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WP6 – Attracting people to ICT: innovative learning and teaching

DELIVERABLE 6.2 – Report on training outcomes

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1 Introduction to the deliverable and scope

1.1 Short introduction to the deliverable

The outputs described in this deliverable focus on the outcomes of the online training programmes designed and deployed for in-service teacher about computer science and programming skills as part of the activities of Work Package (WP6) of the DIGITALJOBS project.

1.2 Description of Work Package

This deliverable is part of WP6– Attracting people to ICT: innovative learning and teaching. The main objectives of WP6 are described below:

- The objective of WP6 is to boost the supply side for ICT jobs creation through more aligned educational schemes as well as structural changes inside educational systems. It will therefore:
- Organise regional and European roundtables linking education, training, industry and wider stakeholders to identify and exchange best practice in primary and secondary teaching and learning about ICT.
- Deploy teacher training, both online and face to face to encourage practitioners to take up innovative and best practice in teaching and learning about ICT and computer science, and to give young people a more realistic view of technology studies and careers.
- Identify education relevant outcomes from the pledges of the Grand Coalition and disseminate them to key education stakeholders.

1.3 Description of the deliverable

This report describes the overall online training methodology, including curricula per course, assessment strategy, platform(s) and engagement mechanism for teachers put in place by EUN during the two years of the DIGITALJOBS project. It also summarises the feedback received from trainers and students involved in the courses, and give recommendations for future deployments of the training programmes in across different contexts.

2 Academy EUN

2.1 Description of the Academy

The training courses object of this report have been deployed through an online platform exclusively dedicated to host and manage massive open online courses tailored to teachers' needs, the European Schoolnet Academy.

The European Schoolnet Academy is an online training platform to learn about innovation in the school and classroom through online professional development courses for teachers in primary and secondary schools. The Academy offers EUN projects a central place to advertise and run online training for teachers to find out about training opportunities offered by European Schoolnet projects and as part of this, access project resources in a meaningful and pedagogically effective manner, ensuring that teachers receive a substantial added value from this content.

The courses offered in the platform are completely free of charge, and offer the participants an introduction to key concepts and ideas that are relevant to developing their teaching practice.

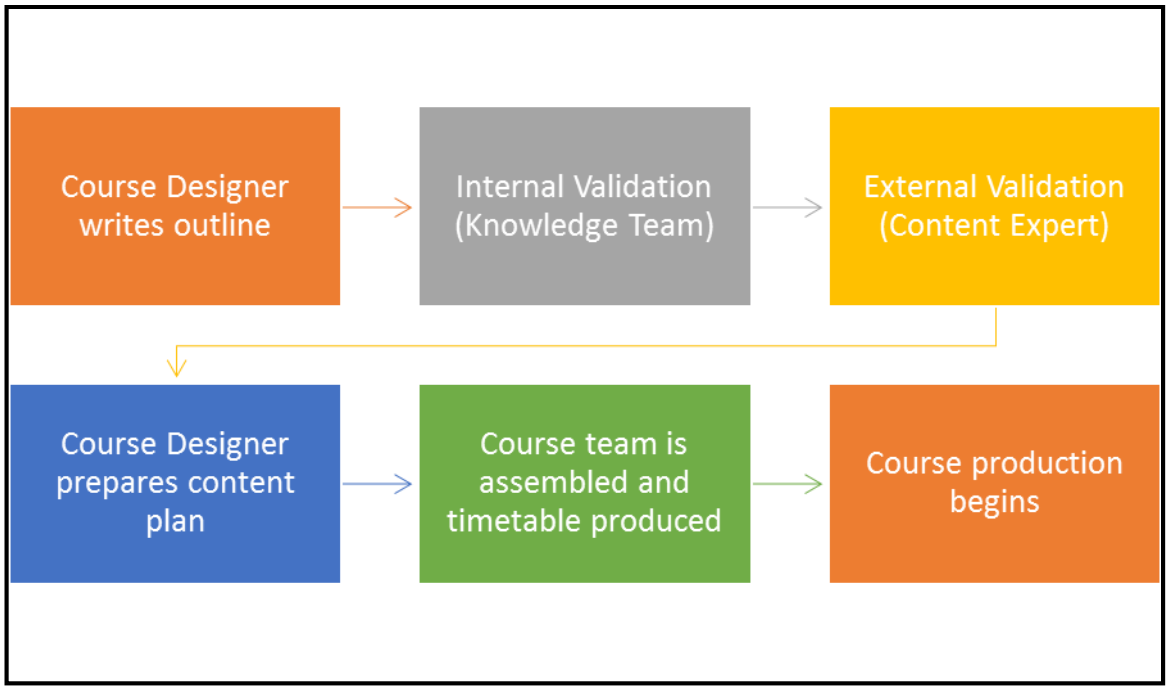
2.2 Methodology of the Academy courses

2.2.1 Design of the course

The initial step of the course creation process is the drafting of a course outline by the course designer which identifies the rationale, objectives and offers an overview of the content and methodology to be used for the course. This course outline is first validated by the Knowledge Building Team at EUN to ensure the proposed course methodology is feasible and appropriate for the EUN Academy context. The course is then validated by an external content expert to ensure the relevancy of the proposed course content.

Once the course outline receives the go-ahead from initial validators, the course designer prepares a course content plan which identifies each piece of content (video, animation, activity, documents, etc.) that is required for the course. Based on this content plan and on the required resources to create the course, a course team is assembled and a general timetable for the course production and the launching of the course is set.

The process is better illustrated in the graphic below.



Graphic 1: Process of the creation of a course in the EUN Academy

2.2.2 Production of the course

After the proposed course passes these initial steps, the course production starts. The course team sets regular dates for course meetings to ensure everyone remains on track and in line with the course design; the course coordinator prepares a detailed chart for all content creation and communication activities; production templates are created to ensure consistency in the use of style and visual materials.

Once all content for a module is ready and prepared on the platform, the external validators[1] test the entire module, preparing a feedback report for each module using the course validation framework documents (Annex 1). The course designer makes final adaptations to the organisation of the content based on the feedback of the validators. Only in exceptional cases, should the feedback necessitate a redrafting of the content, the process starts again from step 2 onwards.

2.2.3 Course management

Before the course

Before launching the course, dissemination on social media is made, and the participants enrolled receive a link to a pre-course survey, a link to a participant map and instructions for any other required pre-course activities. The course coordinator

[1] A team of external course validators should be recruited. These validators have to be individuals who are representative of the target audience (usually teachers). Preferably they would represent a mix of experiences, nationalities, subjects, etc. and depending on the main target audience have limited association with the project or EUN itself to ensure neutrality and a complete outside perspective.

prepares the module 1 introduction video that provides an overview over the functioning of the course and an outline of the first module and includes an overview of the data gathered by the pre-course activities.

During the course
During the course, the course coordinator announces the participants that a new module is accessible. Also, an email is sent to all enrolled users who have not yet started the course as a reminder about participating on the course. Regular meetings between the course coordinator, the course communicator and the course supporter are essential during the course to exchange information about the participant's input, feedback and questions offered via the communication channels on the course.

Course follow-up
Once the course has come to an end, a course evaluation will be conducted to rate the participants comments and experiences to take them into account for further improvements in the courses.

2.3 Assessment strategy

Participants in the MOOCs are encouraged to participate and interact in the activities proposed in every module. Besides, the participants have to complete a module to be awarded a module badge. They complete Modules by passing the quiz at the end of each module. If they fail to pass the quiz, they can still complete the rest of the modules and earn the corresponding module badges, but they will not receive the course certificate at the end.

To complete the last module participants also have to submit a final composition (which may be a lesson plan) and complete a peer review activity. Once they have completed all the modules' compulsory activities and tests participants will receive badges for each module which give them the right to receive the official course certificate and a final digital badge.

2.4 Technical overview of the Academy platform

The Academy platform is a learning management system (LMS) specifically designed for large-scale courses but also offering tools that are only applicable for smaller courses.

The main sections/tools available for a course on the platform are:
- Course Homepage
- Modules which are divided into "activities". The main activities are:
    - Surveys
    - Test (Quizzes)
    - Peer to peer activity
    - External resource (integrating outside content such as a YouTube video)
    - SCORM resource
    - A resource from the platform media library
    - Tutor Assessments
- Forum

- Wiki
- Course Announcements
- Course Mailings
- Course Timeline
- Question and Answer
- Statistics

3 Online training courses on computing

Within the context of the DIGTALJOBS project, EUN has developed three MOOC (Massive Open Online Course) type training courses on computer science education delivered through the European Schoolnet Academy described above.

The first MOOC targeted teachers from secondary school, the second one teachers from primary school and the third one targeted teachers working both in primary and secondary schools with the aim of promoting the introduction of computing with a cross curricular approach:

- 1st MOOC: How to Teach Computing: an Introduction to Concepts, Tools and Resources for Secondary Teachers
- 2nd MOOC : How to Teach Computing: an Introduction to Concepts, Tools and Resources for Primary Teachers
- 3rd MOOC: Introducing computing to your classroom

These training courses have been developed in close collaboration with experts on both ICT Education and Industry.

In the sections below, details on the contents and outcomes of each of the three MOOCs are provided.

3.1 How to Teach Computing: an Introduction to Concepts, Tools and Resources for Secondary Teachers

3.1.1 Course overview

The MOOC for secondary school teachers, launched in November 2014, was designed not only as an introductory course, to cover key concepts, resources and tools relevant to computer science teaching at secondary level, but also to highlight the relevance and practical use of these concepts and tools in other subjects. The course has a pragmatic approach by exploring specific activities to run in the classroom.

Graphic 2: The introductory page to the course

Target audience

The course was aimed at secondary school teachers but was open to anybody interested in the topic. While some of the activities presented in the course were more relevant for Computer Science teachers, the course was aimed at teachers from any subjects. Some basic understanding on how to operate computers and software was required for this course.

Duration & Workload

The course lasted 6 weeks from November 3rd 2014 to 14th December 2014.
The course was divided into 6 modules, one module per week, and the estimated workload for each module was around 2 hours per week, depending on the participant's level of engagement.

Certification

For each module completed, participants were awarded a digital module badge. After completing the entire course, participants received a digital course certificate and a digital course badge.

Instructors

The course has been conducted by **Benjamin Hertz**, Coordinator of the European Schoolnet Academy and supported by: **Ben Bastiaensen**, IT teacher and Future Classroom Lab ambassador; **Francis Wyffels**, Chairman and educator of Dwengo VZW; and **Patrick Feeney**, game designer and consultant for the Future Classroom Lab in European Schoolnet.

3.1.2 Description of modules

The course included the following modules:

- **Introductory Module**
  It provided participants with an overview of the key organisational features of the course.

- **Module 1: Why teaching computing at schools**
  Description of the module
  This module emphasised the fact that Computing is still a very rare subject in most schools around Europe while it would deserve more attention. The module explored therefore why teaching Computing is of key importance, and allowed teachers to reflect on what areas and ways they should introduce this subject in their teaching.

  Learning Objectives
  To understand why it is so fundamental to focus more on computing at schools.
  To get inspiration and resources that support teachers in discussions about the role of computing at schools.

To use the answer to this question to start reflecting about what and how we should be teaching computing.

- **Module 2: What and how are we teaching? Introducing concepts and methods**

Description of the module

Module 2 focused on general questions around the topic of Computing: what teachers should be focusing on in their teaching and how should they be teaching it? The module provided answers to these questions and triggered a reflection about how teachers are currently organising their teaching or how they are planning to do so in the future.

Learning Objectives

To be clear about the varied terminology used for the different areas of Computing.

To start developing an understanding of concepts, methods and ways of thinking that are relevant to Computing.

To reflect on some general and specific ideas of how to approach teaching computing skills.

To explore the range of resources suggested in the module and in particular gain an understanding how and why computing should be taught without using computers.

Graphic 3: Some participant's reflection to the question "does the work of students in computing classes impact their work in other subjects or other areas of life?"

- **Module 3 How to teach computing using visual programming tools?**
  Description of the module
  Module 3 focused on a critical reflection about the value of visual programming tools (e.g. Scratch) and the effective use of these tools when teaching Computing.

  Learning Objectives
  To understand and reflect about the value of visual programming tools in the classroom.
  To explore some examples of effective use of visual programming tools.
  To develop an understanding of the different pedagogical approaches to teaching Computing (from the Webinar).

- **Module 4: How to teach computing using game design tools & involving more girls**
  Description of the module
  The module introduced concepts and methods to teach computing using different game design tools (Kodu, Gamemaker, Alice and Greenfoot). It also focused on the topic of girls and computing to come up with some ideas on how girls can be more involved in the use of computing.

  Learning Objectives:
  To understand the advantages and disadvantages of the main game design tools available for education.
  To come up with a concrete activity for one of the tools that teachers can use in their classroom.
  To reflect on how teachers engage girls in your classrooms and to come up with strategies to get more girls involved in computing.

- **Module 5: How to teach computing creating? Creating for mobile & preparing your Hour of Code**
  Description of the module
  The tools introduced in this module focused on teaching software development for mobile devices and reflected on the importance of using these tools to enable students to actively interact with technology and smart devices such as smartphones and tablets.

  Learning Objectives:
  To explore two tools for developing mobile apps in the classroom.
  To reflect on previous modules and brainstorm how each of the tools, resources and ideas can be used in the classroom.
  To design a lesson plan using tools, ideas and resources presented on the course.

- **Final Project: Running your Hour of Code**
  Description of the module
  This module served to reflect how the teacher's lesson plans can be useful for their own teaching practice. Also, teachers were meant to analyse

different lesson plans and explore how they could be useful for their own teaching.

Learning Objectives:

Experiment with a new computing tool or idea in your classroom.
Reflect on, evaluate, and then refine the teacher's lesson plan.
Review two lesson plans and reflect on how the ideas in those lesson plans can be useful for the teaching practice of the teachers.

3.1.3 Live webinars

Two live webinars have also been offered during the course. The first one, *An Introduction to Pedagogical Approaches of Teaching Computing*, took place on November 19th 2014, and the second one *Rails Girls - how to get more girls to code*, took place on November 27th 2014.

- **An Introduction to Pedagogical Approaches of Teaching Computing**

The first webinar, presented by Prof. Dr. Ira Diethelm, teacher of maths and computer science at secondary school in Braunschwig, gave insight into various perspectives on what computer science in school is about and offered different approaches on how to select topics and structure lessons.

- **Rails Girls - how to get more girls to code**

The second webinar presented by Oana Sipos, a telecommunications engineer, explored how culture can impact girls as they normally don't find programming a very appealing field of study. Oanatried to suggest to teachers ways to encourage them to get into computing.

3.1.4 Impact of the course and participants feedback

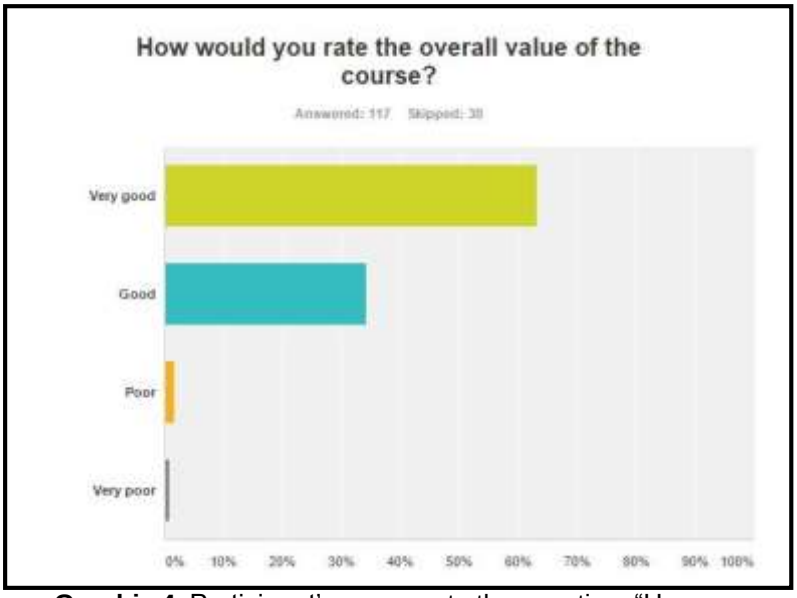
Number of participants

A total of 1014 teachers from around Europe (Italy, Romania, Portugal, Greece, Lithuania, Czech Republic, Finland, France, Germany, Ireland, Netherlands, Spain, Sweden) and beyond (Tunisia, Turkey, Peru, Israel, Madagascar, Republic of Macedonia, India and Colombia) actively participated to the course while a total of 1423 registered to take part. A total of 258 participants completed all tasks of the course and received the course certificate.

Participants' feedback

63% of the participants interviewees (74 out of 114) rated the course to be very good and 34% of them (40 out of 114) stated the course was good, while only 1% of the participants (2 out of 114) and 0,8% (1 out of 114) rated it to be poor and very poor respectively.

The course had a very positive impact in teachers, with 56% of the participants reporting to have gained practical ideas of how they can improve their professional practice, while 47% indicated they would use ideas and examples presented in the course in their everyday teaching practice, and 44% of them stated that the course made them feel more confident and able to teach Computing topics in their classrooms.



Graphic 4: Participant's answers to the question: "How would you rate the overall value of the course"?

All the contents, videos, quizzes and material of the course are openly available on the European Schoolnet Academy website at *How to Teach Computing: an Introduction to Concepts, Tools and Resources for Secondary Teachers*

3.2 How to Teach Computing: an Introduction to Concepts, Tools and Resources for Primary Teachers

3.2.1 Course overview

The MOOC on *How to Teach Computing: an Introduction to Concepts, Tools and Resources for Primary Teachers* course was launched in April 2015. The course explored the ideas, concepts, processes and skills related to computing and then introduced teachers to the tools and resources that can help them teach basic computer science concepts and processes in their day to day classroom practices.

The course was designed as an introductory course relevant to primary school teachers of all levels of experience.

Graphic 5: Course welcome page

Target audience

The course was targeted at classroom teachers working in primary schools (students at least 5 years and maximum 13 years of age). However, the course was open to anyone interested in the topic of computing.

Duration & Workload

The course lasted 5 weeks (each module last 1 week plus 1 extra week for the final module), from 20th April 2015 to 24th May 2015. The course was divided into 4 different modules, one module per week, and the estimated workload for each module was around 2 hours per week, depending on the participant's level of engagement.

Certification

For each module completed, participants were awarded a digital module badge. After completing the entire course, participants received a digital course certificate and a digital course badge.

Instructors

The course has been conducted by **Benjamin Hertz**, Coordinator of the European Schoolnet Academy, and supported by: **Ben Bastiaensen**, IT teacher and Future Classroom Lab ambassador, **Tullia Urschitz,** trainer of SEN teachers on the use of ICT and educational robotics for learning and Italian Scientix Ambassador; **Aikaterini Topalidou**, Communications Officer at European Schoolnet; **Ollie Bray**, senior policy adviser for the Scottish Governments Technologies for Learning Strategy and leading expert on Internet safety and responsible use for schools; and **Neil Rickus**, ICT and Computing tutor and CEOP (Child Exploitation and Online Protection) Ambassador.

3.2.2 Description of modules

The course included the following modules:

- **Introductory Module**
  It provided participants with an overview of the key organisational features of the course.

- **Module 1: Why teach computing at primary and what to focus on?**
  Description of the module
  This module emphasised the importance of teaching computing at primary levels and explored the aspects teachers should focus on in their teaching when teaching computing to very young pupils.

  Learning Objectives
  Develop a clear understanding of what the term computing refers to and to reflect about the role of computing in the participants' own country
  Acquire a broad understanding why computing and coding in particular are relevant to our pupils' lives and their understanding of the world around them
  Understand the variety of skills that can be developed using computing
  Develop an understanding of the concept of computational thinking

- **Module 2: How to teach computing at primary level?**
  Description of the module
  Module 2 focused on general aspects regarding computing at primary level such as the focus on unplugged activities (pedagogical activities that do not require the use of any electronic devices), the focus on collaboration and engaging girls or the focus on links across different subjects.

  Learning Objectives
  Develop an understanding of a range of approaches and focus areas of how to teach computing
  Identify methods/activities that can be used to highlight the importance of collaborative work in the area of programming
  Reflect on why girls are often disengaged from computing topics and how this can be addressed in your classroom
  Provide an example of how computing can be linked to other subjects

- **Module 3: What tools and resources can I use to teach computing - I**
  Description of the module
  Module 3 focused on different tools and resources available to help teachers bring Computing into their classroom in engaging ways. The module also explored educational robotics and the development of computer games.

  Learning Objectives
  Understand how educational robotics can develop a range of key competences.
  Understand how different game design tools can be used in a primary school context.
  Gain more in-depth skills of using game-design tools by creating a simple game.

- **Module 4: What tools and resources can I use to teach computing - II**
  Description of the module
  Module 4 continued exploring different tools and resources that can help teachers not only to address coding or programming related areas, but also web editing, internet search, computer networks and eSafety.

  Learning Objectives
  Understand how different tablet-based tools can be used to develop specific computing competences.
  Identify a range of tools that can be used to explore internet search, computer networks and web design.
  Acquire a sense of the type of resources that are available for addressing eSafety issues in the primary school classroom.
  Reflect on the course topics and how to implement them in the classroom by designing a lesson plan.

Graphic 6: An example of teachers' participation in Module 4

3.2.3 Live webinars

Two live webinars were also organised and offered to participants during the course. The first one "*What do students want to learn about computing?"* took place on April 29th 2015. The second one *Educational robotics and coding inside the curriculum* took place on May 6th 2015.

- **What do students want to learn about computing?**

The first webinar was led by Christian Borowski, a special needs education teacher. During the webinar, Christian explored what do students want to learn about computing, and in particular how the answers to this question can be used to guide the participants' teaching focus when it comes to computing in the classroom. He also gave an insight into how these questions are related to the teaching of non-computing related topics.

- **Educational robotics and coding inside the curriculum**

The second webinar, conducted by Tullia Urschitz, trainer of SEN teachers on the use of ICT and educational robotics for learning, aimed to encourage teachers to engage students of all ages - from kindergarten to upper secondary school - in the study of

STEM subjects with the Educational Robotics approach, a methodology that involves the use of robotics to generate competences within the regular curricula.

3.2.4 Impact of the course and participants feedback

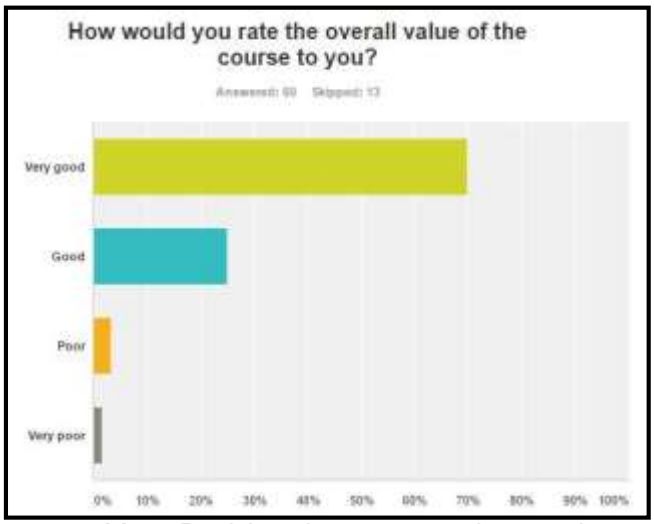
Number of participants

A total of 910 teachers from around Europe (Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Italy, Latvia, Lithuania, Malta, Norway, Poland, Portugal, Romania, Spain and Sweden) and beyond (Serbia and Turkey) actively participated on the course while a total of 1452 registered to take part. A total of 247 participants completed all tasks of the course and received the course certificate.

Participants' feedback

The course had a very positive impact in teachers, with 37% of the participants who answered the final survey stating that the course allowed them to develop professionally in a flexible way and 25% pointing out that the specific topic addressed was of direct interest and relevance to their job.

After completing the course, 61% of the participants reported to have gained practical ideas of how they can improve their professional practice, while 50% indicated they would use ideas and examples presented in the course in their everyday teaching practice, and 40% of them stated that the course made them feel more confident and able to teach Computing topics in their classrooms. 70% of the participants interviewees (42 out of 60) rated the course to be very good and 25% of them (15 out of 60) stated the course was good, while only 3% of the participants (2 out of 60) and 1% (1 out of 60) rated it to be poor and very poor respectively.



Graphic 7: Participant's answers to the question: "How would you rate the overall value of the course"?

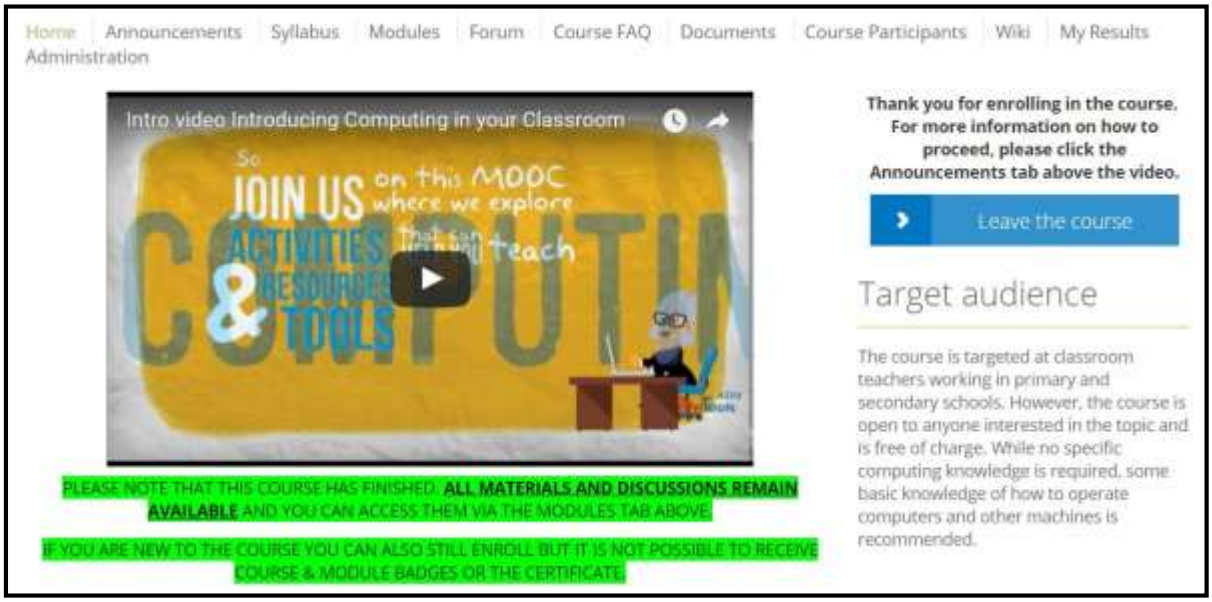
The course material can be accessed via the European Schoolnet Academy website at *How to Teach Computing: an Introduction to Concepts, Tools and Resources for Primary Teachers*

3.3 Introducing computing to your classroom

During and after the deployment of the first two courses, both the educators taking part in the training and the European Commission showed high interest on the topic and expressed the need for additional training opportunities. Therefore EUN proposed the European Commission to run a third online training programme, addressing both primary and secondary teachers which was not foreseen in the Description of Work. For this purpose, EUN made use of the remaining unspent budget initially allocated to web design to set up the project website. The proposal was officially approved by the European Commission on 9th December, 2015. As the time necessary to develop and roll out the course was of at least three months, EUN decided to start adapting the educational material and deploy the course prior to receive the formal Commission approval and after having received an informal initial agreement with both the Project Coordinator and the Project Officer.

3.3.1 Course overview

"Introducing Computing to your Classroom" was designed as an introductory course, for teachers to use as a starting point to explore some of the ideas and tools to teach and learn computing. This course was tailored to be relevant to both primary and secondary school teachers of all levels of experience.



Graphic 8: Introductory page to the course

This additional course utilised largely the education material previously developed, putting this time more emphasis on the cross curricular approach to integrate computing in the classroom. The training programme, launched in December 2015, explored the ideas, concepts, processes and skills that are important in computing, and showed different tools and resources which allow teachers to integrate computing into their teaching practice across different subjects and age ranges.

Target audience

The course was targeted to both primary and secondary teachers of all levels of experience; however, the course was open to anyone interested in the topic and is free of charge. While no specific computing knowledge is required, some basic knowledge of how to operate computers and other machines is recommended.

Duration & Workload

The course lasted 5 weeks from November 16th 2015 to December 20th 2015.
The course was divided into 4 different modules, one module per week, and the estimated workload for each module was around 2 hours per week, depending on the participant's level of engagement.

Certification

For each module completed, participants were awarded a digital module badge. After completing the entire course, participants received a digital course certificate and a digital course badge.

Instructors

The course has been conducted by **Benjamin Hertz**, Coordinator of the European Schoolnet Academy and supported by: **Aikaterini Topalidou**, Communications Officer at European Schoolnet **Patrick Feeney**, game designer and consultant for the Future Classroom Lab in European Schoolnet; **Tommaso Dalla Vecchia**, DIGITALJOBS project Coordinator for European Schoolnet; and **Naír Carrera**, Digital Citizenship Team Project assistant in European Schoolnet.

Course Ambassadors

Sergio González, ICT teacher and Future Classroom Ambassador for Spain; and **Daniela Cuccurullo**, English teacher and member of National Committees for both language and multimedia teaching.

3.3.2 Description of modules

The course included the following modules:

- **Introductory Module**
  It provided participants with an overview of the key organisational features of the course.

- **Module 1: What is it, why teach it and what to focus on?**
  Description of the module
  This module focused on some broad questions revolving around computing teaching: what is computing? Why teach computing? And what to focus on when teaching computing?

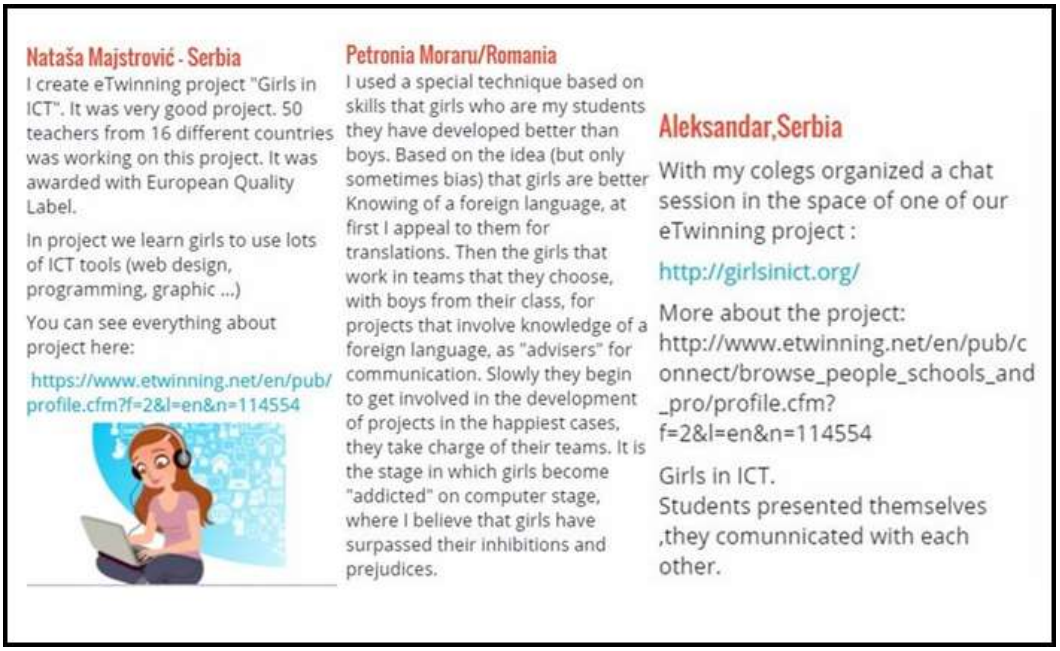
  Learning Objectives
  Develop a clear understanding of what the term computing refers to and to reflect about the role of computing in different schools and countries.
  Acquire a broad understanding why computing in general and coding in particular are relevant to the student's lives and their understanding of the world around them.
  Understand the variety of skills that can be developed using computing.

Develop an understanding of the concept of computational thinking.

- **Module 2: How to teach computing without computers / collaboratively / cross-curricular / gender inclusive**

Description of the module

This module explored some interesting approaches and strategies on how to teach computing and highlight some important issues along the way, such as how to engage girls to learn computing. Another aspect they focused on in this module was for instance in how to teach computing without using computers.



Graphic 9: Some teachers' contribution when they were asked what did they think were good strategies to engage girls in computing topics

Learning Objectives

Develop an understanding of a range of approaches and focus areas of how to teach computing.

Identify methods/activities that can be used to highlight the importance of collaborative work in the area of programming

Provide an example of how computing can be linked to other subjects

- **Module 3: Tools and Resources I**

This module explored the different tools and resources to help teachers bring Computing in an engaging fashion into their classrooms.

Learning Objectives

Acquire an understanding how educational robotics can develop a range of key competences.

Reflect about the value of visual programming tools in the classroom.

Understand reasons for focusing on mobile development in the classroom and experiment with two mobile app development tools.

- **Module 4: Tools and Resources II**
  This final module continued to explore some tools and resources that can help teachers not only address coding or programming related areas but also web editing, internet search, computer networks. These areas are sometimes overlooked with all the hype around coding at the moment but are no less important to address with the students.

  Learning Objectives

  Explore a range of game design tools and understand the potential of the different tools as well as the use of game design tools to teach computing more generally.
  Understand what a microcontroller is and can do and how to use it in the classroom.
  Identify a range of tools that can be used to explore internet search, computer networks and web design.
  Reflect on the topics on the course and how to implement them in the classroom by designing a lesson plan for the Hour of Code.

3.3.3 Live webinars

Three webinars were also offered during the course. The first one *Competence-based Pedagogy for Teaching Computing* took place on November 26th 2015; the second one, *App Development*, took place on December 1st 2015; the last webinar *Arduino and microcomputers in the classroom* took place on December 10th 2015.

- **Competence-based Pedagogy for Teaching Computing**

The first webinar was led by Tullia Urschitz, expert teacher of maths, science and ICT in a Junior Secondary School in Verona, Italy. During the webinar, Tullia presented on the topic of how key competences can be developed through the teaching of computing with a particular focus on the use of robotics to develop such competences. Tullia used the framework of key competences provided by the European Commission which includes competences such as civic and social competences, digital competence, communicating in foreign languages, mathematical competence, etc. She provided concrete examples from her own work with children on how these competences can be developed using computing topics in the classroom.

- **Making mobile apps in your classroom**

This webinar was presented by Patrick Feeney, game designer and consultant for the Future Classroom Lab. Patrick provided an introduction to making mobile apps in the classroom and analysed why this is an important element to include in the teaching practice. He presented an overview of different tools and resources available to use in the classroom such as *Touchdevelop*, *Appinventor*, *Appsforgood*, Wixmobile, Pocketcode, etc. and explained some example activities of using these tools with the students.

- **Using Arduino to De-mystify Sensor Data Collection**

The third webinar was conducted by Tom Smith, an Engineering Education Specialist working for Vernier Software and Technology. During the webinar, Tom talked about how students increasingly have access to sensor data collection tools that operate as "black boxes". They put a temperature probe into a glass of water and a number pops up on a computer screen. In this webinar Tom explored how to shine some light into that "black box" through the use of Arduino micro computing devices and Vernier sensing technology. Participants had the opportunity to learn how they can easily take the electrical signal from a sensor, read that value and convert it into a sensor value by coding in Arduino IDE.

3.3.4 Impact of the course and participants feedback

Number of participants
A total of 1230 teachers from around Europe (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Turkey and United Kingdom) and outside Europe (Albania, Peru, Australia, Macedonia, Serbia, Azerbaijan, Argentina, Saudi Arabia, Costa Rica, Montenegro and Georgia) actively participated on the course while a total of 1547 registered to take part. A total of 513 participants completed all tasks of the course and received the course certificate.

Participants 'feedback
The course had a very positive impact on teachers, as it is stated in the survey the participants completed at the end of the course, where 61% of the participants interviewed reported to have gained practical ideas of how they can improve their professional practice; 53% indicated they would use ideas and examples presented in the course in their everyday teaching practice and 37% of them stated that the course made them feel more confident and able to use effective teaching methods in the areas addressed by the course.

Furthermore, the evaluation conducted at the end of the training gave a very positive feedback with 73% of the participants interviewees (141 out of 193) rating the course to be very good, 26% of them (51 out of 193) stating the course was good, and only 0.5% of the participants (1 out of 193) rating it to be poor.

All the contents, videos, quizzes and material of the course are openly available on the European Schoolnet Academy website at the course *Introducing computing to your classroom*

4 Conclusions and recommendations

From a quantitative perspective, the metrics related to the three training programmes proved that the courses were successful in attracting a high number of interested teachers, which is highlighted by the following figures:

- **4422** teachers **registered to the course**, gaining full access to all the educational activities and materials made available
- **3159** of these teachers **took actively part to the live roll out of the course**
- A total of **1018 completed all the modules and tasks of the course attended**.
- **The courses involved participants from 28 different countries in Europe (**Italy, Romania, Portugal, Greece, Lithuania, Czech Republic, Finland, Estonia, France, Germany, Ireland, Netherlands, Spain, Sweden, Bulgaria, Croatia, Cyprus, Denmark, Latvia, Malta, Poland, Norway, Austria, Belgium, Hungary, Slovakia, Slovenia, and United Kingdom) **and educators from 18 different countries beyond Europe** (Tunisia, Turkey, Peru, Israel, Madagascar, Republic of Macedonia, India, Colombia, Albania, Australia, Macedonia, Serbia, Azerbaijan, Argentina, Saudi Arabia, Costa Rica, Montenegro and Georgia).

From a more qualitative perspective, the best recognition of the courses impact are the comments from participants who described the training as "*very helpful and inspiring for the professional development*", with "*a lot of new resources discovered*" that would help them to create new coding courses at their schools.

Teachers also pointed out to have enjoyed the participation in The Hour of Code, the CS Unplugged activities and the Learning Designer experience. For some teachers, participating in these courses was also a great occasion "to revise the whole approach to computing teaching and coding", Likewise, working in international groups of teachers helped them to realize "the lack of technology", but it also gave them the "hope, sense and stability" to their own work.
What has also to be take into account is that, beside the effect on the ability to teach computing in an innovative way or integrating it into the classroom, many teachers declared to have gained more experience in the effective use of technology in their day to day teaching and confirmed that they feel more confident in embracing innovative teaching methods.

	Strongly agree	Agree	Disagree	Strongly disagree	N/A	Total
As a result of the course I have used a new tool or activity in my classroom	47.01% 55	41.03% 48	4.27% 5	3.42% 4	4.27% 5	117
As a result of the course I have adapted my teaching methods or tried out a new teaching method	35.04% 41	53.85% 63	4.27% 5	2.56% 3	4.27% 5	117
As a result of the course I collaborate more often with my colleagues	28.21% 33	47.01% 55	11.97% 14	5.13% 6	7.69% 9	117
As a result of the course I use technology more effectively in the classroom	30.77% 36	55.56% 65	5.13% 6	2.56% 3	5.98% 7	117
As a result of the course I have tried out a new technology in my teaching	46.15% 54	41.88% 49	5.13% 6	2.56% 3	4.27% 5	117

Graphic 10: Teachers' answers to the question *"Pedagogical change: To what extent do you agree with the following statements?"* From the EUN Academy Computing Course Evaluation

Difficulties encountered by teachers

Certainly of interest is also the feedback received from the participants regarding the use of ICT in their schools. This showed that while many of the participants didn't know how to integrate coding within their subjects or did not feel confident in doing so, other teachers did try to teach coding, and shared their experiences.

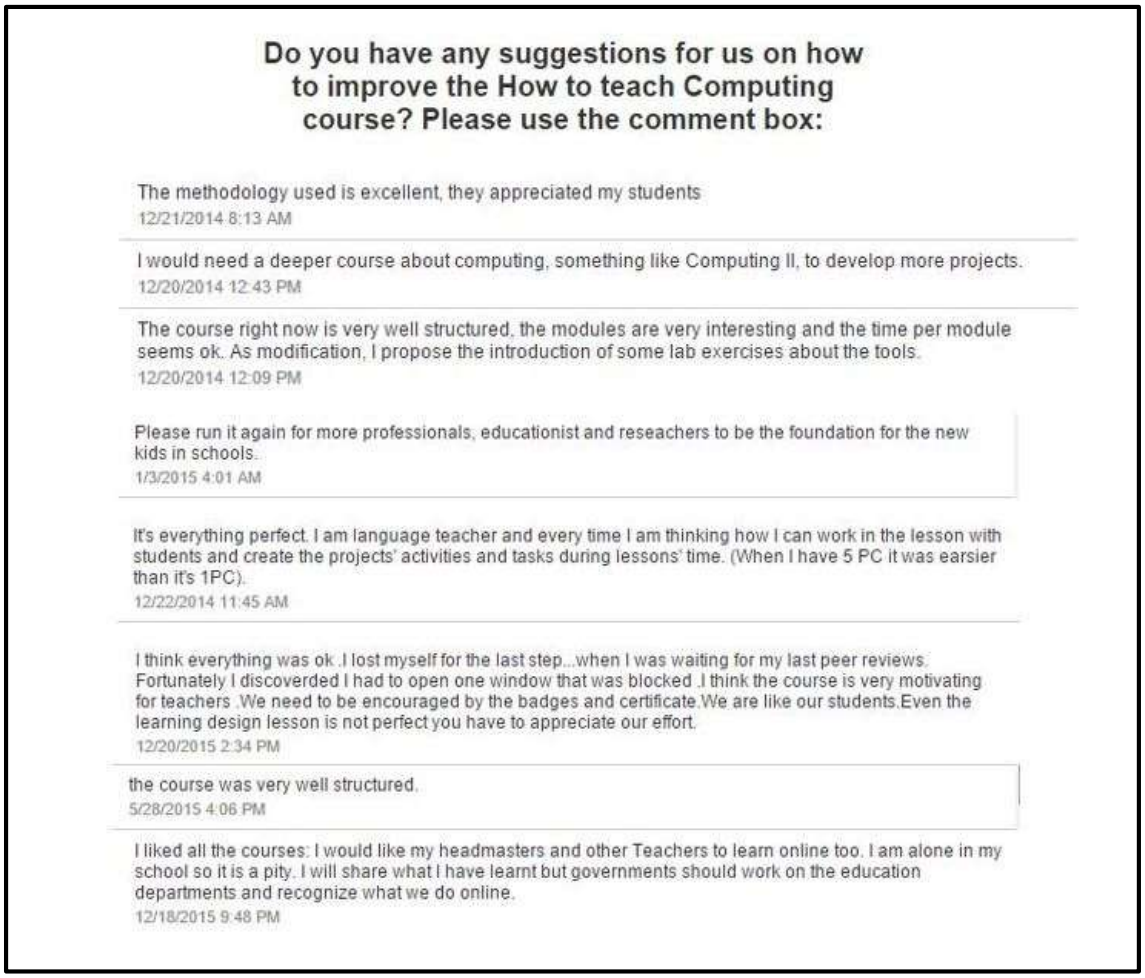
Some of the participants pointed out that computing is not regarded as a topic of interested in their own schools, which makes it difficult for them to embrace innovative practices as on teaching coding: "In my school there are few teachers interested in computing teaching. At the beginning of this year I proposed to plan a project on coding or educational robotics, but I couldn't find enough support" (Andrea Cesetti, Italy).

Furthermore, most of the participants reported to have problems to teach computing because their schools are not well equipped or the technological facilities are somehow limited: “In our secondary school, the technological facilities are limited to some extend and for this reason our pupils cannot go beyond mere watching videos or typing some words on computers. They haven’t still developed any skills or digital literacy like creating or editing the files, documents, etc.” (Fatih Toy, Turkey).

As a conclusion, it should not be forgotten that on top of the actual specific professional development gained by participants, the training programme, with its connectivist approach, is a valuable way of inspiring them and allowed to “learn about new subjects” while giving them the opportunity to “exchange and network with peers from around the world”.

Suggestions for improvement and recommendations

- As a common concern, participants shared the problem of time management, as in spite of the fact that they would like to have had more time to explore and practice before producing games, many of them were not able to do it: “maybe *a week break in the middle of the course would be useful in case somebody needs to catch up with the modules or it is the end of the term and we have to mark tests* (which varies from country to country)”.
- Besides, participants pointed out the need of “*deepen the analyses made on the tools and to be given more resources to be able to make a progressing start with a new tool*”.
- Regarding the general recommendations for future courses, teachers suggested it would be very beneficial “publishing the participant’s learner’s designers and activities”, “making a tool based learning exercise” and possibly the establishment of a platform “where participants send their sample works about course topic after finishing the course face to face course academy by applying Erasmus +”.
- Moreover, they asked for the courses to be run for “more professionals, educationist and researchers to be the foundation for the new kids in schools”.
- Finally, many teachers were asking for other courses on computing: “I would need a deeper course about computing, something like Computing II, to develop more projects”.



Graphic 11: Teachers' answers to the question *"Do you have any suggestions for us on how to improve the How to teach Computing course?"* From the EUN Academy Computing Course Evaluation

Overall, many comments received by teachers and trainers pointed to the need of offering more similar professional development opportunities to reach out a broader number of educators and mainstream change in the education sector. Additionally, many teachers expressed interest for more in depth training to be able to advance their lessons and being able to introduce the use of more complex visual programming tools, app development software, programming languages as well as elements of robotics.

In order to respond to the demand of follow up to these training opportunities, EUN has been already planning ahead and exploring ways to continue offering support to teachers willing to embrace computing at school.
On one side we have made sure to exploit the courses' outputs, e.g. selecting some of the best lessons plans created by participant teachers, curanting them andmaking them available on the European Coding Initiative Website: lessons plans. On the other we are trying to secure funding for being able to continue offering online, face to face and live sessions to promote and disseminate innovative ways of teaching computing, linking these activities with long lasting programmes we are keen to keep supporting on this field.

5 Annexes

5.1 Annex 1: Validation Framework for Modules

Validator:	
Course:	
Module	

Please explain in the comments section any specific concerns, identifying exactly which video, exercise, etc. is being referred to.

Content & Pedagogical Issues		
Question	Please give a score from 1 – 5: 1 = Very weak 5 = Very strong	Comments
Are there any content inaccuracies / factual errors in the content?		
Is the sequencing of the topics appropriate?		
Are the learning objectives clearly identified?		
Does each piece of content relate to the learning objectives?		
Are the discussion questions sufficiently clear?		
Are instructions sufficiently clear?		
Can the content be accessed/understood without substantial prior knowledge (unless specified in the course description)?		
Is specialist terminology sufficiently explained?		
Are clear references made when referring to external content?		
Are the assessment activities appropriate (in nature and difficulty) for the content covered?		
Are the learning activities appropriate (in nature) for the content covered?		

Are clear links made between modules?		
Is the content "culture-neutral", i.e. is it acceptable and understandable by people from different cultural and national backgrounds?		
Is there a clear summary / conclusion section per module?		
Does the course intro give an appropriate overview of all modules? Does the module intro give an appropriate overview of the module?		
Can participants track their own progress?		
Is there a good mix of content transmission and collaborative activities?		
Are resources accessible to learners with special needs (e.g. learners with visual impairment, etc.)		
Presentation Issues		
Question	Please give a score from 1 – 5: 1 = Very weak 5 = Very strong	Comments
Do the presenters speak clearly and slowly? (please indicate the name of the presenter next to your score)		
Is the presenter engaging and enthusiastic about the topic presented?		
Is the PPT (or similar) presentation clearly structured?		
Is text on the PPT kept to a minimum while at the same time providing a clear message/fact?		
Is the background (visual and audio) of video material appropriate to the context of the video (e.g. lots of background noise from the street)?		
Technical Issues		

Question	Please give a score from 1 – 5: 1 = Very weak 5 = Very strong	Comments
Is the technical production of good quality? i.e. is the sound sufficiently audible/understandable, are the visuals of sufficient resolution		
Can the activities be conducted on a massive scale? i.e. does the tool used support large numbers of users accessing it at the same time		
Are any platform external audio-visual materials, animations and tools sufficiently compatible with mainstream browsers, operating systems, devices, etc.		
Any other comments?		