eCraft2Learn

**Digital Fabrication and Maker Movement in Education
Making Computer – supported Artefacts from Scratch**

Deliverable D6.6

Exploitation Strategy Documentation

PROJECT DESCRIPTION

Acronym:	**eCraft2Learn**
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The University of Oxford, United Kingdom, (UOXF)

SYNYO GmbH, Austria, (SYNYO)

University of Padua, Italy, (UNIPD)

Technopolis City of Athens, Greece (TECHNOPOLIS)

Evothings, Sweden (EVOTHINGS)

Arduino, Sweden (ARD)

Ultimaker, United Kingdom (ULTIMAKER)

Linnaeus University, Sweden, (LNU)

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1	20.12.2018	Stela Shiroka (SYNYO)	Draft	Bernhard Jäger, (SYNYO)
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EXECUTIVE SUMMARY

This deliverable summarises all achievements of the eCraft2Learn project, describing the concrete outputs that are highly relevant for future use by the consortium partners and the target groups. The two-year project has created a learning ecosystem including a pedagogical methodology, a technical infrastructure and a series of guiding materials for implementing an ecosystem of crafts- and project-based learning in formal and informal education. As such, the project stakeholders include a vast community of teachers, coaches as well as decision-makers at national and European from all over Europe. As one of the main aims of the project and the aim of this document is to create plan for ensuring the learning ecosystem is widely embraced by the community and implemented in the educational ecosystem all over Europe, this document presents the measures taken within the project to enable a sustainable future use and the next steps with regards to a boarder dissemination within the educational community in Europe.

1 INTRODUCTION

This report presents exploitation strategy for the eCraft2Learn learning ecosystem including all its components developed within the project lifetime. The main purpose of this strategy is to tailor concrete future plans that ensure the learning ecosystem, validated and improved through the two pilot phases in Finland and Greece during the project lifetime, reach a boarder range of community stakeholders and has a greater potential to be implemented as part of formal or informal learning all over Europe and beyond. Secondly, this strategy document seeks to identify individual results generated within the project, that are potentially re-usable for similar purposes, and products and services that can be triggered by them. The provided exploitation plan seeks to ensure the sustainability of the project outcomes after the finalization of the H2020 funding.

The exploitation strategy was created in the last project months allowing the consortium to have a better understanding of concrete outcomes of the overall project and potential exploitation opportunities. The Expert and Advisory board was engaged in this task by providing their feedback for a broader uptake or refinement of the learning ecosystem in the future.

The first part of this document lists the all components of the eCraft2Learn learning ecosystem and additional outputs of the project that can be considered as exploitable results for future purposes. The second part describes the plan for keeping the community as a whole alive, and ensuring that greater interest is ignited to teachers, students, coaches and decision-makers in the education sphere, to embrace the methodology and tools created by eCraft2Learn. We do this by listing again the types of stakeholders the project it targeted to, and the support materials for each of these groups to understand the project outcomes and be able to implement them in a sustainable way. Further on we describe the overall support materials developed, a community group created for ensuring the continuation of cooperation among the community members and the for enabling its expansion, and concrete next steps the partners intend to take with regards to further funding opportunities for training and dissemination purposes. The last part of the documents lists the individual exploitation plans of each of the partners organizations with regards to the individual expertise gathered by their engagement in the project as well as the impact this engagement and contribution had in all partner organizations.

2   EXPLOITABLE RESULTS AND PRODUCTS

The following sections describe exploitable outcomes of each of the work packages, the partners that were responsible or involved for their creation, types of materials, the target groups they are mainly oriented to as well as how they are expected to be sustainable for future use and what their future impact can be.

2.1.   WORK PACKAGE 2

Task	T2.2
Involved Partners	SYNYO
IP Object	Scenarios and Recommendations
Type	Digital Material
Description – During the project	Future Scenarios with regards to innovation barriers and enabler in education based on the teacher interviews conducted as part of WP2 and their related recommendation to each of the project stakeholder groups for enabling the creation of an education ecosystem that
License	CC-BY-SA 3.0
Target Group	Teachers, school principals, national educational authorities, educational technology providers, European Union
Sustainability	Part of the overall guiding package available at the project website, community group, Scientix platform etc.
Expected Impact	Support target stakeholder groups in taking the right measures for creating an education ecosystem that is more open to innovative practices and concepts, and thus can ensure a smoother implementation of the eCraft2Learn learning ecosystem.

2.2.   WORK PACKAGE 3

Task	T3.1
Involved Partners	UEF
IP Object	pedagogical framework
Type	conceptual material
Description – During the project	a craft- and project-based pedagogical approach described in 5 stages based on inquiry-based learning and design thinking: ideation, planning, creation, programming and sharing
License	CC-BY-SA 4.0
Target Group	researchers, teachers and students
Sustainability	sustainable through the scientific community uptake as well as the (re)use by educators and practitioners
Expected Impact	explanation and visual aid demonstrating the interrelated stages of project develoment within the eCraft2Learn learning ecosystem

Task	T3.2
Involved Partners	ZSI/SYNYO/UEF
IP Object	use case scenarios and personas
Type	conceptual material

Description – During the project	use cases, user stories and description of personas reflecting the diversity of end-users and the potential of the eCraft2Learn learning ecosystem
License	CC-BY-SA 4.0
Target Group	researchers, teachers, administrative staff
Sustainability	sustainable through the uptake by the community of practice of educators and practitioners
Expected Impact	explanations and description of use case scenarios (19) ranging in the entire STEAM spectrum, as well as personas indicating the use of the propose scenarios

Task	T3.3
Involved Partners	Ultimaker/SYNYO
IP Object	OER - Introduction to 3D Printing
Type	Digital Materials
Description – During the project	Resource to introduce 3D printing, where it is used, how it works and the 3D printing process.
License	Creative Commons 3.0
Target Group	Teachers and Students
Sustainability	Sustainable through the eCraft2Learn ecosystem, but also through publishing on other teacher resource sharing platforms such as TES and CREATE Education.
Expected Impact	Supports all new users of 3D printing, both within the eCraft2Learn ecosystem and externally.

Task	T3.3
Involved Partners	Ultimaker/SYNYO
IP Object	OER - 3D modelling in Tinkercad
Type	Digital Materials
Description – During the project	Resource to introduce Tinkercad, designing for 3D printing and saving a model for 3D printing in Tinkercad.
License	Creative Commons 3.0
Target Group	Teachers and Students
Sustainability	Sustainable through the eCraft2Learn ecosystem, but also through publishing on other teacher resource sharing platforms such as TES and CREATE Education.
Expected Impact	Supports all new users of 3D printing, both within the eCraft2Learn ecosystem and externally.

Task	T3.3
Involved Partners	Ultimaker/SYNYO
IP Object	OER - Extruding a 3D model from a 2D image
Type	Digital Materials
Description – During the project	Resource to show the process and settings for extruding a 3D model from a 2D image using Cura slicing software, complete with examples.

License	Creative Commons 3.0
Target Group	Teachers and Students
Sustainability	Sustainable through the eCraft2Learn ecosystem, but also through publishing on other teacher resource sharing platforms such as TES and CREATE Education.
Expected Impact	Supports both new and experienced users of 3D printing who may not be aware of this technique, both within the eCraft2Learn ecosystem and externally.

Task	T3.3
Involved Partners	Ultimaker
IP Object	OER - Cura Videos
Type	Digital Materials
Description – During the project	Series of 13 short videos to show how Cura can be used to prepare, slice and save 3D models for 3D printing.
License	Creative Commons 3.0
Target Group	Teachers and Students
Sustainability	Sustainable through the eCraft2Learn ecosystem, but also through publishing on other teacher resource sharing platforms such as TES and CREATE Education.
Expected Impact	Supports both new and experienced users of 3D printing, both within the eCraft2Learn ecosystem and externally.

Task	T3.3
Involved Partners	Ultimaker/SYNYO
IP Object	OER - 3D Printing Dummy's Guide Print Not Sticking
Type	Digital Materials
Description – During the project	Resource to hlep users to troubleshoot and fix problems when 3D printing with a print not sticking to the buildplate.
License	Creative Commons 3.0
Target Group	Teachers and Students
Sustainability	Sustainable through the eCraft2Learn ecosystem, but also through publishing on other teacher resource sharing platforms such as TES and CREATE Education.
Expected Impact	Supports both new and experienced users of 3D printing, both within the eCraft2Learn ecosystem and externally.

Task	T3.3
Involved Partners	UEF
IP Object	OER - a variety of sensors, DIY electronic component, and actuators description
Type	Digital Materials
Description – During the project	Open educational resources (50+ pages) describing a variety of electronic components that could be used in the eCraft2Learn learning ecosystem
License	CC-BY-SA 4.0
Target Group	Teachers and Students
Sustainability	sustainable through the uptake by the community of

	practice of educators and practitioners
Expected Impact	scaffolding for the general understanding of circuits and DIY electronic components

Task	T3.3
Involved Partners	EDUMOTIVA/UEF
IP Object	Teacher and student resources
Type	Digital Materials
Description – During the project	Worksheets for students were developed and provided in most of the pilot sessions. Supporting resources were also prepared for teachers to coach their students
License	Creative Commons 3.0
Target Group	teachers, students, youth
Sustainability	Publicly available through the eCraft2Learn UUI
Expected Impact	Supports teachers and students in eCraft2Learn and externally to run making activities.

Task	T3.4
Involved Partners	UEF
IP Object	Teacher Manual - pedagogical core description and excersices
Type	Digital Materials
Description – During the project	Scaffolding materials to assist the teacher's understanding of the eCraft2Learn ecosystem pedagogical framework
License	CC-BY-SA 4.0
Target Group	teachers
Sustainability	sustainable through the uptake by the community of practice of educators and practitioners
Expected Impact	supports all users interesting in learing the pedagogical considerations of the eCraft2Learn learning ecosystem

Task	T3.4
Involved Partners	UEF
IP Object	Teacher Manual - technical tools description supporting the pedagogical core
Type	Digital Materials
Description – During the project	Scaffolding materials to assist the teacher's understanding how the developed technological tools support the eCraft2Learn ecosystem pedagogical framework
License	CC-BY-SA 4.0
Target Group	teachers
Sustainability	sustainable through the uptake by the community of practice of educators and practitioners
Expected Impact	supports all users interesting in learing the pedagogical considerations of the eCraft2Learn learning ecosystem

Task	T3.4
Involved Partners	UEF/EDUMOTIVA
IP Object	Teacher Manual - teacher training schedule guide
Type	Digital Materials
Description – During the project	support and guidance for self-training including time schedule and topics covered during the implementing training activities in Greece and Finland
License	CC-BY-SA 4.0
Target Group	teachers
Sustainability	sustainable through the uptake by the community of practice of educators and practitioners
Expected Impact	supports all users interested in self-training on the eCraft2Learn learning ecosystem (pedagogical and technical aspects)

Task	T3.4
Involved Partners	Ultimaker/SYNYO
IP Object	Teacher Manual - 3D Modelling and 3D Printing Sections
Type	Digital Materials
Description – During the project	Resource to guide teachers through the process of 3D modelling and 3D printing, with practical activities to build their skills and confidence.
License	Creative Commons 3.0
Target Group	Teachers
Sustainability	Sustainable through the eCraft2Learn ecosystem, but also through publishing on other teacher resource sharing platforms such as TES and CREATE Education.
Expected Impact	Supports all new users of 3D printing, both within the eCraft2Learn ecosystem and externally.

Task	T3.4
Involved Partners	EDUMOTIVA/UEF
IP Object	teacher training resources
Type	Digital Materials
Description – During the project	worksheets and other supporting materials for teachers' training introducing making technologies, and methodologies in formal and informal education.
License	Creative Commons 3.0
Target Group	Teachers, trainers of teachers
Sustainability	Publicly available through the eCraft2Learn website
Expected Impact	Supports teachers and teacher trainers in eCraft2Learn and externally to run training activities.

Task	T3.4
Involved Partners	Arduino
IP Object	Teacher Manual - Arduino environment setup and infrastructure

Type	Digital Materials
Description – During the project	Resource to give teachers a guide on the Arduino environment and infrastructure and what the existing OER are and where to access them.
License	Creative Commons 3.0
Target Group	Teachers
Sustainability	Sustainable through the eCraft2Learn ecosystem, but the existing OER is publicly available through the Arduino platforms,
Expected Impact	Supports all new users of the Arduino ecosystem, both how its used within the eCraft2Learn ecosystem and externally.

Task	T3.4
Involved Partners	Arduino
IP Object	OER - Arduino Education Livecasts
Type	Digital Materials
Description – During the project	Weekly episodes (42 episodes released. as of 10 Dec. 2018) of live-streamed videos showcasing different aspect of the Arduino ecosystem, including general Arduino basic starting guides for teachers
License	Creative Commons 3.1
Target Group	Teachers
Sustainability	Publicly available through the Arduino's Youtube channel, the recorded version can be embedded into the eCraft2Learn ecosystem
Expected Impact	Supports all new users of the Arduino ecosystem, in eCraft2Learn and externally.

2.3. WORK PACKAGE 4

The main outcome of this work package includes the digital platform described as the Unified User Interface and the Educational Extension. The UUI is composed of specific pieces developed by different partners. The following describe each component of the UUI, partners responsible/involved for its creation and their related sustainability/exploitation plans.

Task	T4.4
Involved Partners	MDH
IP Object	Unified User Interface (UUI)
Type	Digital Patform
Description – During the project	The interface allowing access to eCraft2Learn tools and resources.
License	MIT
Target Group	students, makers
Sustainability	Available from https://github.com/ecraft2learn/uui
Expected Impact	

Task	T4.4

Involved Partners	MDH
IP Object	UUI Tools Management
Type	Software
Description – During the project	Allows the teachers to personalize the UUI according to their needs.
License	MIT
Target Group	teachers
Sustainability	Available from https://github.com/ecraft2learn/learning-analytics
Expected Impact	

Task	T4.3
Involved Partners	MDH
IP Object	Project and File Management
Type	Software
Description – During the project	Software solution for handling file storage on eCraft2Learn space and handling project and files relationships. Used by most UUI tools.
License	MIT
Target Group	Software developers
Sustainability	Available from https://github.com/ecraft2learn/uui
Expected Impact	

Task	T4.3
Involved Partners	UOXF
IP Object	A.I. teacher and student resources
Type	Digital Materials
Description – During the project	Sample projects using speech synthesis, speech recognitioin, image recognition, machine learning, and word embeddings.
License	CC Attribution 4.0
Target Group	teachers, students, youth
Sustainability	Source at https://github.com/ecraft2learn/ai. Available online from eCraft2Learn UUI and ecraft2learn.github.io/ai
Expected Impact	Supports teachers and students in eCraft2Learn and externally to make AI artefacts and apps.

Task	T4.3
Involved Partners	UOXF
IP Object	A.I teacher and student resources
Type	Digital Materials
Description –	Library of new Snap! blocks for speech synthesis, speech recognitioin, image

During the project	recognition, machine learning, and word embeddings.
License	BSD-3-Clause
Target Group	teachers, students, youth
Sustainability	Source at https://github.com/ecraft2learn/ai. Available online from eCraft2Learn UUI and ecraft2learn.github.io/ai
Expected Impact	Supports teachers and students in eCraft2Learn and externally to make AI artefacts and apps.

Task	T4.3
Involved Partners	UOXF
IP Object	JavaScript AI programming library
Type	Programming Library
Description – During the project	JavaScript library for accessing AI services and functionality in a web browser. Used in both Snap! and ToonTalk.
License	BSD-3-Clause
Target Group	Software developers
Sustainability	Available from eCraft2Learn UUI and ecraft2learn.github.io/ai
Expected Impact	Supports programmers who want to build a similar library of AI programming components for students.

Task	T4.3
Involved Partners	Evothings Labs
IP Object	The Craftbot for Arduino
Type	Software
Description – During the project	Software solution for distributed compilation and deployment of Arduino sketches, for crafting, debugging and monitoring
License	Apache 2.0
Target Group	students, makers
Sustainability	Available from https://github.com/ecraft2learn/craftbot-for-arduino
Expected Impact	Allowing learners to program their Ardunino and compatibles without the use of a designated computer; e.g. from a phone or tablet computer.

Task	T4.3
Involved Partners	UEF
IP Object	3D modelling and slicing tool
Type	Software
Description – During the project	Web-based tool for 3D modelling and slicing
License	MIT
Target Group	students, makers
Sustainability	Available from https://github.com/ecraft2learn/uui

Expected Impact	3D modelling without registration, web-based slicing tools not available

Task	T4.3
Involved Partners	UEF
IP Object	eCraft Search tool
Type	Software
Description – During the project	Search tool that uses several 3rd party APIs to search resources online
License	MIT
Target Group	students, makers
Sustainability	Available from https://github.com/ecraft2learn/uui
Expected Impact	

Task	T4.3
Involved Partners	UEF
IP Object	eCraft TODO tool
Type	Software
Description – During the project	Enables users to plan tasks
License	MIT
Target Group	students, makers
Sustainability	Available from https://github.com/ecraft2learn/uui
Expected Impact	

Task	T4.3
Involved Partners	UEF
IP Object	eCraft Sketch tool
Type	Software
Description – During the project	Enables users to ideate and plan through sketing
License	MIT
Target Group	students, makers
Sustainability	Available from https://github.com/ecraft2learn/uui
Expected Impact	

Task	T4.3
Involved	LNU

Partners	
IP Object	Sharing module (UUI)
Type	Software
Description – During the project	Enables students to share their work. Allows teachers to share their documents with their colleges
License	CC BY-SA
Target Group	Teachers and students
Sustainability	Available from https://github.com/ecraft2learn/uui
Expected Impact	Promotes the sharing of educational content and facilitates collaboration

Task	T4.3
Involved Partners	LNU
IP Object	Call for Action module
Type	Software
Description – During the project	Enables teachers to request from students the completion of learning activities.
License	CC BY-SA
Target Group	Teachers and students
Sustainability	Available from https://github.com/ecraft2learn/uui
Expected Impact	Facilitates purposeful communication between teachers and students

Task	T4.3
Involved Partners	LNU
IP Object	Commenting module (UUI)
Type	Software
Description – During the project	Enables students to provide feedback to content produced by peers.
License	CC BY-SA
Target Group	Teachers and students
Sustainability	Available from https://github.com/ecraft2learn/uui
Expected Impact	Facilitates collaboration between students.

Task	T4.3
Involved Partners	ZSI
IP Object	Inspiratorium
Type	Software
Description – During the project	Resource for teachers finding ideas and inspirations on using Arduinos in education

License	Creative Commons 3.0
Target Group	teachers, students, youth
Sustainability	Sustainable through the eCraft2Learn ecosystem
Expected Impact	Supports teachers, students and young people to find ideas and inspiration with instructions on how to bulid the artefact

Task	T4.3
Involved Partners	UNIPD
IP Object	Badge System
Type	Software
Description – During the project	Enables students to have feedback on the achieved learing and motivation for fostering their learning process
License	CC BY-SA
Target Group	Teachers and students
Sustainability	Available from the githb UUI location

Expected Impact	Foster learners' motivation and facilitates purposeful communication between teachers and students
Task	T4.3
Involved Partners	UNIPD
IP Object	Self-evalutation System
Type	Software
Description – During the project	Guides students in developing selfevaluation skills, enables teachers to asses selfevaluation and to evaluate students
License	CC BY-SA
Target Group	Teachers and students
Sustainability	Available from the githb UUI location
Expected Impact	Promote self evaluation skills in students and foster active learning

Task	T4.5
Involved Partners	UEF
IP Object	Learning analytics system (teacher's interface)
Type	Software
Description – During the project	Enables teachers to analyze student data through several machine learning algorithms
License	MIT
Target Group	students, makers
Sustainability	Available from https://github.com/ecraft2learn/learning-analytics
Expected Impact	Open ended learningn analytics system that enables teachers to learn together with the machine learning algorithms

2.4. WORK PACKAGE 5

Task	T5.1
Involved Partners	EDUMOTIVA
IP Object	The eCraft2Learn Pilot Protocol
Type	Digital Materials
Description – During the project	Resource that can guide teachers through the process of preparing the pilot site for the eCraft2Learn learning intervention.The pilot protocol includes the realization and the equipment setup of the labs in order to enable the full operation of the eCraft2Learn learning ecosystem.
License	Creative Commons 3.0
Target Group	Teachers, school authorities, owners of maker spaces
Sustainability	Publicly available through the eCraft2Learn website
Expected Impact	The protocol supports teachers, maker spaces, hubs, schools, informal learning centers to establish and run the eCraft2Learn ecosystem or to informe their already running activities and practices.

Task	T5.1
Involved Partners	EDUMOTIVA/UEF
IP Object	Good practices videos
Type	Digital Materials
Description – During the project	Good practices that were identified during the pilots implementation in Greece and Finland
License	CC-BY-SA
Target Group	teachers, school authorities parents, students
Sustainability	Publicly available through the eCraft2Learn youtube list/website
Expected Impact	Supports teachers to follow the recommended good practices in their own teaching and learning activities

Task	T5.4
Involved Partners	EDUMOTIVA/ZSI/UEF
IP Object	Impact and recommendations
Type	Digital Materials
Description – During the project	General recommendations based on impact analysis for education for STEAM with e crafting
License	Creative Commons 3.0
Target Group	policy makers, educators, researchers
Sustainability	Publicly available through the eCraft2Learn website
Expected Impact	Supports policy makers and educators in decision making

2.5. WORK PACKAGE 6

Task	T6.1
Involved Partners	SYNYO
IP Object	Project Website
Type	Public Domain
Description – During the project	Provides an overview on the overall ecosystem, including aim, use-cases, personas, all deliverable reports, all scientific publication and most importantly the teacher guides and stakeholder guides for implementing eCraft2Learn.
License	CC BY-SA
Target Group	All involved project stakeholders
Sustainability	Available from https://ecraft2learn.eu
Expected Impact	Providing an overview about the overall project structure and the basis for disseminating the project outputs in the community.

Task	T6.4
Involved Partners	TECHNOPOLIS
IP Object	eCraft Learn Public Events Videos (Athens Maker Faire 2018)
Type	Videos
Description – During the project	Video spot for ecraft2learn event at ASF2018 in Athens, Greece capturing the overal vibe and showing the interaction between the project participants, other exhibitors and the public
License	CC-BY-SA
Target Group	teachers, school authorities, students, parents
Sustainability	Publicly available through the eCraft2Learn youtube list/website
Expected Impact	Promotes and disseminates ecraft2learn project and encpurage educators and students take part in similar events

Task	T6.4
Involved Partners	EDUMOTIVA/UEF
IP Object	eCraft Learn Public Events Videos
Type	Videos
Description – During the project	Videos that showcase sharing practices and students' experieces from Athens Science Festival as well as SciFest 2018 Joensuu Finland
License	CC-BY-SA
Target Group	teachers, school authorities, students, parents
Sustainability	Publicly available through the eCraft2Learn youtube list/website
Expected Impact	Supports teachers and students to run similar sharing and demonstration activities.

Task	T6.6
Involved Partners	UEF/Ultimaker
IP Object	UUI Demonstration Video

Type	Video
Description – During the project	A walkthrough video of the eCraft2Learn students' interface (the UUI). This video guides on how to move inside the platform, demonstrates all the tools and functionalities in the platform and explains in brief how to use them. Captions for this video are available in three different languages (EN, FI, GR).
License	CC-BY-SA 4.0
Target Group	Teachers, teacher trainers, STEM educators, informal educators, students
Sustainability	Publicly available through the eCraft2Learn youtube list/website
Expected Impact	Supports all new users to get familiar with the eCraft2Learn students' interface and its tools and functionalities.

Task	T6.6
Involved Partners	UEF/ULTIMAKER
IP Object	Teacher's interface demonstration video
Type	Video
Description – During the project	A walkthrough video of the eCraft2Learn teacher's interface. This video, targeted for educators, provides a brief explanation about the use of the teacher's interface with its tools and functionalities. Besides demonstrating the functionalities, this video gives insights on how to use the different tools in the student's interface customisation as well as the learning analytics in tracking student actions and providing support for student learning. Captions for this video are available in three different languages (EN, FI, GR).
License	CC-BY-SA 4.0
Target Group	Teachers, STEM educators, informal educators
Sustainability	Publicly available through the eCraft2Learn youtube list/website
Expected Impact	Supports educators to get familiar with the eCraft2Learn teachers' interface and its tools and functionalities.

Task	T6.6
Involved Partners	EDUMOTVA/Ultimaker
IP Object	eCraft2Learn craft and project-based methodology demostation
Type	Video
Description – During the project	This video demonstrates the craft and project based methodology by showcasing "episodes" of the making process in the eCraft2Learn labs. It is a short, introductory video that acts as a teaser inviting the teachers to dig deeper into the good practices that were video recorded during the implementation of the pilots in Greece and Finland. Focus is placed on how the 5 stages of the craft and project based methodology (ideation, planning, creation, programming and sharing) are brought together towards computer-supported artefact creation.
License	CC-BY-SA
Target Group	Teachers, teacher trainers, STEAM educators, informal educators parents, students
Sustainability	Publicly available through the eCraft2Learn youtube list/website
Expected Impact	Promotes and disseminates the craft and project based methodology (by showcasing real classroom experiences) and invites teachers and representatives of the school community to explore the eCrafr2Learn initiative towards computer-supported artefact construction

Task	T6.6
Involved Partners	Ultimaker
IP Object	eCraft2Learn Community Group
Type	Online social colllaboration platform
Description – During the project	CREATE Connect Social Collaborative platform for STEAM educators (the eCraft2Learn project supported fast track development of this platform). Within the platform a dedicated eCraft2Learn social community group has been created. The platform also supports educators to creae their own project sub-groups.
License	CC-BY-SA
Target Group	Teachers, consortium partners, STEAM educators, informal educators
Sustainability	"The CREATE Connect community platform will be heavily promoted through Ultimaker's education networks and activities (globally) to drive STEAM educators to sign-up. The eCraft2Learn group will be visible and accessible to all members of the platform, ensuring the long term sustainability of the project.

Available at www.connect.createeducation.com with links also available from the teacher guides and the eCraft2Learn website." |
| Expected Impact | Provides a tool for long term disemination and educator engagement with the eCraft2Learn project as well as a social platform for educators to connect, collaborate, support and share their eCraft2Learn experiences. |

Task	T6.6
Involved Partners	Ultimaker/SYNYO
IP Object	eCraft2Learn Teacher Guides (x 10)
Type	Video
Description – During the project	A series of 10 guides that introduce eCraft2Learn and the various elements of the ecosystem. These will help teachers new to eCraft2Learn to get started, forming an introductory training and support package whilst linking to the further support materials provided via the eCraft2Learn deliverables.
License	CC-BY-SA
Target Group	Teachers, teacher trainers, STEAM educators, informal educators
Sustainability	Available through the eCraft2Learn ecosystem as downloads from the eCraft2Learn website and through the CREATE Connect eCraft2Learn user group, but also through publishing on other teacher resource sharing platforms such as TES and CREATE Education. These guides contribute to the sustainability by providing teachers with a set of documentation to help them easily get started with eCraft2Learn.
Expected Impact	Supports educators in learning about eCraft2Learn and how they can set up and run their own eCraft2Learn projects.

Task	T6.6
Involved Partners	UNIPD
IP Object	eCraft2Learn Teacher Guide
Type	Video
Description – During the project	A guide for teachers describing one eCraft2Learn activity using almost all eCraft2Learn ecosystem resources

License	CC-BY-SA
Target Group	Teachers, teacher trainers, STEAM educators, informal educators
Sustainability	Available through the eCraft2Learn ecosystem as downloads from the eCraft2Learn website. This guide contributes to the sustainability by providing teachers with a set of documentation to help them easily get started with eCraft2Learn.
Expected Impact	Provides an example to educators about eCraft2Learn and how they can set up and run their own eCraft2Learn projects.

3   RELEVANT STAKEHOLDERS AND TARGET GROUPS

The Communication and Dissemination Strategy created at the beginning of the projects sought to define the most critical stakeholder groups that are relevant for dissemination of the project outcomes. The following groups were identified at the project start as targets for the eCraft2Learn outcomes:

- Students

- Teachers

- Schools

- Research Centres and Universities, Researchers and professors, Research Projects

- Industry Stakeholders

- Associations

- Policy Makers

- Media (Mass & small / International & Local / Media & Individual Journalists),

As mentioned in the document, further stakeholder groups could be added through the project lifetime as deemed relevant. In this sense, the European Commission as the financial source of the project, funding other initiatives in the field, and potentially other actions as a continuation of eCraft2Learn, was also included in this group through tailored recommendations for promoting innovation in the educational system in different European regions and countries.

These communities represent the starting point for the development of a dissemination and exploitation master plan to make the project outcomes understandable and easily implementable by each of the stakeholder groups.

The following section thus lists the types of activities meant and materials created for 'explaining' eCraft2Learn and brining it closer to the relevant stakeholder groups.

4   EXPLOITATION PLAN

This section describes which concrete measure the consortium has taken in order to ensure the uptake of the eCraft2Learn project results after the project lifetime. This plan was created in close cooperation between all consortium partners, taking into consideration the advice and feedback from the external Expert and Advisory Board members as well as the project reviewers. As a result of the discussion and feedback rounds, two types of outputs were deemed important for a successful

exploitation plan: first a user-friendly manual explaining the overall ecosystem, it components, functionalities, outcomes and benefits to the identified stakeholders; and second, an online space to keep the created communities (especially around the pilots in Greece and Finland) alive, but provide them the opportunity to expand by allowing new members to get familiarized, ask questions, share contents etc. Each of these points have been tackled as follows:

4.1. ECRAFT2LEARN ECOSYSTEM MANUAL

As described in Chapter 2 of this document, the project produced a long list of materials that guide users on the functionalities of the ecosystem (Open Educational Resources, Videos, Teacher Support Guides etc.), guide stakeholders for supporting the implementation of the ecosystem etc. Each of the materials describe provide valuable knowledge that can be used for implementing the project or repurposed for additional future activities. The consortium – based also on the inputs from other stakeholders – however recognizes the difficulty of different stakeholders to dig into the project reports and find explanations about each of the components of the ecosystem and their development, potentially preventing them from seeing the bigger picture and understanding the functioning of the ecosystem as a whole. To tackle this issue, as part of the project's Exploitation Strategy, a full package of refurbished materials has been created, to put together all the knowledge generated in the project and bring it the stakeholder in a reader-friendly and simplified manner. The so-called 'ecosystem manual' or 'dissemination package' contains more than 10 guides for implementing the ecosystem, targeting mainly teachers but also the rest of the involved stakeholders. The idea is to create a package of materials explaining most of the project outcomes in the most simplistic manner possible, that can be easily used as a digital material or a printed folder to present in future meetings and events with stakeholders. All guides are available in a separate section of the project website branded as '**Getting Started with eCraft2Learn**' accessible through: https://project.ecraft2learn.eu/getting-started. Besides their official location on the website, the guides are also uploaded on the Unified User Interface, the online eCraft2Learn community group (describe in the next section) and related community platform such as Scientix, eTwinning, I-LINC, Open Schools for Open Societies etc.

The series of more than 10 short teacher- and stakeholder-friendly guides presents the eCraft2Learn solution to people with no prior knowledge or experience of the project. These were simplified enough to capture interest and remain readable, however provide enough detail to allow teachers to be able to proceed with. The guides largely consist of information already available in the various deliverables, but focussing on the core required information that teachers will need to get started. Value can be added to the guides by signposting teachers throughout to the various deliverable documents (and section references) where they can read about that specific area in more depth. Links will also be provided to specific supporting OERs. The whole package/manual contains the followings:

- Introducing eCraft2Learn - The project, pedagogy, tools, resources and outcomes
- Who is it for? – Personas
- What can you do with it? – Use-Cases
- How to get started?
- Setting up an eCraft2Learn learning environment – hardware, software, tools and materials (*includes other optional configurations of available technologies and related learning outcomes*)

- Using the eCraft2Learn Project Platform (The UUI) – (*demonstration video of all platform components*)
- Designing and running an eCraft2Learn Project
- Integrating DIY electronics into an eCraft2Learn Project
- Integrating 3D printing into an eCraft2Learn Project
- Using the eCraft2Learn learning analytics tools
- Collaborating and sharing in the eCraft2Learn connected community
- Learning outcomes and impacts of the ecosystem – (*results from the pilots*)
- Stakeholder recommendations – contains a refurbished set of recommendations for all stakeholder groups

The creation of these materials ensures that all interested stakeholders can find concise information on the ecosystem that increases their incentives for implementing it in teaching STEAM subjects. The materials themselves however, are do not guarantee per se an increased interest from the community. Thus, to ensure the exiting community remains alive and it expands, an online community group was created as explained below.

4.2.   eCraft2Learn Online Community Group

The CREATE Connect is an online education community platform developed as part of the eCraft2Learn project for teachers and educators interested in STEAM to find and connect with others to discuss different projects, share ideas, work together or simply help one another with their problems by sharing insights and best practice.

The CREATE Connect platform aims to provide the bridge between technology and teachers. One of the biggest problems with new technology in education is educators not being able to connect with other people who have successfully integrated new technologies into the classroom for advice and support or even experts in the industry for help and resources. This platform solves this problem by offering an open platform that educators at all levels, industry partners and educational leaders can interact with each other, discuss common issues and create solutions for integrating technology into their classrooms, labs and makerspaces. This in turn it facilitates every student having the opportunity to access, experience and learn about ground-breaking technology and educators can realise the learning benefits technology provides with confidence.

Education is fundamentally about sharing knowledge and the education community should have their own dedicated space to discuss things related to their interests, be able to connect with other likeminded people and facilitate peer to peer development. Currently educators are having to use other platforms (Facebook, Twitter, Instagram etc), blurring lines between professional and personal, being bombarded with advertising, with more and more users concerned about privacy and usage of their data. By providing this solution for eCraft2Learn, we can ensure our community aren't subject to content unrelated to them such as political posts, adult content and other distractions. No data will be sold to third party organisations and the negative behaviour that is increasingly associated with the big platforms will not be tolerated. All the benefits of digital connections without the concerns!

The CREATE Connect platform available at www.connect.createeducation.com, has a Groups feature that allows people to join and create groups, which can be public or private, so the discussion is always relevant and involves the people you want to share with. There is also the ability to upload files such as images, documents, audio and videos making the dissemination of content painless and (if required) private.

eCraft2Learn has its own dedicated project user group on the platform where educators who are interested in or actively using the eCraft2Learn ecosystem for delivering projects can connect with other. The group can be used to learn more about the eCraft2Learn project, share ideas and projects, ask questions, help and support each other.

Users will also be able to create their own smaller eCraft2Learn sub-groups if required which can be private or public. This feature is useful perhaps where a group of local schools are collaborating on a specific project. Users are also able to browse and join other groups of STEAM educators who are also active on the platform.

The official launch of the platform will be at BETT 2019 where Ultimaker and CREATE Education will be promoting the platform and encouraging sign-ups to the platform. Considering the huge community of the CREATE education project which will be invited to populate it, the platform has the potential to connect thousands of STEAM educators around the globe, allowing them to join the eCraft2Learn community group.

4.3. ECOSYSTEM DEPLOYMENT

Besides the creation, expansion and sustainability of the eCraft2Learn community online, other future plans of the partners include continuing the exploitation of the pilot sites created during the project and enable the deployment of the ecosystem in other schools or learning ecosystems, for using or improving it further. The followings describe the next steps in this regard:

▪ **Greek Pilot Site**

To ensure a sustainable exploitation of the pilot site created at Athens Technopolis including all its technical components, but also the expertise in training teachers and students acquired by the involved partners EDUMOTIVA and TECHNOPOLIS, a detailed plan was drawn up by both partners. The accreditation of the setting as laboratory/makerspace by accreditation programs in Greece, has been one of the initial steps thereof. Following an accreditation and increased popularity of the lab, both Greek partners will offer training courses for local teachers on the use of technologies and methodological approached to the pedagogy of eCraft2Learn, as well as courses for children of different ages. All materials created during the project lifetime – those created especially during the pilots, and additional dissemination materials created as a full 'user manual' will be exploited through these actions. As a means for increasing the interest of the students and teachers in the lab and its training courses, short study visits for school groups will also be offered as a means to gain a pre-introduction to eCraft2Learn and its components.

▪ **1st Vocational Lyceum at Korydallos, Greece**

Further important actions in Greece, include the deployment of the ecosystem in the 1st Vocational Lyceum at Korydallos, Athens which has been involved in the pilots. An agreement between the school governance and the partners to continue running the eCraft2Learn lab in the school and integrate it in the curriculum has been reached. A full integration of the eCraft2Learn in the curriculum represents a great opportunity not only for other school teachers and students to learn more about it and develop their ideas, but also as a multiplication effect for wider deployment in other schools.

- **Light-a-Bot Makerspace Joensuu, Finland**

The involvement of the group of teachers and student in the pilot phase of eCraft2Learn in Joensuu, gave life to the Light-a-Bot makerspace. The makerspace was established by one of the piloting teachers who is acting as a coordinator and working closely with UEF to translate all the training materials and OERs in Finnish, aiming to raise awareness locally and nationally and provide support for a wider deployment. Similar to the Greek pilot site, the makerspace understands itself as a continuation of the project activities by inviting students and teachers to participate in digital fabrication and making activities.

- **ABB Gymnasium, Sweden**

A structured collaboration has been also agreed by MDH with the ABB Gymnasium in Sweden in order to further test and verify the ecosystem with respect to the artificial intelligence related projects. This represent a great opportunity for further research on the functionalities of the UUI but also increasing the incentives of the school to deploy eCraft2Learn as part of their formal learning. This includes a first step towards deployment in Sweden, potentially followed by next ones.

- **Liceo Statale Enrico Fermi, Italy**

Another collaboration has been agreed in Italy between UNIPD and the local high school "Liceo Statale Enrico Fermi" in Padua through a national project involving 18 high-school students (from 15 to 19 years old) in testing and eventually deploying the eCraft2Learn ecosystem as part of their curriculum. The first activities carried out in the school were the implementation of the two eCraftLearn proejcts (the 'Lighthouse' and the 'Intelligent Garden'). Independently from the collaboration with the mentioned school, but accompanying it, UNIPD will offer a yearly course on Educational Robotics for around 30 teachers per year, as part of which the eCraft2Learn ecosystem will be presented in detail with the aim to increase their incentives for deploying in as part of their teaching while also training their skills.

4.4.   PUBLICATIONS, CONFERENCES AND WORKSHOPS

Together with the plans for deploying the whole eCraft2Learn ecosystem in schools and makerspaces in the partners countries and offering training on the ecosystem as a whole, bits of the outcomes and learnings of the project will also be exploited individually for scientific purposes such as participation in workshops, trainings, conferences or scientific publications, etc. The potential exploitation of the knowledge from eCraft2Learn can live for a long term for all partners. The following list includes some of the first plans for exploiting it during 2019.

- **Arduino Live-cast Series - Second Season:** A good practice initiated by Arduino as part of the project to familiarise the community with it's the making technologies and answer their questions, will be carried out also in 2019 in their second season, which is dedicated to inspiring educators a student in education robotics by live-testing projects, featuring student project etc. As the first season was part of the eCraft2Learn project as a means of providing other sources of educational materials it included a clear reference to the project. References to eCraft2Learn will

however continue also during the second season which will help in raising awareness on the deployment of the ecosystem as whole or parts of it, and expanding the community.

- **A new master program by LNU on Digital Learning** with a specific direction towards STEM and CTE will make reference to the learnings and outcomes of eCraft2Learn.

- **The stakeholder recommendations for creating an innovative ecosystem (D2.2) will be integrated in the final publication of the study '2nd Survey of Schools: ICT in Education'.**

- **At least one scientific paper will be presented at MIS4TEL'19**, '9th International Conference in Methodologies and Intelligent Systems for Technology Enhanced Learning' disseminating the results of eCraft2Learn.

- **A study on the perception of students on the augmented reality tool created in eCraft2Learn** was carried out in Spring 2018 by MDH with students of the Riman Gymnasium in Sweden. In 2019 this will be followed by a final-run of the study analysing data from students in the ABB Gymnasium. The outcomes of both will be published in a multi-disciplinary journal article.

- **Further research is planned by UEF on the Learning Analytics system** developed as part of the eCraft2Learn Unified User Interface. The primary aim of the research includes the analysis of educational data not necessarily collected from the Unified User Interface (UUI), but brought in from other sources openly available in order to further test the proposed open educational data mining process and study its strengths and weaknesses critically.

- **A project at the Bandung Pedagogical University in Indonesia to run AI programming workshops on the basis of the samples created for eCraft2Learn** in three Indonesian cities has received funding, in addition to the ones they have already run in Bandung for high school students and teachers.

- **The Beijing Normal University plans to translate the eCraft2Learn materials to Chinese and trial it in several schools**. This will provide a great chance for the deployment in China.

- **Additional AI programming workshops for schools run by Create Lab Pte Ltd for children in Singapore, Sri Lanka, and India using eCraft2Learn resources** are planned to continue in 2019.

- **A new project funded by the Welcome Interdepartmental Strategic Support Fund will start in March** for training technicians and medical personal using the appearance of fingernails to diagnosis diseases. The basis of the concept prototypes of the project have been the machine learning block added to Snap! for the eCraft2Learn UUI.

- **Additional meetings have been confirmed between UOXF and the Wolfram Research Europe, interested in using the eCraft2Learn resources for building learning materials for schools** involving AI and mathematics and has expressed interest in our resources.

- **3 new PhD places will be offered by LNU with a potential to use eCraft2Learn as a case for further research.**

- **The DOIT and SySTEM2020 projects of ZSI as well as the IoThink project of SYNYO will build upon the knowledge of eCraft2Learn and integrate it in their activities.**

4.5. INDUSTRIAL EXPLOITATION

Along with the exploitation of the eCraft2Learn outcomes for further research purposes by partners that include universities or research-based organisations, companies represented in the consortium or related to other consortium partners have an opportunity for further industrial exploitation of the ecosystem as a whole or parts of it.

The Craftbot for Arduino developed by EVOTHINGS offers an opportunity for the Evothings Lab to expand its products and services pallet by offering bespoke solutions for supporting novel hardware devices and APIs/Cloud Services based on the Craftbot code base.

In the last section (Impact), other partners from the business sector detail the benefits of the project to their business and the further exploitation after the project end.

4.6. FURTHER FUNDING OPPORTUNITIES

The final component of the future exploitation plan of the eCraft2Learn project includes plans of several consortium partners for pursuing additional funding through different schemes for further improving the ecosystem and bringing it closer to the market. This plan includes a list of the main funding programmes will are currently seeking. Additional funding schemes and precise calls may be identified by the partners in the future, especially at the national level. Below we mention some of the calls we have currently identified and how they are related to a second funding option for eCraft2Learn.

H2020: Industrial Leadership: Fast Track to Innovation

FTI supports actions undertaking innovation from the demonstration stage through to market uptake, including activities such as piloting, test-beds, systems validation in real-world working conditions, validation of business models, pre-normative research, and standard-setting. It targets relatively mature, ground-breaking new technologies, concepts, processes and business models that need final development to be able to shape a new market and achieve wider deployment. FTI accelerates the market uptake of ground-breaking innovations by providing funding in an open, accessible scheme that nurtures ideas from consortia of innovators of all types and sizes from across Europe. If the proposal involves technological innovation, the consortium should declare that the technology or the technologies concerned are at least at Technology Readiness Level (TRL) 6. The intention will be to bring the TRL up to 8 for technological innovations and to an analogous level of maturity for non-technological innovations during the lifetime of the FTI action. FTI actions are encouraged to be interdisciplinary, cutting across different sector and technologies. Actions supporting innovative concepts that have the potential to disrupt or to create new markets are particularly welcome.

Since UEF has been identified by the Commission Innovation Radar as an innovative organisation, the Innovation Radar Support Service (IRSUS) has been in contact with the coordination of the project in order to establish the potential commercialization of the eCraft2Learn learning ecosystem innovation, through a roadmap to determine the projection to the market. The innovation is titled "New pedagogical models connecting school and practice through technology involvement" and it is placed within the exploration category of the innovation readiness indicator x innovation management indicator chart. The IRSUS will assist in identifying the suitability of the innovation towards the market within the Fast Track to Innovation (FTI) funding opportunity.

Erasmus+

Strategic Partnerships aim to support the development, transfer and/or implementation of innovative practices as well as the implementation of joint initiatives promoting cooperation, peer learning and exchanges of experience at European level. Depending on the objectives and the composition of the Strategic Partnership, projects may be of two types:

1. Strategic Partnerships supporting innovation:
Projects are expected to develop innovative outputs, and/or engage into intensive dissemination and exploitation activities of existing and newly produced products or innovative ideas. Applicants have the possibility to request a dedicated budget for Intellectual Outputs and Multiplier Events in order to directly answer to the innovation aspect of the Action. These types of projects are open to all fields of education, training and youth.

2. Strategic Partnerships supporting exchange of good practices:
The primary goal is to allow organisations to develop and reinforce networks, increase their capacity to operate at transnational level, share and confront ideas, practices and methods. Selected projects may also produce tangible outputs and are expected to disseminate the results of their activities, although in a way that is proportional to the aim and scope of the project. These results and activities will be co-financed through the standard budget for project management and implementation.

In order to boost the EU intake of the eCraft2Learn learning ecosystem, UEF together with other partners such as SYNYO, EDUMOTIVA etc. is exploring the deployment of the project results through an Erasmus+ Strategic Partnership with Schools project. The aim is to prepare and submit the application in Autumn 2019.

5 INDIVIDUAL EXPLOITATION PLAN PER PARTNER

The upper part has sought to provide an overview of all the future plans for the exploitation of the eCraft2Learn ecosystem as a whole and parts of it. The followings section details the plans of each of the partners with regard to dissemination and future exploitation of project outcomes, that are still in progress as the project funding comes to an end, or are planned in the future agendas of the partner organisations and their team members.

5.1. UEF

In terms of continuous deployment of the eCraft2Learn ecosystem, UEF is already collaborating with the teachers involved in the teacher training and piloting activities in order to maintain the eCraft2Learn presence in schools in Joensuu. At the moment several teachers that did not participate formally in the teachers' training have expressed interest to adopt the eCraft2Learn learning ecosystem as part of their teaching their classrooms (the 20 teachers that participated in the eCraft2Learn workshop in November 2018). The teachers that took part in the training and piloting activities are now acting as mentors and advisors to the other teachers that have expressed interest in deploying the learning ecosystem. One of the mentors is coordinating the newly established Light-a-Bot Makerspace in Joensuu and is closely collaborating with the UEF team in order to produce and/or translate OERs into Finnish language and to continue providing advice and informal training to interested teachers, as well as a space where they can come and test their ideas before bringing them to their classrooms. The makerspace also welcomes students' groups interested in tinkering and discovering alternative uses of technology. With this, we aim at reaching

as many of the teachers in the region as possible to create a strong local base for ideas sharing and networking among peers.

In terms of scientific publications exploitations, UEF is planning to disseminate the conceptual implementation of the pedagogical approach put forward in the eCraft2Learn learning ecosystem using the results obtained from the pilots. Furthermore, the Learning analytics (LA) system will be used to analyse educational data not necessarily collected from the Unified User Interface (UUI), but brought in from other sources openly available in order to further test the proposed open educational data mining process and study its strengths and weaknesses critically. This is a good venue of research, since machine learning algorithms are for the most part very data-consuming however our approach in fact learns from and handles much smaller dataset size that is collected and analysed in real-time.

5.2. MDH

One of the goals of approaching human-system interaction, and also HW/SW-programming, through a unified interface was to investigate the limitations with respect to deploying standard solutions through one single interface. The focus here is on simple solutions for non-professional users. There are several existing services, and ongoing projects, that address specific domains (using several programming languages through one interface), however, these solutions mostly work like isolated silos i.e., it is not possible to transform data/files between different tools.

Based on this challenge MDH applied for, and received, funding for a new 3-year project: "Developing a digital tool for increased participation in child assessments (Dig-Child)" (Budget: €470,000, Funding agency: FORTE, Sweden). This project aims at increasing children's participation in child welfare investigations by introducing a digital tool that children can use under the process of the investigation. Raising children's participation in conversations and investigations in the municipal social services is necessary for all involved parties, especially for the children who are the focus of the work. This innovation project may increase the very sense of control and influence over their lives that children often are deprived of in child welfare settings, by inviting children to co-develop the 'digital 'assessment plan'.

MDH has also started a collaboration with ABB gymnasium, which is an upper secondary school, Västerås, to see how the eCraft2Learn UUI and educational extension works in a sharp educational context with highly motivated student. The focus here will be on verification and validation within the context of artificial intelligence (AI) related student projects. Finally, as part of the Teacher's education at MDH a new programming course for the students will be developed. This course is part of the curricula for several programmes from Fall 2019. The ambition is to extend this course to include programming environments for children. This way, we will be able to both evaluate the proposed solutions from the perspective of becoming teachers, and contribute to the teacher education.

Scientific exploitation is an essential part of MDH's activities. A pre-study has been performed, during early Spring 2018, with the students at the Riman gymnasium (upper secondary school). This study focused on the perception of the students on the augmented reality tool developed as part of the eCraft2Learn educational extension to see how it support 3D object design (relevant for 3D printing). The final run of studies will be committed at the ABB gymnasium to collect the data that will make the basis for a multi-disciplinary journal paper.

5.3. ZSI

eCraft2learn experiences, materials and processes are used in several ongoing projects such as DOIT (Entrepreneurship and social innovation learning for children 6-16 yrs old) as well as SySTEM2020 (Informal science learning outside schools). Especially the experiences made during pilot one and pilot two had already impact to the design and performance of a maker workshop for children that was organised in September under the DO IT project. Although the students were much younger (6-12), the general recommendations were well used. In 2019, further maker and crafting activities with older students will be performed in Wiener Neustadt. The final recommendations will be sent to the consortium of both projects to give input for the second pilot phase.

It also informs our collaboration with schools and innovation agencies in Austria.

In addition, the eCraft2Learn impact study will be used as basis for further publications in cooperation with EDUMOTIVA and UEF. As for now, one submission is planned for MIS4TEL'19.

5.4. UOXF

The AI extension, associated interactive guides, and sample projects are freely available and have generated a good deal of interest. We are aware of the following efforts to use our resources:

- A project at the Bandung Pedagogical University in Indonesia that has received funding to run AI programming workshops in three Indonesian cities (in addition to the ones they have already run in Bandung) for high school students and teachers.
- Plans by the Beijing Normal University to translate our materials to Chinese and trial it in several schools
- After school AI programming workshops run by Create Lab Pte Ltd for children in Singapore, Sri Lanka, and India using our resources. They plan to do more workshops in 2019.
- The machine learning blocks added to Snap! have been used in the proof of concept prototype that is basis of a research project regarding training technicians and medical personal in using the appearance of fingernails to diagnosis diseases. This has led to a project beginning in March funded by the Welcome Interdepartmental Strategic Support Fund.

- Wolfram Research Europe is building learning materials for schools involving AI and mathematics and has expressed interest in our resources. After one, meeting they asked for additional meetings in 2019.

5.5. SYNYO

The network and the knowledge acquired throughout the eCraft2Learn project puts another tile to the portfolio of existing SYNYO projects in the field of education such as SciChallenges, SicherSocial, IoThink etc. that can be further exploited as a package, for additional research, development and dissemination activities. One of the most recent SYNYO projects in this filed, IoTHink, funded by the national program NETIDEE, involves the introduction of young people in schools to IoT devices, AI and programing tools as well as the rest of the digital fabrication tools that form part of eCraft2Learn. The eCraft2Learn ecosystem thus will be part of the packages of the training and awareness raising activities in Austria as part of this NETIDEE project.

Additionally, the stakeholder recommendations drawn by SYNYO as part of D2.2. will be further disseminated in 2019 through an integration in the study 'ICT in Education' tendered by the European Commission and allowing open inputs by stakeholders.

As the company is research-oriented and has a broad experience in EU projects, the immediate future plans also include the participation in upcoming calls for proposals together with other

consortium partners of eCraft2Learn for designing meaningful follow-up projects that can ensure to bring the eCraft2Learn ecosystem closer to the educational community in Europe.

5.6. UNIPD

UNIPD will adopt the eCraft2Learn methodology and resources in the educational activities it is running in collaboration with local schools. Every year UNIPD is running a course on Educational Robotics for in service teachers which involves about 30 teachers every year. The eCraft2learn ecosystem and the the eCraft2learn resources will be used during the teacher course and teachers will be encouraged to use them during the year with their students.

UNIPD is running a collaboration with a local high-school "Liceo Statale Enrico Fermi" in the frame of the Italian project "Alternanza Scuola-Lavoro". In this collaboration a group of 18 high-school students (from 15 to 17 years old) is involved in a project in which the eCraft2Learn ecosystem is exploited. In particular, two of the activities created in the eCraft2Learn project are implemented (namely, the "Intelligent Garage" and the "Lighthouse" activity. This activity is a preliminary step to a more large-scale exploitation of eCraft2Learn ecosystem and pedagogical approach. The "Liceo Statale Enrico Fermi" is very active in robotics projects and they would like to adopt the eCraft2Learn ecosystem also for curricular activities.

Moreover, UNIPD is porting the activity and the ecosystem developed in eCraft2Learn in the schools thanks to the start-up company of the Intelligent Autonomous Systems Laboratory (IAS-Lab) called EXiMotion srl which takes care of in school laboratories and educational projects in educational robotics and ICT.

The experience and the experimental validation of eCraft2Learn methodologies will be exploited for scientific publication in journals and conferences. This will make UNIPD even more capable to win competitive call for proposals for new research and educational projects within the H2020 and ERASMUS+ frameworks.

5.7. EDUMOTIVA

EDUMOTIVA will sustain, further develop and exploit the labs already created in Athens (formal education) and in Athens Technopolis (informal education) in collaboration with the partner Technopolis City of Athens.

We have made an agreement with the 1st Vocational Lyceum at Korydallos, Athens, to continue running the eCraft2Learn lab at the school integrating it in the school curriculum. More teachers and students will be benefited from their involvement in lab activities that will be based on the eCraft2Learn pilot projects and new ideas developed by the school staff. Our aim is to convince the school community, through the example of this pilot school, that the eCraft2Learn ecosystem or similar maker spaces can be integrated in school curriculum to incorporate the making culture in school education.

In the other eCraft2Learn lab at Technopolis, Athens, and in collaboration with the partner Technopolis City of Athens, we have joint plans for new training actions that include:

- teacher training courses for local teachers in the use of the eCraft2Learn technologies and methodologies.

- learning activities and courses for children. The courses will be adapted to the age of the children.

- short study visits for school groups while visiting Technopolis in collaboration with the Technopolis Museum.

- summer school for teachers/student-teachers and children aged 13-18 to deliver training in eCraft2Learn technologies and methodologies inviting teachers and children from all Europe. In addition to the eCraft2Learn consortium, these actions will be supported by the European project INBOTS Coordination & Support Action (2018-20) http://inbots.eu in which EDUMOTIVA participates as a partner. INBOTS CSA consortium brings together 25 partners from 12 different countries and can provide wide access to teachers and students at European level. Our vision is to make the eCraft2Learn labs in Athens a European educational and research centre to promote innovation in STEAM education, making technologies and educational robotics.

- The labs will be open to local universities offering practical training for students.

- An international scientific advisory committee with the participation of European partners and other distinguished scientists will be set up to support the actions of the laboratory.

In addition to these plans, EDUMOTIVA will exploit the experiences gained from the eCraft2Learn project, and especially from the pilots in Athens, to:

- Inform and enrich our local training actions with the eCraft2Learn technologies, methods and resources

- Employ teachers who have participated in Athens teacher training courses and pilots in our future actions

- Build an eCraft2Learn community of teachers and students locally in Athens

- Contribute to the growth of an eCraft2Learn community at European level

- Make proposals for new research and educational projects within the H2020 and ERASMUS+ framework

- Publish further papers in books, journals and conferences

5.8. TECHNOPOLIS

Technopolis will sustain, further develop and exploit the informal education lab that has been created in their premises and will offer various training courses in collaboration with Edumotiva using eCraft2Learn technologies and methodologies.

The new activities will be conducted according to the following action plan that sets the lab as open in new opportunities and ready to be used for several purposes that serve in the direction of the further development, dissemination and exploitation of ecraft2learn technologies and methodology.

This plan is comprised from:

- training activities and courses for students. The courses will be adapted according to the age of the students
- teacher training courses in the use of the eCraft2Learn technologies and methodologies
- study visits for schools and groups visiting Technopolis in collaboration with the Technopolis Industrial Gas Museum educational department

Apart from these activities that will be contacted in local level, there is a plan for internationalization of the project and its outcomes and further use by:

- setting an international scientific advisory committee with the participation of European partners and other distinguished scientists will be set up to support the actions of the laboratory

- finding open calls and participating in other European projects
- organising summer schools in collaboration with Edumotiva

Accreditation of the laboratory

There has been conducted extensive research in order to identify the right accreditation programs available in Greece in order to certify the educational program for the trainers using eCraft2Learn methodology. The process is described in D 6.5.

5.9. EVOTHINGS

Evothings Labs is apart from an engineering provider also the creator and maintainer of the Evothings Studio software suite, an open source initiative and tool framework purposely built for the development of mobile services catering for the Internet of Things and industrial internet applications, licensed under the Apache 2 license.

Our offering spans over both extending Evothings Studio to incorporate support for novel hardware, devices and APIs/Cloud Services, alongside non-recurring engineering and project work for customer organisations. On the embedded side, we've had very little to offer and have relied heavily on frameworks for development, deployment and maintenance being in place by other means. During the course of the project, several fruitful ideas have come up, while the prime exploitable resource is the distributed compiler called Craftbot for Arduino. We already find it being an advantage to include such a component when offering project work, and our strive is to offer bespoke solutions based on the Craftbot code base, as complimentary offerings. This means exploiting the fact that compilation and serial monitoring can take place elsewhere than in the absolute proximity to the embedded device in question.

Collaboration with other European Projects
Within the ECSEL Joint Untertaking project AFarCloud [https://www.ecsel.eu/projects/afarcloud] with focus on digitisation and aggregating farming in the cloud, there is a major need for being able to program and reprogram edge devices running in production. Here, our network partner Imagimob as well as partners in the Swedish cluster are interested in using the Craftbot for Arduino as part of their initiatives to monitor livestock and farming equipment, both for the development of mock-ups and demonstrators as well of code for running applications in full scale trials and actual production at the local and holistic demonstrator testbeds.

Collaboration with educational institutes
In collaboration with RISE (Research Institutes of Sweden), a project on disseminating research results in relation to long-range wide area networking (LPWAN), there will be a public dissemination at RISE Kista on December 12, in the Stockholm, Sweden area at the annual IoT and Sensor day 2018. Our intent is to further the collaboration with RISE and the Royal Institute of technology (KTH) in Stockholm to include Craftbot in one or several of the courses given on Master's level. These students are a bit older than the young learners, while the tools and supporting framework can remain without little adjustments before it can be deployed in learning environments.

5.10. ARDUINO

Learning from the results of the first season (21 episodes, released from 15 Mar. 2018 to 26 Jun. 2018), the second season was restructured from its original format of guides, that were aimed to help teachers use Arduino in their classrooms, to the format mentioned in the previous paragraph. The reason for these changes was that while the first episode, in the first season, had a good response with over 2500 views, the later episodes rarely went over 500 views. Over time there was a

pattern where episodes that were longer and had a more theoretical approach were doing worse than the episodes that featured projects and shorter.

Thus, the second season was changed with that pattern in mind, and the new episodes focuses on projects and 15-30 minutes long. Which have resulted in that the first seven episodes from season two have in average 1000 views each, as of 10 Dec. 2018.

5.11. ULTIMAKER

Ultimaker will exploit eCraft2Learn by signposting it as a potential solution when advising schools and educators about maker and STEAM education, both in our consultation services and in our training programmes.

The eCraft2Learn project outcomes also provide a collection of resources for Ultimaker's CREATE Education Project 3D printing community. The inclusion of eCraft2Learn on the CREATE website as an open-source resource adds significant credibility and value to the CREATE platform as well as providing a valuable product to our large and expanding community of maker educators.

www.createeducation.com/community/ecraft2learn

In future, Ultimaker plans to use the eCraft2Learn ecosystem as a platform for delivering our own eCraft2Learn school workshops and projects through our education partner CREATE Education.

In addition to the eCraft2Learn Project UUI and resources, the project has enabled Ultimaker to fast track the development and launch our STEAM educator community platform "CREATE Connect" as a tool for ongoing dissemination of the project. This platform aims to connect like minded educators and provide project and special interest groups allowing teachers to share, collaborate and learn from each other. Following Beta testing in M23 and M24, the platform will be launched initially with the eCraft2Learn community group and a small number of test user groups in January 2019.

www.connect.createeducation.com

The official launch of the platform will be at BETT 2019 where Ultimaker and CREATE Education will be promoting the platform and encouraging sign-ups to the platform. We would be unable to launch the platform without some initial content and groups, eCraft2Learn has provided the perfect launchpad for this as it is an established project with pilot users in Finland and Greece as well as the consortium members who are able to join the eCraft2Learn community group and collaborate during BETA testing, providing an initial community, activity stream, communication and content for the launch. We believe over time the CREATE Connect Platform will connect thousands of STEAM educators around the globe and that eCraft2Learn will be a valuable and popular group within the platform.

We also plan to investigate how we can further exploit the eCraft2Learn hardware solution, perhaps by offering eCraft2Learn makerspace hardware craft and electronic component bundles as a product that we can provide to customers directly through the CREATE education marketplace as a ready made school makerspace solution.

To conclude, through our involvement of eCraft2Learn as a consortium partner, Ultimaker have benefitted from exploring a range of technologies, complimentary to 3D printing and how they can be embedded in a complete STEAM learning ecosystem. We have been able to fast track development of a new global community STEAM educator platform and can exploit the eCraft2Learn UUI and resources to enhance our position as a market leading STEAM education technology solutions provider.

5.12. LNU

The focus of our research efforts at the Center for Learning and Knowledge Technologies at LNU (CeLeKT) lies on the design, implementation, use and evaluation of Web and Mobile Technologies to support learning and teaching with a focus on STEM (Science, Technology, Engineering and Math). A complementary research direction includes the field of Computational Thinking Education (CTE) and how Maker Spaces can promote students´creativity and interest for STEM related areas. We closely collaborate with the public sector, schools and companies. In these lines of actions we have a strategic and long-term strategic partnership with Region Kronoberg and The National Museum of Science and Technology . Agencies such as Vinnova, Tillväxtverket, The KK foundation, The National Agency of Education (Skolverket), the EU commission and EU-Regional Development programs have granted financial support for the period 2018-2022. The exploitation of the outcomes of the project eCraft2Learn can be canalized via the different activities as described below:

1. Long Term capacity building for Mathematic and Technology teachers as part of our ongoing projects (2018-2021).

- Make It Happen: https://avmedia.kronoberg.se/make-it-happen/
- Capacity Building for teachers within Computational Thinking and Programming in Schools: https://lnu.se/mot-linneuniversitetet/Organisation/fakulteten-for-teknik/utbildning/grundlaggande-programmering/
- A new master program on Digital Learning will start at LNU with a specific direction towards STEM and CTE

2. Implementation activities connected to the following national project (2018-2022)
- Maker Tour – Mot Nya Höjder - http://motnyahojder.com/

3. Research in the field and dissemination activities
- We are about to recruit 3 new PhD students, so some of the outcomes of the eCraft2Learn project can serve as a basis for research for these new 3 PhD candidates. https://sites.google.com/view/edtech-doc
- Second International Workshop on Computational Thinking and Coding Skills in Schools https://lnu.se/en/ctcs18

6 IMPACT

6.1. UEF

In the short term, UEF has received a positive impact from coordinating the eCraft2Learn project in terms of widening networks and international visibility, hosting and preparing scientific events under the project umbrella in renown international forums.

In terms of innovative research, as a university it has been very important to develop theoretical research, practical development of software solutions as well as deployment and testing in real contexts, which has permitted the participation of the university publications to well-known scientific forums in collaboration with world-leading partners. This has a very positive impact in the national ranking of the university in the short and medium term. Furthermore, the UEF has been identified by the Commission Innovation Radar through the development of the eCraft2Learn project as an innovative organisation. UEF's inclusion in this initiative could in the medium to long term open up new opportunities to partner with businesses or other academic organisations and

could also trigger interest from potential customers (e.g., schools in Europe) or investors interested in supporting taking the developed platform to the business realm. Above all this inclusion in the EU Innovation Radar will demonstrate to a global audience the innovative work that we have been doing and that we are capable of delivering.

In the long term, UEF plans to continue the research in the open-ended learning analytics that is influenced by the Learning analytics system (LA). LA enables to analyse any data collected from the educational settings and thus, LA can be used in the future to enhance learning, enable interventions in the educational settings and to understand certain machine learning algorithms more deeply. Furthermore, based on the experiences during the pilots, a secondary school teacher in Joensuu, Finland created a makerspace where the students can go through making activities by using the UUI and its several tools. This will be an excellent test ground for innovative ideas testing in terms of the further development of the eCraft2Learn learning ecosystem.

6.2. MDH

This partner focuses on creating long-term and sustainable impact through the measures and activities defined in Sect. 5.2 A key dimension here is collaboration with other entities at the MDH, and in addition schools and the municipalities in our surroundings (larger Stockholm, Södermanland, Västmanland, and the rest of the Mälardalen lake region). The former assumes impact through scientific activities i.e., through research projects, publications. The latter assumes deployment of the proposed eCraft2Learn technologies in sharp learning situations. Programming in early ages is becoming an important cornerstone in Swedish formal education. All the way from pre-school year (6 years of age) to upper secondary school programming is becoming part of the different curricula. Through several contacts MDH has an excellent network in its region. EVOTHINGS LABS by proving solutions that incorporate sensors and hardware solutions to create relevant solutions.

6.3. ZSI

Our work on innovation management and use cases made us acutely aware of the needs and constraints in today's school environment. This strengthens our profile as research institute with a focus on different forms of participation in design and evaluation. Moreover, we already took some of the experiences developed within eCraft2learn and continued their refinement in other projects such as DOIT (entrepreneurial learning) and System2020 (informal learning). Although these projects are not focused on learning technologies, the Arduinos and the design thinking approach were well suited the prototyping in entrepreneurial education.

eCraft2learn was also a good bottom line with which we could compare newer boards emerging over the last years. So, we knew the process with younger kids and opted for a board (Calliope.cc) more suitable for the age of 6-9-year-old children. The internal capacity we were able to build up led to the production of training materials for this specific board.

Further actions are planned in pushing for more artefact-based research as a means to make results more tangible and open to feedback from a variety of perspectives such as ethics, materials and, of course, experiential factors.

6.4. UOXF

The University of Oxford has plans to continue the development of the AI extension. We are currently working on new blocks for creating, training, testing, and using deep learning models. An

example project involving discovering a connection between weather and incidence of influenza is ongoing.

The library of Snap! AI blocks is being used in a project in 2019 involving screening for various diseases based upon the appearance of fingernails. Researchers at the Indonesian Pedagogic University in Bandung are in the midst of a project introducing the Snap! AI blocks to high school students and teachers in four cities in Java. Create Lab Pte Ltd has run AI programming workshops for young children (8 to 12 years old) in Singapore and Sri Lanka and plan to do more including workshops in India. Beijing Normal University has agreed to fund a project involving translating and trialing the AI programming blocks and guides in China. Wolfram Research Europe has met with us and plans further meetings to help guide their efforts in developing AI programming tools and exercises for school children learning mathematics.

Our publications, conference presentations, workshops, and seminars on AI programming by children has reached many hundreds of researchers and teachers. Many have expressed interest and plans to use our AI learning materials.

6.5. SYNYO

The role of Dissemination Lead in eCraft2Learn helps SYNYO put another significant expertise in its portfolio acting as a very good showcase for the acquisition of further projects and customers for marketing, design and communication services. The project website, communication activities and additional dissemination materials are a good showcase of the company's products and expertise, supporting it in the acquisition of further industrial projects for design/communication services.

Moreover, the engagement with the educational community in events and through online communication has enabled it to create bigger network of partners from the education sphere, that can enable the company to increase its involvement in research projects with an educational character from funding schemes less explored by SYNYO such as Erasmus+. The network and the knowledge acquired throughout the whole project will be used to promote the company as a partner in future projects but also to establish valuable partnerships for the own research proposals.

6.6. UNIPD

Ecraft2learn was the third European project run by UNIPD about educational robotics. But it was the first ICT project the other two were ERASMUS+ and Copernicus projects. This ICT H2020 project increased very much the visibility of our research group both internally in the University of Padua, which count 2000+ researchers, and externally in the educational robotics community. This visibility is very important for our team in order to get involved in future projects and future proposals. Moreover, this project has been a great opportunity of mediatic visibility for UNIPD: we successfully issued many press releases and several articles appeared in newspapers. Prof. Menegatti and Prof. Moro were invited in several public events, and events reserved to teachers, to present the results of eCraft2Learn together with their research.

Very important for UNIPD is the result achieved by eCraft2learn in creating a self-contained ecosystem. In particular, it is very important for Italy to have created the specifications for an ecosystem composed of hardware and software which is cheap, easily transportable and self-contained. The possibility to go to different schools with eCraft2Learn kits and to deploy the ecosystem independently from the computers, the software and the technical skills available in the schools is very important. This enables and foster the possibility to start educational robotics and digital-enabled activities also in school without modern computer equipment. In our expertise

several time we could not run a didactical lab in schools because the hardware was not up to date or the software was not compatible or the school did not had computers. The hardware and software eCraft2Learn ecosystem will enable UNIPD to run more educational activities in local schools and to act as partner in educational projects run by the schools adopting the eCraft2Learn methodology.

6.7. EDUMOTIVA

First, the project has strengthened our links with the European academia, research community, companies and organisations with similar aims and interests. This has helped EDUMOTIVA to increase visibility in the community.

Then, our contribution to the development of the open educational resources to be used within the eCraft2Learn pilots has enriched our expertise in producing educational resources and supporting our future educational actions.

The organization of the eCraft2Learn pilots in Athens has increased our experience in organizing educational actions, strengthened and extended our ties with local communities of teachers, students and parents.

Our involvement in designing the eCraft2Learn technical and learning environment has greatly impacted our ability to use new technologies in our educational actions, to train teachers in this new environment and provide learning activities for kids following the eCraft2Learn methodology.

The eCraft2Learn experiences are also useful for our involvement in the new H2020 project INBOTS (inclusive robotics) when we exploit the eCraft2Learn experiences to suggest a framework for promoting revisions and reforms in the European robotics education.

6.8. TECHNOPOLIS

The eCraft2Learn project has been a great opportunity for Technopolis. Although Technopolis has been active in educational activities oriented to STEAM, this was the first time that the organization has created a lab that was dedicated exclusively in this field. Therefore, this has set the ground for new partnerships, new endeavours and more projects to come. Additionally, the lab has attracted many students and educators that have been involved in the trainings and by this way this further developed Technopolis establishment in the maker movement field.

Moreover, ecraft2learn was the first project that Technopolis has been a partner in a research programme and such an involvement has created opportunities for the organisation to get in touch with the research community and academia in European level and support future actions.

6.9. EVOTHINGS

The eCraft2learn project has created an impact on our organisation and how we work. One important aspect is being an introduction to the European research community, meeting other companies and organisations with similar agendas and experiences from development work in adjutant fields. We were soon after the start of the eCraft2learn project, invited to apply for a ECSEL Joint Undertaking alongside some of the other partners, where our role will be to contribute with technology both on the mobile and embedded side, and the interplay from eCraft2learn has helped us focus on the quintesse of what Evothings Labs does best.

As mentioned in previous reports, the application of having a distributed development environment also have proven to have advantages when a system is hard to reach once it is deployed, like in the case with ABB Research and microprocessor platforms on-board the 800,000 V distribution system for industrial electricity distribution. Power lines for entire factory or city cannot be powered down to reflash firmware of a sensor device. Rather it has to be remotely accessible using a companion device carrying if not the compiler itself, the means of distributing the firmware binaries. This is an on-going effort, where we collaborate closely with ABB. We are aware of that the use case is clearly outside the realm of crafting with young learners, while the need and expectations are similar. Vice versa we also believe that experiences from the industry work; the need for clarity, verbose code annotation, ease of use without deep dives in manuals and reference documentation contributes to a better learning experience also for the student population targeted within eCraft2Learn.

Other aspects of impact lie in the use of methodology in collecting qualitative and quantitative feedback from users, e.g. how to create a baseline for the learning population, and methodically asking questions to reach an understanding of the current learning situation to better understand the impact on the introduction of a novel processes and tools for crafting and education. We will also support MDH's approach to allow the usage of the eCraft2Learn technologies in educational settings in the schools.

6.10. ARDUINO

Direct Impacts for that Arduino gained from eCraft2Learn come in three areas.

First area is open educational resources: The open educational resources made to be used within the eCraft2Learn ecosystem, provides assistance for educators to start using Arduino in their classrooms. Outside that ecosystem, the Arduino Education Livecasts episodes have and will continue to create content dedicated to inspire educators and students. These LiveCasts are free and open, transmitted through Arduino's official YouTube channel and disseminated using social media.

Second area is the extended knowledge on how to setup and run a live streaming series: Throughout the first season of the livecast, Arduino have improved significantly how the episodes are made, both in how and with what tools to use in creating the series, but also how run a live streaming series on a service like Youtube. This can be seen in both the viewer response from the first season compared to the second one, but also in the improved quality of the newer episodes.

The third and last area is Arduino's increased visibility in the video space and in the community as a whole: The livecast provides content for a steady audience to build up around, improving Arduino's official YouTube channel views and subscriber. Also, with the start of the livecasts, Arduino opened a Discord chat room, that have proven to be a great tool to have temporary conversations in.

6.11. ULTIMAKER

The eCraft2Learn project has had impact in the organisation by facilitating a deeper understanding of the challenges faced when embedding STEAM based curriculum in the education system.

The consortium has successfully addressed some of these issues and has established a robust plan to enable users to realise the learning benefits digital crafts provide and to combine different elements of Industry 4.0 technologies. The pedagogical developments will have an impact not only for ecraft participants but for the broader Ultimaker education users.

Some of the development requirements have accelerated plans internally and identified particular areas of focus, such as the CREATE Connect STEAM Educator Community. The fast-track development and launch of this community will have a huge impact on the growth and credibility of Ultimaker's CREATE Education Project.

Participation in the development of ecraft2learn has allowed Ultimaker to access new stakeholders and the successful dissemination will further improve this access.

Ultimaker has realised a number of strategic impacts through participation in the consortium. Whilst much of the knowledge required to get the best out of 3D printing lies within the organisation, our existing community and our partners it's become clear that this does not make it truly accessible for all. The technical threshold in terms of skills required for using an Ultimaker is relatively low, however, the pilot feedback has highlighted there's more to be done in this regard. This has already stimulated strategic conversations in terms of product portfolio but also the broader offering.

The other impact that has been underlined from this project is the importance of community when embedding new technologies. Whilst technology product manufacturers do a good job (in most instances) at the set-up phase, there is more opportunity for sharing best practice and continually sharing user experiences so that each individual does not have to 'reinvent the wheel' when faced with a barrier or if they have identified a benefit but they're unsure how to best to approach it.

By working in such a collaborative manner, the consortium has established a genuine rapport with internal stakeholders who recognise the innovation benefits of peer to peer learning. If we can replicate this with external parties across the EU then the adoption of best practices and the removal of barriers for STEAM education will be accelerated.

In terms of impact from the project development issues, we have learnt that clear delegation of tasks supported by modular communication, which is all consolidated into the main thread, allows partners in different time zones with differing time critical pressures to produce a body of work that should live long beyond the end of the funding.

We believe the impact of this project will only truly be felt when it goes live and we can see the improved engagement and subsequent improvement in learning outcomes in multiple countries.

6.12. LNU

Our participation in eCraft2Learn allowed us to strengthen our ongoing efforts concerning the creation of teaching programs of Mathematics and Technology to teachers and other learning communities (as mentioned in section 5). We expect to show the potential exploitation of the eCraft2Learn results in Sweden and internationally:

- Number of Local Municipalities we collaborate with: 50 +
- Number of Children and Students (ages 6-16): 6000+
- Number of Teachers (grades K1-9) involved: 1000+
- Strategic Partners: Region Kronoberg, The National Museum of Science & Technology, Nobel Center & IST
- Industrial Collaboration: Swedish EdTech Industry Association http://swedishedtechindustry.se/tseia/
- Conferences we organize: DigDag 2019 (600+ participants), International Symposium Computational Thinking (50+ participants)
- Public Science Outreach Activities: Linnaeus Science Outreach & Science City
- Strategic Academic Collaboration: Stockholm University; The Open University of the Netherlands; Ruhr West University of Applied Sciences; Germany, The Education University of Hong Kong, HIT Holon, Israel.

7 CONCLUSION

This document sought to present the outcomes of the eCraft2Learn project as a whole as well as its bits and pieces that can be used sustainably and exploited in the future. The first part presented each of the individual outcomes created by different partners with a reference to the audience of the material, the means of keeping it sustainable, the license for further use as well as the impact its future exploitation can have for the stakeholders. The second part of the document mentioned again all the project stakeholders and a roadmap for the future exploitation of the whole ecosystem. As described in the following table, the dissemination plan of the project sought to create informing and supportive materials for each of the stakeholders mentioned in the project.

Type of stakeholder	Available materials
Students, teachers, Schools	Project Website, Dissemination Package, UUI, Events and Fairs
Research Centres, Universities, Researchers	Project Website, Dissemination Package, Scientific Publications, Conferences
Industry Stakeholders	Project Website, UUI, Dissemination Package
Associations	Project Website, Dissemination Package (Guide 10)
Policy Makers	Project Website, Dissemination Package (Guide 10)
Media	Project Website, Dissemination Package

To further disseminate the project and make sure its outcomes are exploited in the future, the consortium draws a detailed plan for the actions expected to take place in 2019. These include continuing with the work in the already established communities, especially in Greece and Finland through an online community group via CREATE Connect, and the exploitation of the pilot sites in both countries for further training activities for teaches and students interested in deploying the ecosystem. Moreover, a series of other activities are planned by other partners including the deployment of the eCraft2Learn in two schools in Sweden and Italy, as well as scientific and industrial exploitations for future publications, additional research and developments, etc. Pursuing further funding as a means for bringing the ecosystem closer to the educational community – since the actual funding scheme of two years was very tight for researching, designing, validating and also disseminating the outputs – constitutes also an integral part of the plan for achieving maximal exploitation of the eCraft2Learn ecosystem.

The last part of the document details the concrete plan of each of the partners and the impact the action had and will have on their organizations. This plan has a relatively short-term character and potentially greater impacts and exploitations options are expected in the future.