

4) For higher education, university partners will utilize the results and experiences in their courses, lectures and seminars as well as disseminate the outcomes in various pedagogical higher education contexts.

5) For all target groups, presentations in professional and scientific national and international conferences and meetings will be given also after the project based on the research results and practical experiences.

6) For researchers and policy makers, publications in professional journals and textbooks as well as scientific journals and compilation works will be published also after the project based on the research results and practical experiences.

7) All partners will use their professional networks as well as social media to make the experiences and project results available after the project lifetime.

In general, the outcomes of the project are open and free for any user. The idea is that anyone can use them, but we wish that the source is mentioned. Authors have, however, the copyright always in their own materials.

Our approach to market analysis is not confined to economic-financial aspects. Rather, we see the market analysis, first and foremost, as an analysis of needs and use: who could use the result being developed, how the benefit from using the result is conceived/assessed by its would-be users, what parallel/alternative tools and practices that serve a similar function are available, etc.

Various mainstreaming and multiplication actions will be carried out in various levels to ensure the impact of the project beyond its lifetime: in institutional level, in regional and national level, in cross-national professional networks, in the international scientific community, in the user and developer communities as well as by education authorities and policy makers. These are carried on by individual partners.

The researchers will further apply and develop the theoretical framework of the trialogical learning approach as well as the research instruments (e.g., the Collaborative Knowledge Practices Questionnaire) in their future research endeavours and projects.

Research partners have made their own plans for publications in professional and scientific journals, social media and newspapers in their countries as well as for presentations at the international forums, conferences and meetings after the project for the further exploitation of the KNORK outcomes. Joint publications between partners are also predicted.

6. Contribution to EU policies

The project have contributed to key EU policies in the following ways:

- *Supporting the development of innovative ICT-based content, services, pedagogies and practice for lifelong learning:* In the project, a large number of secondary and tertiary level teachers were trained in applying knowledge creation pedagogies that promote students' knowledge work and digital competences. A large amount of web-materials were created and published, including models, guidelines and teacher training resources about knowledge creation pedagogies.

- *Encouraging the best use of results, innovative products and processes and exchanging good practice, in order to improve the quality of education and training:* One key strategy was to direct the training and support activities for a bigger group of teachers in each organization, in order to promote teacher collaboration and, thus, more effective spreading and sustainability of the pedagogical improvement also after the project. All created support materials are openly available in the web, and active dissemination efforts have been made to inform about them. Most material is in English, but some recourses especially targeted for secondary level teachers are offered in national languages of the partner organizations.

- *Promoting European co-operation in fields covering two or more sub-programmes:* One explicated principle in the pedagogical approach of the project was the promotion of cross-fertilization between secondary and higher education institutions as well as between higher education institutions and work life organizations. This was successfully achieved in multiple actualized educational activities and courses, and most practices will continue also in the future implementations of the same courses.

- *Reinforcing key competences, such as digital competence, bridging the worlds of education and work.* The main motivation of the whole project was to develop and disseminate pedagogical practices that promote secondary and tertiary level students' knowledge work and digital competences. The use of digital technologies in collaborative knowledge practices in a professional and sophisticated way was an essential element in all pedagogical models and activities created and implemented. Bridging the worlds of education and work was was most concretely achieved in multiple secondary and university level courses where studens directly collaborated with experts from the work life.

- *Promoting equality between men and women and contributing to combating all forms of discrimination based on sex, racial or ethnic origin, religion or belief, disability, age or sexual orientatio:* The pedagogical ideal declared by the project emphasized that formal education both in secondary and tertiary levels should develop all students' knolwedge work and digital competences, regardless of their background and life situation. We believe that the increased use of digital technologies in formal education has especially strengthened female students' and teachers' self-confidence in digital competence.