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SEnDIng

D7.3

PROJECT PRESENTATIONS

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Responsible Organisation(s):	University of Patras
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Delivery Slip

	Name	Partner	Date
From	Vasileios Gkamas	UPATRAS	14/01/2021
Reviewed by	Maria Rigou	UPATRAS	15/01/2021
Approved by	Maria Rigou	UPATRAS	15/01/2021

PROJECT SUMMARY

SEnDIng project aims to address the skills' gap of Data Scientists and Internet of Things engineers that has been identified at the ICT and other sectors (e.g. banking and energy) at which Data Science and Internet of Things have broad applications. To achieve this goal, SEnDIng will develop and deliver to the two aforementioned ICT-related occupational profiles two learning outcome-oriented modular VET programmes using innovative teaching and training delivery methodologies.

Each VET program will be provided to employed ICT professionals into three phases that include: (a) 100 hours of on-line asynchronous training, (b) 20 hours of face-to-face training and (c) 4 months of work-based learning. A certification mechanism will be designed and used for the certification of the skills provided to the trainees of the two vocational programs, while recommendations will be outlined for validation, certification & accreditation of provided VET programs.

Furthermore, SEnDIng will define a reference model for the vocational skills, e-competences and qualifications of the targeted occupational profiles that will be compliant with the European eCompetence Framework (eCF) and the ESCO IT occupations, ensuring transparency, comparability and transferability between European countries.

Various dissemination activities will be performed – including the organization of one workshop at Greece, Bulgaria and Cyprus and one additional conference at Greece at the last month of the project – in order to effectively disseminate project's activities and outcomes to the target groups and all stakeholders. Finally, a set of exploitation tools will be developed, giving guides to stakeholders and especially companies and VET providers, on how they can exploit project's results.

TABLE OF CONTENTS

1 Introduction

This deliverable presents the presentations of SEnDIng project and its main results done during the project lifetime. The scope of these presentations was to present to relevant stakeholders the project and its main results. More specific, the following presentations have been done at various workshops and conferences.

- *Sector Skills Alliance for the design and delivery of innovative VET programmes to Data Science and Internet of Things professionals* at 22nd Pan-Hellenic Conference on Informatics.
- *SEnDIng project: Design of VET programmes for Data Science and Internet of Things professionals* at EO4GEO Workshop.
- *Sector Skills Alliance for the design and delivery of innovative VET programmes to Data Science and Internet of Things professionals* at 14th International Conference on Design & Technology of Integrated Systems in Nanoscale Era.
- *SEnDIng Online Training Concept – Competency-Based, Adaptive Learning in Data Science for ICT Professionals* at 28th EDEN Annual Conference.
- *The SEnDIng project - Data Science and Internet of Things professionals' training* at 10th International Conference on Information, Intelligence, Systems and Applications.
- *Bridging the skills gap in the Data Science and Internet of Things domains: A Vocational Education and Training Curriculum* at 28th ICDE World Conference on Online Learning.
- *The SEnDIng project - Data Science and Internet of Things professionals' training* at SEnDIng final conference.
- *Defining learning outcomes for curriculum development in Data Science and IoT domains* at SEnDIng final conference.
- *Upskilling IT Professionals: A MOOC for the Data Science and IoT domains* at SEnDIng special session at 24th Pan-Hellenic Conference on Informatics.
- *Training of ICT professionals in soft skills: the case of SEnDIng* at SEnDIng special session at 24th Pan-Hellenic Conference on Informatics.

The presentations are attached at the annexes of this document and are also uploaded at the project website:

http://sending-project.eu/index.php/en/dissemination/dissemination-activities

Moreover, during the first months of SEnDIng a core project presentation has been produced.

2 Annexes

The following annexes are attached at this document:

- Annex 1: Sector Skills Alliance for the design and delivery of innovative VET programmes to Data Science and Internet of Things professionals.
- Annex 2: SEnDIng project: Design of VET programmes for Data Science and Internet of Things professionals.
- Annex 3: Sector Skills Alliance for the design and delivery of innovative VET programmes to Data Science and Internet of Things professionals.
- Annex 4: SEnDIng Online Training Concept – Competency-Based, Adaptive Learning in Data Science for ICT Professionals.
- Annex 5: The SEnDIng project - Data Science and Internet of Things professionals' training.
- Annex 6: Bridging the skills gap in the Data Science and Internet of Things domains: A Vocational Education and Training Curriculum.
- Annex 7: The SEnDIng project - Data Science and Internet of Things professionals' training.
- Annex 8: Defining learning outcomes for curriculum development in Data Science and IoT domains.
- Annex 9: Upskilling IT Professionals: A MOOC for the Data Science and IoT domains.
- Annex 10: Training of ICT professionals in soft skills: the case of SEnDIng.

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Annex 1

Sector Skills Alliance for the design and delivery of innovative VET programmes to Data Science and Internet of Things professionals

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of the European Union

Greek Computer Society

Ioannis Voyiatzis

Panhellenic Conference on Informatics

(PCI 2018)

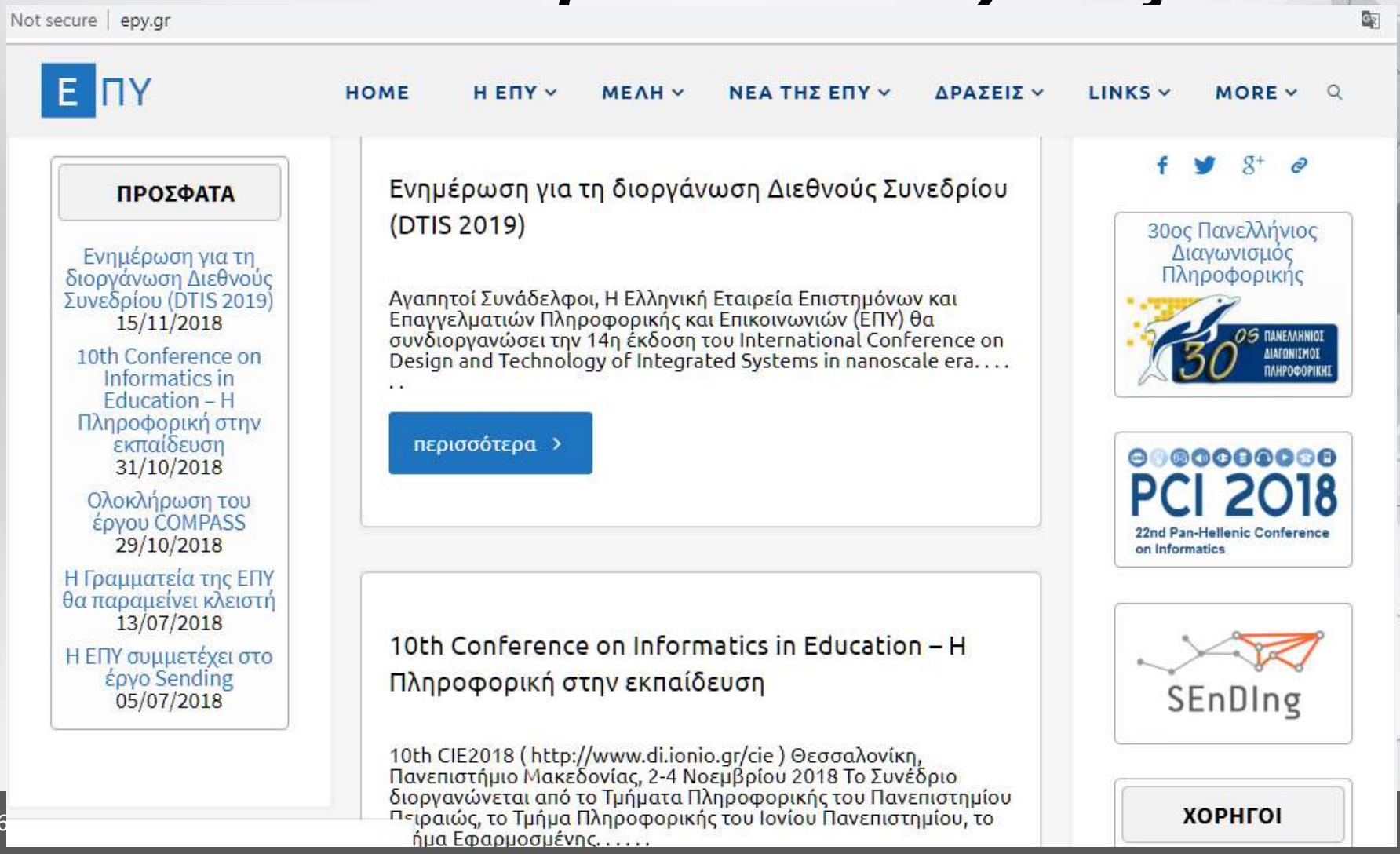
29 November 2018

Aigaleo, Greece

The Greek Computer Society Profile

- The Greek Computer Society (GCS) is a non-profit organisation, committed to representing all Greek scientists and professionals engaged in activities relevant to Computer Science, Information Technology (IT), Telecommunications and other relevant scientific areas.
- It was established in 1977 with the vision of becoming a world-class organisation for Information and Communication Technologies (ICT).
- Currently CGS numbers more than 5,500 members including practitioners, IT industry, academics and students in Greece and internationally.
- www.epy.gr

The Greek Computer Society Profile



Mission and Strategic Objectives

- CGS has a clear mission towards
  - enabling the Information Society by promoting wider social and economic progress through the advancement of IT science and practice.
- CGS brings together
  - industry, academics, practitioners, **students** and government to share knowledge, influence the development of computer and informatics education, shape public policy and inform the public.

Objectives

GCS seeks to:

- Promote **the use of Information Technology** to the general public
- Contribute to the **development of scientific research** on and education in Information Technology, throughout Greece and at an international level, and establishing synergies between research and education practice
- Represent and support the **professional development of Information Technology professionals** in Greece and abroad
- Develop professional codes of practice for Information Technology professionals
- Provide technical consultancy on Information Technology to the State, when so requested
- **Contribute to IT standardisation processes** in collaboration with national, European and international standardisation Bodies

GCS Branch

- A GCS Branch for Macedonia and Thrace has been operating since 1985, in Thessaloniki.
- The Branch is directed by a five-member Board.
- Active participation in the organization of the Panhellenic Competition

PCI

- GCS organises conferences and workshops in Greece, relevant to Information and Communications Technology
- The "**Panhellenic Conference on Informatics (PCI)**" with international attendance since 2004.
- Held annually

PCI roadmap


Αλβανία
Θεσσαλονίκη
Ελλάδα
Αιγαίο Πέλαγος
Σμύρνη
İzmir
Αθήνα
Aydın
Χανιά
Κρήτη


Κύπρος

PCI features

- Scientific profile
  - ACM Proceedings
  - Rigorous review processes
  - "Acceptable" acceptance rate (≈50%)
  - Downloads and citations
- Wide adoption by the community
  - Increasing submission count (100-140 / year)
  - High (and increasing) attendance
- Parallel tracks
- Nice Social event!

Edition	Downloads	Citations
PCI2013	6,410	40
PCI2014	7,812	21
PCI2015	9,708	19
PCI2016	4,097	20
PCI2017	2,574	1
Sum	30,601	101

Competition on Informatics (1)

- GCS carries out the **Panhellenic Competition on Informatics**
- For High School and Lyceum students
- One of the six national UNESCO competitions
- Under the auspices of the Ministry of Education
- Assemble the
  - National Informatics team (for Lyceum).
  - National Informatics Junior team (for highschool)
- Teams participate in international competitions
- Medals allow free entrance to Universities

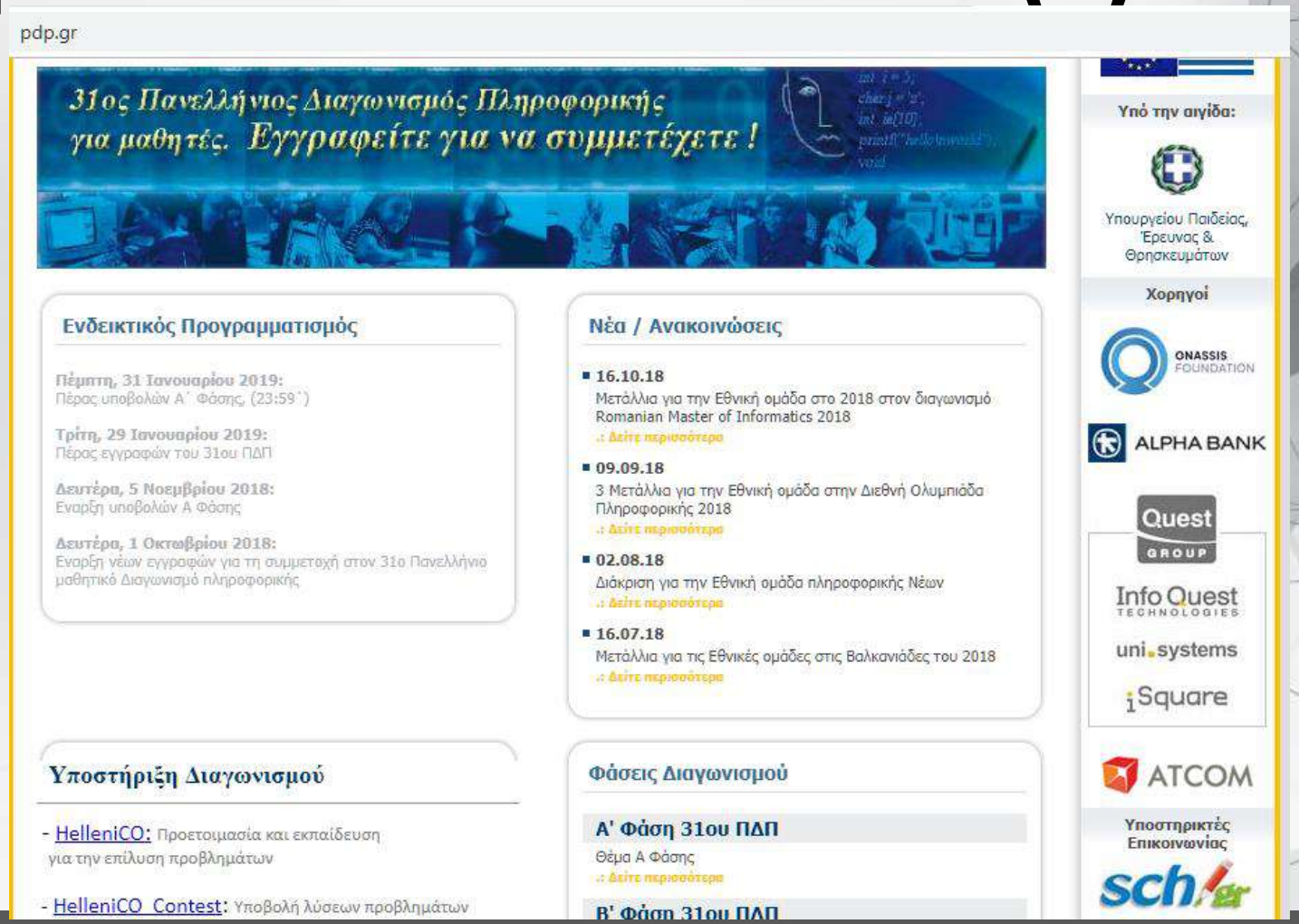
Competition on Informatics (2)

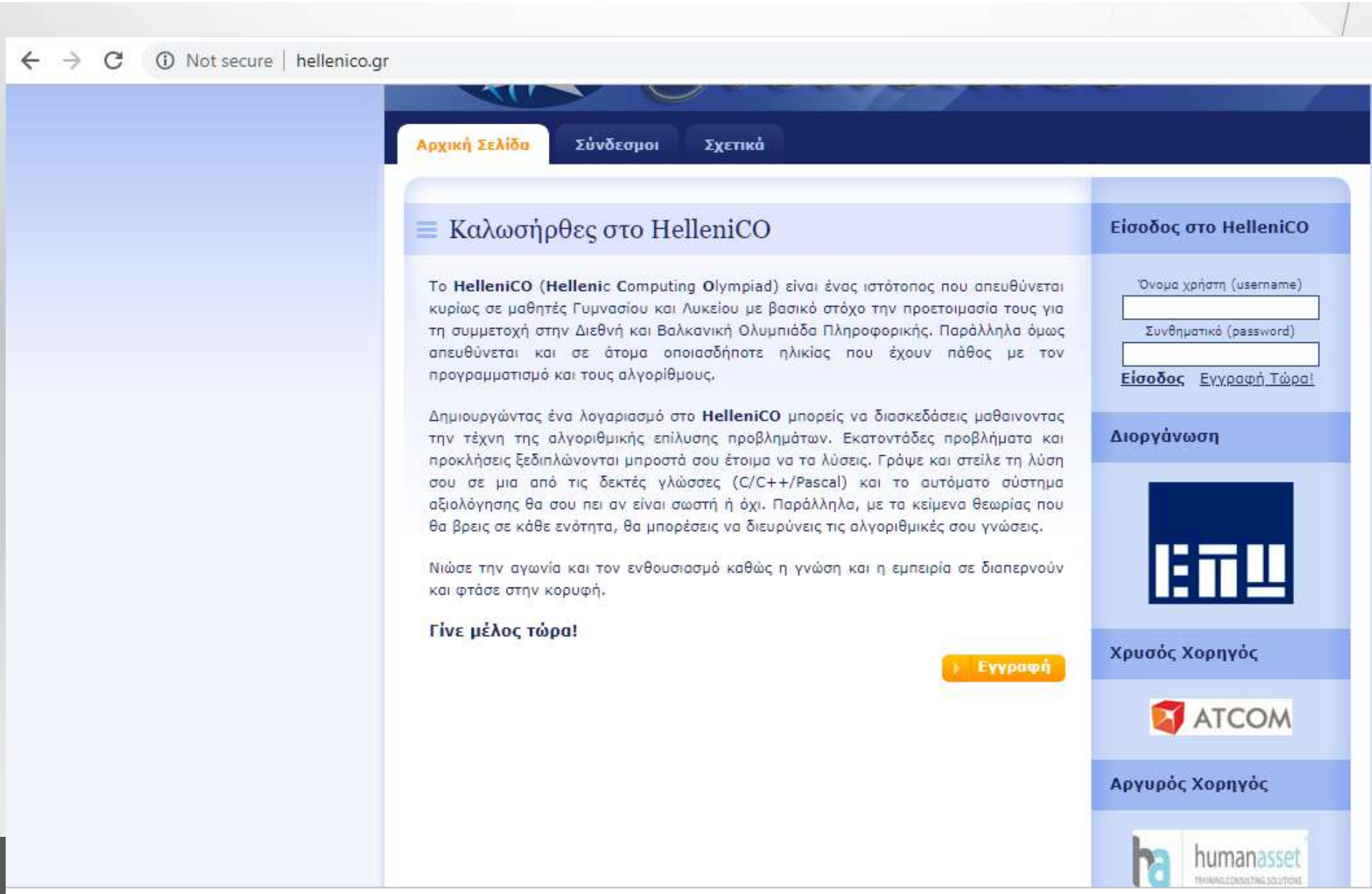
- During the last 31 years
- National Teams have organised/ participated in
  - Balkan Olympiad in Informatics (BOI)
  - International Olympiads in Informatics (IOI)
  - Balkan Olympian in Informatics for Juniors (jBOI)
  - European Junior Olympiad in Informatics (EJOI)
- Medals won every year!
- BOI to be organized in Greece in 2019!

Competition on Informatics (3)

- Organized in three phases
  - Phase 1: online
  - Phase 2: online
  - Phase 3: on-site
  - Phase 3 ½: Preparation camp
- Students submit solutions to algorithmic problems
- Online evaluation of results
- Competition site: www.pdp.gr
- Accompanying site: www.hellenico.gr

Competition on Informatics (4)




Not secure | hellenico.gr
Αρχική Σελίδα
Σύνδεσμοι
Σχετικά
Καλωσήρθες στο HelleniCO
Το HelleniCO (Hellenic Computing Olympiad) είναι ένας ιστότοπος που απευθύνεται κυρίως σε μαθητές Γυμνασίου και Λυκείου με βασικό στόχο την προετοιμασία τους για τη συμμετοχή στην Διεθνή και Βαλκανική Ολυμπιάδα Πληροφορικής. Παράλληλα όμως απευθύνεται και σε άτομα οποιασδήποτε ηλικίας που έχουν πάθος με τον προγραμματισμό και τους αλγορίθμους.
Δημιουργώντας ένα λογαριασμό στο HelleniCO μπορείς να διασκεδάσεις μαθαινοντας την τέχνη της αλγοριθμικής επίλυσης προβλημάτων. Εκατοντάδες προβλήματα και προκλήσεις ξεδιπλώνονται μπροστά σου έτοιμα να τα λύσεις. Γράψε και στείλε τη λύση σου σε μια από τις δεκτές γλώσσες (C/C++/Pascal) και το αυτόματο σύστημα αξιολόγησης θα σου πει αν είναι σωστή ή όχι. Παράλληλα, με τα κείμενα θεωρίας που θα βρεις σε κάθε ενότητα, θα μπορέσεις να διευρύνεις τις αλγοριθμικές σου γνώσεις.
Νιώσε την αγωνία και τον ενθουσιασμό καθώς η γνώση και η εμπειρία σε διαπερνούν και φτάσε στην κορυφή.
Γίνε μέλος τώρα!
Εγγραφή
Είσοδος στο HelleniCO
Όνομα χρήστη (username)
Συνθηματικό (password)
Είσοδος
Εγγραφή Τώρα!
Διοργάνωση
Χρυσός Χορηγός
ATCOM
Αργυρός Χορηγός
humanasset

Conference on Informatics in Education

- Conference on Informatics in Education (CIE), Πληροφορική στην εκπαίδευση
- Σε συνεργασία με
  - το Τμήμα Πληροφορικής του Πανεπιστημίου Πειραιώς
  - το Τμήμα Πληροφορικής του Ιονίου Πανεπιστημίου
- Τελεί υπό την Αιγίδα του ΥΠΠΕΘ.
- Το Συνέδριο εστιάζει:
  - Στην Πληροφορική στην Εκπαίδευση
  - ΤΠΕ στην εκπαίδευση
  - Καινοτόμες πρακτικές με Πληροφορική-Προγραμματισμό
  - Διεπιστημονικές προσεγγίσεις όπως και STEM, Physical Computing/ Ρομποτική κ.ά. με Πληροφορική-Προγραμματισμό
- Καλύπτει
  - βαθμίδες της τυπικής εκπαίδευσης (Δευτεροβάθμια, Πρωτοβάθμια, Τριτοβάθμια)
  - μη τυπική εκπαίδευση.
- Τα άρθρα δημοσιεύονται στα ηλεκτρονικά πρακτικά του Συνεδρίου με ISBN και στο δικτυακό τόπο του Συνεδρίου.
- http://lefkimi.ionio.gr/cie/

Ρομποτική

- **Πανελλήνιος διαγωνισμός Ρομποτικής και Physical Computing Ανοικτών τεχνολογιών**
- Απευθύνεται σε ομάδες μαθητών δευτεροβάθμιας εκπαίδευσης
- Σε συνεργασία με
  - ΕΛΛΑΚ
  - Πανεπιστήμιο Δυτικής Αττικής
  - …

- https://robotics.ellak.gr/

Ρομποτική


https://robotics.ellak.gr
1ος Πανελλήνιος Διαγωνισμός Ρομποτικής Ανοιχτών Τεχνολογιών
ΑΡΧΙΚΗ
ΣΤΟΧΟΙ
ΚΡΙΤΗΡΙΑ
ΟΔΗΓΙΕΣ
ΟΡΓΑΝΩΤΙΚΗ ΕΠΙΤΡΟΠΗ
ΕΡΩΤΗΣΕΙΣ
ΧΟΡΗΓΙΕΣ
ΝΕΑ
OPEN ROBOTICS
1ΟΣ ΠΑΝΕΛΛΗΝΙΟΣ ΔΙΑΓΩΝΙΣΜΟΣ ΕΚΠΑΙΔΕΥΤΙΚΗΣ ΡΟΜΠΟΤΙΚΗΣ & PHYSICAL COMPUTING ΑΝΟΙΧΤΩΝ ΤΕΧΝΟΛΟΓΙΩΝ
ΔΗΛΩΣΤΕ ΣΥΜΜΕΤΟΧΗ
open source hardware

Ρομποτική

Ο Οργανισμός Ανοιχτών Τεχνολογιών (ΕΕΛΛΑΚ), το Πανεπιστήμιο Δυτικής Αττικής, η Ε.Π.Υ, το ΙΤΥΕ Διόφαντος, το Πανεπιστήμιο Αιγαίου, το Πανεπιστήμιο Δυτικής Μακεδονίας, το Πανεπιστήμιο Θεσσαλίας, το Πανεπιστήμιο Ιωαννίνων,το Πανεπιστήμιο Κύπρου, το Πολυτεχνείο Κρήτης, το ΤΕΙ Κρήτης, το Πανεπιστήμιο Πατρών, το Πανεπιστήμιο Πελοποννήσου, η Σχολή Ικάρων, η ΑΣΠΑΙΤΕ,το Ίδρυμα

ΕΠΙΣΤΗΜΟΝΙΚΗ-ΟΡΓΑΝΩΤΙΚΗ ΕΠΙΤΡΟΠΗ

(Η επιτροπή είναι ανοιχτή σε στελέχη της εκπαιδευτικής κοινότητας με διάθεση να συμβάλλουν στην υιοθέτηση των ανοιχτών τεχνολογιών. Για να συμμετάσχετε συμπληρώνετε ***τη φόρμα)***

Συμμετοχή σε ευρωπαϊκά προγράμματα

Sector Skills Alliance for the design and delivery of innovative VET programmes to Data Science and Internet of Things professionals (SEnDIng)

Project overview

- **Program**: Erasmus+ KA2: Cooperation for innovation and the exchange of good practices - Sector Skills Alliances
- **Call ID**: EACEA-04-2017
- **Lot**: Lot 2, SSA for Design and Delivery of VET
- **Project Number**: 591848-EPP-1-2017-1-EL-EPPKA2-SSA
- **Grant Agreement Number**: 2017-3184/001-001
- **Project Coordinator**: University of Patras
- **Duration**: 36 months
- **Number of Partners**: 12
- **EU grant**: 982.537 €
- **Start Date**: 1st December 2017
- **End Date**: 30th November 2020

Consortium

ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ
UNIVERSITY OF PATRAS

OLYMPIC Training & Consulting

BASSCOM
Bulgarian Association of Software Companies

ESI European Software Institute
Center Eastern Europe

ΕΛΛΗΝΙΚΗ ΕΤΑΙΡΙΑ ΕΠΙΣΤΗΜΟΝΩΝ ΚΑΙ ΕΠΑΓΓΕΛΜΑΤΙΩΝ ΠΛΗΡΟΦΟΡΙΚΗΣ ΚΑΙ ΕΠΙΚΟΙΝΩΝΙΩΝ (ΕΠΥ)
GREEK COMPUTER SOCIETY (GCS)

Μηχανογραφική
CONSULTING SERVICES

Nemetschek BULGARIA

CODE RUNNERS

UNICERT
Universal Certification Solutions

Πανεπιστήμιο Κύπρου
University of Cyprus

universal learning systems

Needs and challenges

- Addressing the skills' gap of Data Scientists and IoT engineers.
- Contributing to the increased demand of industry sectors other than ICT sector (e.g. banking, energy, logistics) for high-qualified Data Scientists and IoT Engineers.
- Providing the Data Scientists and IoT engineers with skills and competences, that are transferable and recognized among European countries.
- Making the trainings provided more relevant to the actual needs of labor market.

Key objectives (1)

- Define vocational trainings' learning outcomes for the occupational profiles of Data Scientists and Internet of Things professionals.
- Design a common reference scheme of competences, skills, knowledge and proficiency levels needed by Data Scientists and IoT engineers in accordance with European frameworks (e.g. eCF framework and ESCO).
- Design two modular learning outcome oriented VET curricula, one targeting Data Science and another Internet of Things taking into consideration EQAVET.

Key objectives (2)

- Design a mechanism for the certification of skills and competences provided to learners.
- Posing recommendations for the validation, certification & accreditation of the provided VET program and its alignment with NQFs, EQF and ECVET.
- Delivery of vocational trainings into three phases: e-learning, face-to-face and work based learning.

Target Groups

- IT professionals and associations
- VET providers
- Certification bodies
- Higher Education Institutes
- Companies & SMEs
- Policy-makers
- ????

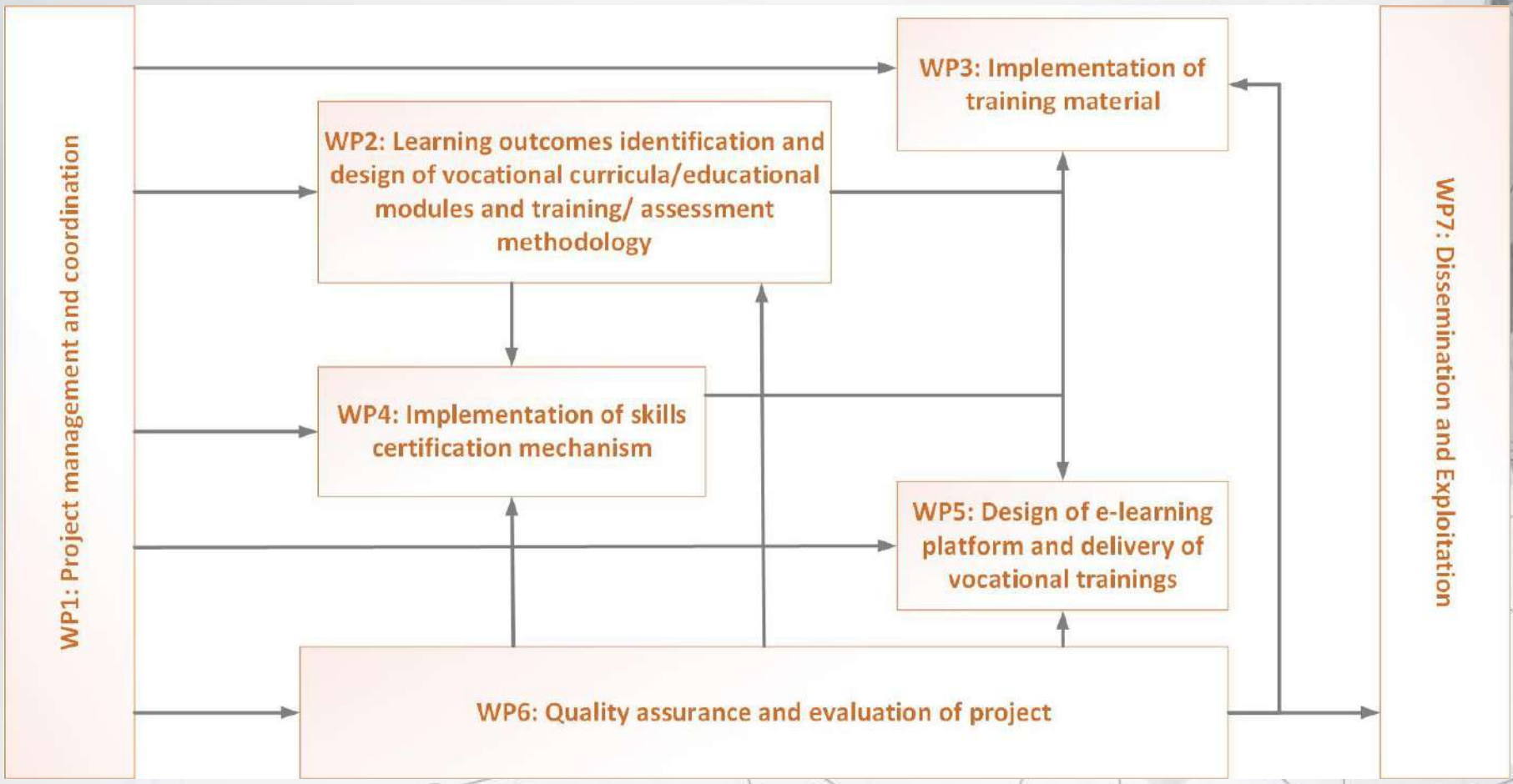
Main results (1)

- Learning outcomes of vocational trainings targeting Data Science and Internet of Things.
- A reference scheme of competences, skills, knowledge, and proficiency levels of Data Scientists and IoT professionals.
- Two modular learning-outcome oriented vocational curricula for:
  - Data Scientists
  - IoT professionals.
- Training material for the implementation of the two VET programs.
- A training methodology for the delivery of the VET programs to the learners including work-based learning.

Main results (2)

- A methodology for the assessment of the learners during the delivery of the VET programs and their tracking after the end of VET programs.
- A mechanism for the certification of the provided skills, knowledge and competences.
- A survey for the validation, certification & accreditation of provided VET programs and their alignment with NQFs, EQF and ECVET.
- A set of exploitation toolkits for higher education institutes, VET providers and enterprises.
- Three workshops organized at Greece, Cyprus and Bulgaria.
- One conference organized at Greece.

Work Breakdown



Useful links for project content

- Work based learning http://ec.europa.eu/education/policy/vocational-policy/doc/alliance/work-based-learning-in-europe_en.pdf
- EU Skills Panorama http://skillspanorama.cedefop.europa.eu/en
- ESCO https://ec.europa.eu/esco/home
- European Skills Councils http://ec.europa.eu/social/main.jsp?catId=1415&intPageId=5062
- ECVET http://ec.europa.eu/education/policy/vocational-policy/ecvet_en.htm
- ECVET pilot projects http://www.ecvet-projects.eu/
- EQAVET http://ec.europa.eu/education/policy/vocational-policy/eqavet_en.htm
- Network "Work-based Learning and Apprenticeships" http://www.net-wbl.eu/ including TOOLKIT - http://www.wbl-toolkit.eu

Thank you!

For more info on GCS please contact

voyageri@teiath.gr

voyageri@uniwa.gr

epy@epy.gr

For more info on pdp please contact

info@pdp.gr

epy@epy.gr

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Dr. Maria Rigou

Project coordinator

University of Patras

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Dr. Vasileios Gkamas

University of Patras

gkamas at ceid.upatras.gr

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Annex 2

SEnDIng project: Design of VET programmes for Data Science and Internet of Things professionals

SEnDIng

Co-funded by the Erasmus+ Programme of the European Union

Sector Skills Alliance for the design and delivery of innovative VET programmes to Data Science and Internet of Things professionals

Project overview

- **Program**: Erasmus+ KA2: Cooperation for innovation and the exchange of good practices - Sector Skills Alliances
- **Call ID**: EACEA-04-2017
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GREEK COMPUTER SOCIETY (GCS)

mixanografiki
CONSULTING SERVICES

Nemetschek BULGARIA

CODE RUNNERS

UNICERT
Universal Certification Solutions

Πανεπιστήμιο Κύπρου
University of Cyprus

universal learning systems

Needs and challenges

- Addressing the skills' gap of Data Science (DS) and Internet of Things (IoT) professionals.
- Contributing to the increased demand of industry's sectors other than ICT (e.g. banking, energy, logistics) for high-qualified DS and IoT professionals.
- Providing the DS and IoT professionals with skills and competences, that are transferable and recognized among European countries.
- Making the vocational trainings more relevant to the actual needs of the labor market.

Key objectives

- Define vocational trainings' learning outcomes for the occupational profiles of DS and IoT professionals.
- Design a common reference scheme of competences, skills, knowledge and proficiency levels for DS and IoT professionals in accordance with European frameworks (e.g. eCF framework and ESCO).
- Design two modular learning outcome oriented VET curricula, one targeting DS and another IoT taking into consideration EQAVET.

Key objectives

- Design a mechanism for the certification of the provided skills and competences.
- Making recommendations for the validation, certification & accreditation of the provided VET program and its alignment with NQFs, EQF and ECVET.
- Each VET program will be delivered in three phases
  - e-learning (100 hours),
  - face-to-face (20 hours) and
  - work based learning (4 months)

  - we must train at least 75 IT professional in DS and 75 in IOT (from GR, BL and CY).

Target Groups

- IT professionals and associations
- VET providers
- Certification bodies
- Higher Education Institutes
- Companies & SMEs
- Policy-makers

Main results (1)

- Learning outcomes of Data Science and IoT VET programs
- A reference scheme of knowledge, skills and competences for Data Scientists and IoT professionals.
- Two modular learning outcomes-oriented vocational curriculum
  - Modularity: each curriculum is divided into educational modules and each module into training units at three levels of proficiency (introduction, core, advanced)
  - Personalized learning: a different learning path for each learner according to its occupational profile.
- A MOOC that will be used for the online training phase of VET programs
- Open Educational Resources.

Main results (2)

- A training methodology incorporating online training, face-to-face training and work based learning
- A framework for the certification of skills, knowledge and competences.
- A survey for the validation, certification & accreditation of provided VET programs and their alignment with NQFs, EQF and ECVET.
- A set of exploitation toolkits for Higher Education Institutes, VET providers and enterprises.
- Workshops organized at Greece, Cyprus and Bulgaria.
- One conference organized at Greece.

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WP2: learning outcomes, vocational curricula design, training/assessment methodology

- Define the learning outcomes of the modular VET programs.
- To define a reference model for the interpretation of existing research evidence into specific skills, e-competences and qualifications needs of DS and IoT professionals.
- To design the vocational curricula and their educational modules.
- Design the training methodology together with the methodology for the training assessment and monitoring.

Wp2 progress (achieved results)

Learning outcomes + curricula

- List the Educational modules and explain the 3 levels

WP3: Development of training material

- To develop the training material for the delivery of vocational trainings to DS professionals
- To develop the training material for the delivery of vocational trainings to IoT professionals
- To develop the training material for transversal skills development

WP4: Skills certification mechanism

- To make recommendations for the alignment of the vocational trainings with NQF of participant countries, EQF and ECVET
- To implement the certification scheme of DS VET programme
- To implement the certification scheme of IoT VET programme

WP5: e-learning platform, delivery of training

- To design and implement the online courses environment.
- To deliver the vocational trainings to the target groups at the three phases.

WP6: Quality assurance, project evaluation

- To ensure that the quality of the outcomes, outputs and activities of the project are maintained at a high standard.
- To assess any potential risks.
- To assess the impact of the project to all stakeholders.
- To establish a learners' tracking and feedback framework for evaluating their progress.

WP7: Dissemination, exploitation

- To increase the visibility and the impact of the project on the participating countries and across the EU, so that the outputs can be transferred to other countries and areas.
- To increase the visibility and the impact of the project on those involved in DS and IoT technologies.
- To link the project practices and results in companies that employ DS and IoT professionals.

Produced results

- Learning outcomes in terms of Knowledge, Skills and Competences (WP2)
  - Desktop research on existing Data Science and Internet of Things curricula and courses -> definitions of skills and knowledge
  - The draft version of the DS and IoT Learning outcomes was discussed among partners and key experts in the respective fields.
  - Design and distribution of an online survey among CIOs of IT companies to explore on their plans and needs (skills and knowledge) in the IoT and the Data Science domains (more than 140 companies and organizations).
    - Data received validated the defined skills and knowledge.
    - Received 36 responses for Data Science learning outcomes and 43 responses for Internet of Things learning outcomes
    - from companies all over the world

Training Characteristics

- Learning outcome based curricula = Flexible
- Flexible = modular
- Flexible = adaptable

- Use micro-modules that will be able to be combined for trainees of different Vocational Level, or different existing knowledge

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DS learning outcomes

Knowledge	Skills	Competences
▪ Describe the key concepts of Data Science ▪ Describe ICT methods and tools applicable for the storage and retrieval of data ▪ Describe methods and tools applicable for the statistical analysis of data ▪ Explain basic concepts and requirements related to information security and privacy (e.g. how to deal with people profiling in the context of GDPR)	▪ Analyse domain specific trends and present them as structured information ▪ Create code to statistically analyse data ▪ Apply data statistics and data visualization ▪ Deploy simple machine learning techniques ▪ Deploy data storage and retrieval techniques; ▪ Implement data models validation techniques ▪ Ensure that IPR, security and privacy issues are respected	▪ Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are still a subject to change ▪ Supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities

IoT learning outcomes

Knowledge	Skills	Competences
▪ Describe the value that IoT delivers in different business domains ▪ Explain the business processes related to IoT in specific domains ▪ Understand IoT architectures and the related network and communication protocols ▪ Recognize different types of sensors, actuators, displays and related embedded electronics ▪ Design the application level (e.g. use protocols that support different IoT applications) of IoT in the context of big data, cloud technologies and data science ▪ Formulate requirements about IoT information security	▪ Analyse, argue and describe the business value of a particular IoT system ▪ Design an IoT system that includes sensors, controllers, actuators and displays, connected to a cloud platform through internet connection ▪ Develop and deploy workflows and dashboards for an IoT system that includes sensors, controllers, actuators and displays, connected to a cloud platform through internet connection ▪ Develop working code for an IoT system that includes sensors, controllers, actuators and displays, connected to a cloud platform through internet connection ▪ Apply IoT information security concepts	▪ Exercise self-management within the guidelines of work or study contexts that are usually predictable, but still are a subject to change ▪ Supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities

Key competences in terms of soft skills

- Communication skills;
- Adaptable to change;
- Team work;
- Ability to present in front of colleagues and clients;
- Goal-oriented;
- Thinking outside the box;
- Agile mindset;

Curricula contents

DATA SCIENCE modules

Introduction to Data Science

Python for Data Science

Statistics for Data Science

Storing and retrieving data

Applied machine learning

Data Visualization

INTERNET OF THINGS modules

IoT System Architecture and Design

IoT Communication technologies

IoT Applications (includes Smart City, Smart Homes, Wearables, Location based etc.)

IoT Security

Business Value (Opportunities) with IoT

Thank you!

For further information please contact

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Technical Manager
University of Patras
gkamas at ceid.upatras.gr

or visit

http://sending-project.eu

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Annex 3

Sector Skills Alliance for the design and delivery of innovative VET programmes to Data Science and Internet of Things professionals

SEnDIng

DTIS Design & Technology of Integrated Systems in Nanoscale Era 2019

Co-funded by the Erasmus+ Programme of the European Union

Sector Skills Alliance for the design and delivery of innovative VET programmes to Data Science and Internet of Things professionals (SEnDIng)

Ioannis Voyiatzis

April 16-18, 2019, Mykonos, Greece

http://sending-project.eu

Greek Computer Society (GCS) Profile

- A non-profit organization
- Representing Greek scientists and professionals engaged in activities relevant to
  - Computer Science,
  - Information Technology,
  - Telecommunications and other relevant scientific areas.
- Established **in 1977** to become a world-class organization for Information and Communication Technologies.
- Currently numbers more than **5,500 members** including professionals, academics and students.
- www.epy.gr

GCS Objectives (1)

- Promote **the use of Information Technology** to the public
- Development of Information Technology w.r.t
  - scientific research
  - education
- Establish synergies between research and education practice
- Support the **professional development of Information Technology professionals**

GCS Objectives (2)

- Develop professional codes of practice for Information Technology professionals
- Provide technical consultancy on Information Technology to the State
- **Contribute to IT standardisation processes** in collaboration with national, European and international standardisation Bodies
- ***Disseminate*** the results of scientific research to scientists, professionals, students

Sending Project overview

- **Program**: Erasmus+ KA2: Cooperation for innovation and the exchange of good practices - Sector Skills Alliances
- **Call ID**: EACEA-04-2017
- **Lot**: Lot 2, SSA for Design and Delivery of VET
- **Project Number**: 591848-EPP-1-2017-1-EL-EPPKA2-SSA
- **Grant Agreement Number**: 2017-3184/001-001
- **Project Coordinator**: University of Patras
- **Duration**: 36 months
- **Number of Partners**: 12
- **EU grant**: 982.537 €
- **Start Date**: 1st December 2017
- **End Date**: 30th November 2020

Consortium

ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ
UNIVERSITY OF PATRAS

OLYMPIC Training & Consulting

BASSCOM
Bulgarian Association of Software Companies

ESI European Software Institute
Center Eastern Europe

ΕΠΥ
ΕΛΛΗΝΙΚΗ ΕΤΑΙΡΙΑ ΕΠΙΣΤΗΜΟΝΩΝ ΚΑΙ ΕΠΑΓΓΕΛΜΑΤΙΩΝ ΠΛΗΡΟΦΟΡΙΚΗΣ ΚΑΙ ΕΠΙΚΟΙΝΩΝΙΩΝ (ΕΠΥ)
GREEK COMPUTER SOCIETY (GCS)

Μηχανογραφική
CONSULTING SERVICES

Nemetschek BULGARIA

CODE RUNNERS

UNICERT
Universal Certification Solutions

Πανεπιστήμιο Κύπρου
University of Cyprus

universal learning systems

Needs and challenges

- **Address the skills' gap** of Data Scientists and IoT engineers.
- Contribute to the **increased demand for highly-qualified Data Scientists and IoT Engineers** in various sectors (ICT, banking, energy, logistics).
- Provide the Data Scientists and IoT engineers with
  - skills and competences,
  - **transferable and recognizable** among European countries.
- Make the provided trainings (more) relevant to the actual needs of labor market.

Key objectives (1)

- Define the learning outcomes of the vocational trainings targeting Data Scientists and IoT engineers.
- Design a common reference scheme of knowledge, skills and competences for Data Scientists and IoT engineers in accordance to European standards and frameworks
  - eCF (e-Competence Framework)
  - ESCO (European Skills, Competences, Qualifications and Occupations).
- Design two modular learning outcome-oriented VET curricula taking into consideration the principles of
  - ECVET (European Credit system for Vocational Education and Training)
  - EQAVET (European Quality Assurance in Vocational Educational Training).

Key objectives (2)

- Design a framework for the certification of skills and competences provided to learners.
- Make recommendations for the validation, certification & accreditation of the VET programs and their alignment with NQFs, EQF and ECVET.
- Delivery of vocational trainings into three phases
  - e-learning
  - face-to-face
  - work-based learning

Target Groups

- IT professionals and associations
- VET providers
- Certification bodies
- Higher Education Institutes
- Companies & SMEs
- Policy-makers

Main results (1)

- Learning outcomes of Data Science and IoT VET programs
- A reference scheme of knowledge, skills and competences for Data Scientists and IoT professionals.
- Two modular learning outcome-oriented vocational curricula
  - **Modularity:** each curriculum is divided into educational modules and each module into training units at three levels of proficiency (introduction, core, advanced)
  - **Personalized learning:** different learning path according to the learner's occupational profile.
- A MOOC for the online training phase of VET programs
- Open Educational Resources.

Main results (2)

- A training methodology incorporating online training, face-to-face training and work based learning
- A framework for the certification of skills, knowledge and competences.
- A survey for the validation, certification & accreditation of provided VET programs and their alignment with NQFs, EQF and ECVET.
- A set of exploitation toolkits for Higher Education Institutes, VET providers and enterprises.
- Workshops organized at Greece, Cyprus and Bulgaria.
- One conference organized at Greece.

SEnDIng

Work Breakdown

Useful links for project content

- Work based learning http://ec.europa.eu/education/policy/vocational-policy/doc/alliance/work-based-learning-in-europe_en.pdf
- EU Skills Panorama http://skillspanorama.cedefop.europa.eu/en
- ESCO https://ec.europa.eu/esco/home
- European Skills Councils http://ec.europa.eu/social/main.jsp?catId=1415&intPageId=5062
- ECVET http://ec.europa.eu/education/policy/vocational-policy/ecvet_en.htm
- ECVET pilot projects http://www.ecvet-projects.eu/
- EQAVET http://ec.europa.eu/education/policy/vocational-policy/eqavet_en.htm
- Network "Work-based Learning and Apprenticeships" http://www.net-wbl.eu/ including TOOLKIT - http://www.wbl-toolkit.eu

Thank you!

For more info please contact:

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- **Maria Rigou,** *Project coordinator,* University of Patras, rigou@ceid.upatras.gr
- **Vasileios Gkamas,** University of Patras, gkamas@ceid.upatras.gr

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Annex 4

SEnDIng Online Training Concept – Competency-Based, Adaptive Learning in Data Science for ICT Professionals

SEnDIng

Co-funded by the Erasmus+ Programme of the European Union

SEnDIng Online Training Concept – Competency-Based, Adaptive Learning in Data Science for ICT Professionals

Teemu Patala, Alan Bruce

Universal Learning Systems / ChangeLearning Alliance (Ireland)

Project overview

- **Program**: Erasmus+ KA2: Cooperation for innovation and the exchange of good practices - Sector Skills Alliances
- **Call ID**: EACEA-04-2017
- **Lot**: Lot 2, SSA for Design and Delivery of VET
- **Project Number**: 591848-EPP-1-2017-1-EL-EPPKA2-SSA
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Consortium




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GREEK COMPUTER SOCIETY (GCS)

mixanografiki
CONSULTING SERVICES

Nemetschek BULGARIA

CODE RUNNERS

universal learning systems

UNICERT
Universal Certification Solutions

Πανεπιστήμιο Κύπρου
University of Cyprus

Needs and challenges

- Addressing the skills' gap of Data Science (DS) and Internet of Things (IoT) professionals.
- Contributing to the increased demand of industry's sectors other than ICT (e.g. banking, energy, logistics) for high-qualified DS and IoT professionals.
- Providing the DS and IoT professionals with skills and competences, that are transferable and recognized among European countries.
- Making the vocational trainings more relevant to the actual needs of the labor market.

Key objectives

- Define vocational trainings' learning outcomes for the occupational profiles of DS and IoT professionals.
- Design a common reference scheme of competences, skills, knowledge and proficiency levels for DS and IoT professionals in accordance with European frameworks (e.g. eCF framework and ESCO).
- Design two modular learning outcome oriented VET curricula, one targeting DS and another IoT taking into consideration EQAVET.

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Key objectives

- Design a mechanism for the certification of the provided skills and competences.
- Making recommendations for the validation, certification & accreditation of the provided VET program and its alignment with NQFs, EQF and ECVET.
- Each VET program will be delivered in three phases
  - e-learning (100 hours),
  - face-to-face (20 hours) and
  - work based learning (4 months)
  - 150+ trained professionals

Co-funded by the
Erasmus+ Programme
of the European Union

Target Groups

- IT professionals and associations
- VET providers
- Certification bodies
- Higher Education Institutes
- Companies & SMEs
- Policy-makers

Main results (1)

- Learning outcomes of DS and IoT VET programs
- A reference scheme of knowledge, skills and competences for Data Scientists and IoT professionals.
- Two modular learning outcomes-oriented vocational curriculum
  - Modularity: each curriculum is divided into educational modules and each module into training units at three levels of proficiency (introduction, core, advanced)
  - Personalized learning: a different learning path for each learner according to its occupational profile.
- An online training course that will be used for the online training phase of VET programs
- Open Educational Resources.

Main results (2)

- A training methodology incorporating online training, face-to-face training and work based learning
- A framework for the certification of skills, knowledge and competences.
- A survey for the validation, certification & accreditation of provided VET programs and their alignment with NQFs, EQF and ECVET.
- A set of exploitation toolkits for Higher Education Institutes, VET providers and enterprises.
- Workshops organized at Greece, Cyprus and Bulgaria.
- One conference organized at Greece.


Project Management
WP2
WP3
WP4
WP5
Learning outcomes identification and design of Vocational Curricula/educational modules and training/assessment methodology
Implementation of training material
Implementation of Skills Certification mechanism
Design of e-learning platform and delivery of vocational trainings
Quality Assurance
Dissemination and Exploitation

Produced results

- Learning outcomes in terms of Knowledge, Skills and Competences (WP2)
  - Desktop research on existing Data Science and Internet of Things curricula and courses -> definitions of skills and knowledge
  - The draft version of the DS and IoT Learning outcomes was discussed among partners and key experts in the respective fields.
  - Design and distribution of an online survey among CIOs of IT companies to explore on their plans and needs (skills and knowledge) in the IoT and the Data Science domains (more than 140 companies and organizations).
    - Data received validated the defined skills and knowledge.
    - Received 36 responses for Data Science learning outcomes and 43 responses for Internet of Things learning outcomes
    - from companies all over the world

The training concept

Training Characteristics

- Learning outcome-based curricula = Flexible
  - > modular
  - > adaptable
- Use micro-modules that will be able to be combined for trainees of different Vocational Level, or different existing knowledge

Data Science learning outcomes

Knowledge	Skills	Competences
▪ Describe the key concepts of Data Science ▪ Describe ICT methods and tools applicable for the storage and retrieval of data ▪ Describe methods and tools applicable for the statistical analysis of data ▪ Explain basic concepts and requirements related to information security and privacy (e.g. how to deal with people profiling in the context of GDPR)	▪ Analyse domain specific trends and present them as structured information ▪ Create code to statistically analyse data ▪ Apply data statistics and data visualization ▪ Deploy simple machine learning techniques ▪ Deploy data storage and retrieval techniques; ▪ Implement data models validation techniques ▪ Ensure that IPR, security and privacy issues are respected	▪ Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are still a subject to change ▪ Supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities

IoT learning outcomes

Knowledge	Skills	Competences
▪ Describe the value that IoT delivers in different business domains ▪ Explain the business processes related to IoT in specific domains ▪ Understand IoT architectures and the related network and communication protocols ▪ Recognize different types of sensors, actuators, displays and related embedded electronics ▪ Design the application level (e.g. use protocols that support different IoT applications) of IoT in the context of big data, cloud technologies and data science ▪ Formulate requirements about IoT information security	▪ Analyse, argue and describe the business value of a particular IoT system ▪ Design an IoT system that includes sensors, controllers, actuators and displays, connected to a cloud platform through internet connection ▪ Develop and deploy workflows and dashboards for an IoT system that includes sensors, controllers, actuators and displays, connected to a cloud platform through internet connection ▪ Develop working code for an IoT system that includes sensors, controllers, actuators and displays, connected to a cloud platform through internet connection ▪ Apply IoT information security concepts	▪ Exercise self-management within the guidelines of work or study contexts that are usually predictable, but still are a subject to change ▪ Supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities

Key competences in terms of soft skills

- Communication skills;
- Adaptable to change;
- Team work;
- Ability to present in front of colleagues and clients;
- Goal-oriented;
- Thinking outside the box;
- Agile mindset;

Curricula contents

DATA SCIENCE modules

Introduction to Data Science

Python for Data Science

Statistics for Data Science

Storing and retrieving data

Applied machine learning

Data Visualization

INTERNET OF THINGS modules

IoT System Architecture and Design

IoT Communication technologies

IoT Applications (includes Smart City, Smart Homes, Wearables, Location based etc.)

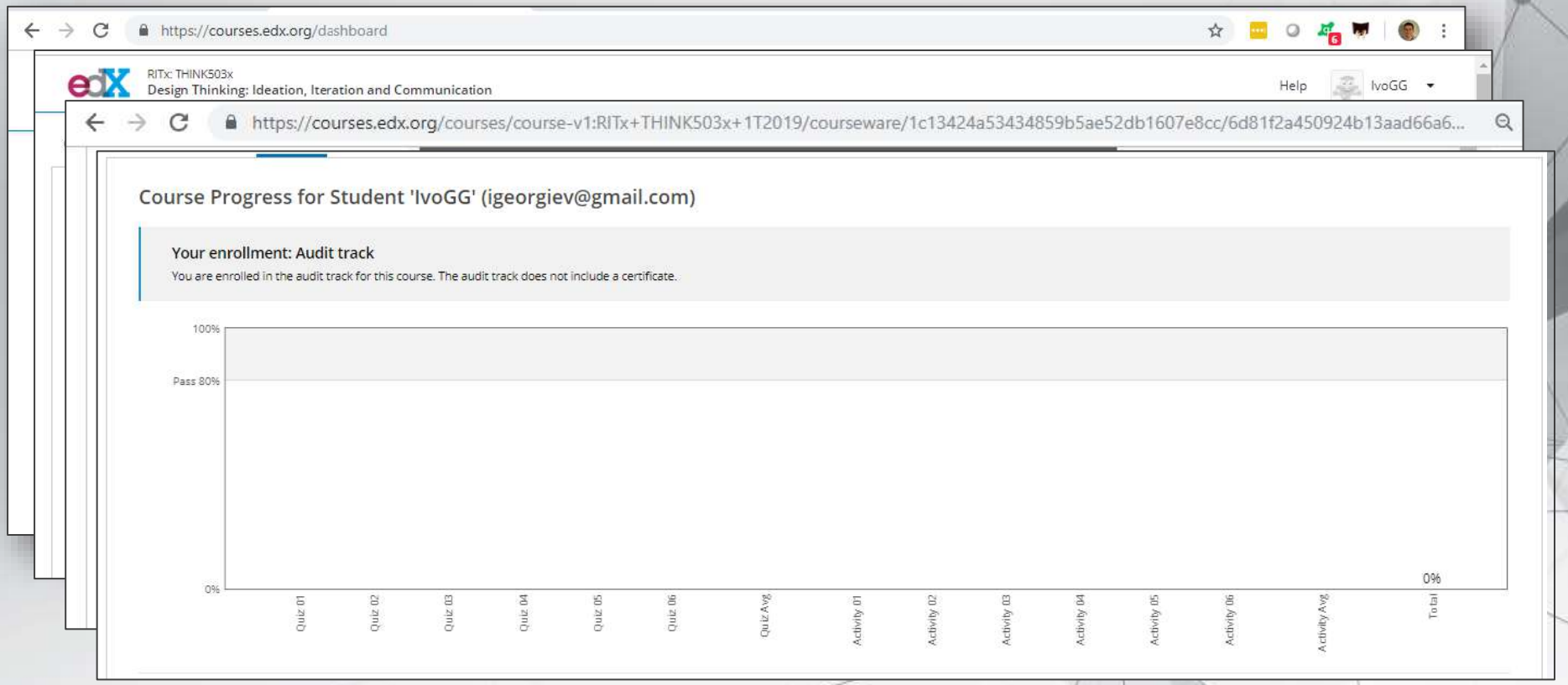
IoT Security

Business Value (Opportunities) with IoT

Online training delivery

- Open edX platform
- Micro-modular
- Built-in assessment
- Adaptable
- Mass-customizable
- Progress follow-up
- Learning data

Samples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Design Thinking: Ideation, Iteration and Communication
Help
IvoGG
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Course Progress for Student 'IvoGG' (igeorgiev@gmail.com)
Your enrollment: Audit track
You are enrolled in the audit track for this course. The audit track does not include a certificate.
100%
Pass 80%
0%
0%
Quiz 01
Quiz 02
Quiz 03
Quiz 04
Quiz 05
Quiz 06
Quiz Avg
Activity 01
Activity 02
Activity 03
Activity 04
Activity 05
Activity 06
Activity Avg
Total

Thank you!

Project website:
http://sending-project.eu

For specific questions related to SEnDIng, contact the project lead partner:

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Teemu Patala
Learning Designer, Co-founder
ULS / ChangeLearning Finland

Alan Bruce
CEO, Co-founder
ULS / ChangeLearning Ireland

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Annex 5

The SEnDIng project - Data Science and Internet of Things professionals' training

SEnDIng

Co-funded by the Erasmus+ Programme of the European Union

The SEnDIng project

Data Science and Internet of Things professionals' training

[EVENT: Patras, 16/7/2019 IISA Conference – Projects track]

Maria Rigou
Project coordinator
Dept. of Computer Engineering & Informatics
University of Patras
rigou@ceid.upatras.gr

Project overview

- **Program**: Erasmus+ KA2: Cooperation for innovation and the exchange of good practices - Sector Skills Alliances
- **Call ID**: EACEA-04-2017
- **Lot**: Lot 2, SSA for Design and Delivery of VET
- **Project Number**: 591848-EPP-1-2017-1-EL-EPPKA2-SSA
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- **Duration**: 36 months
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- **EU grant**: 982.537 €
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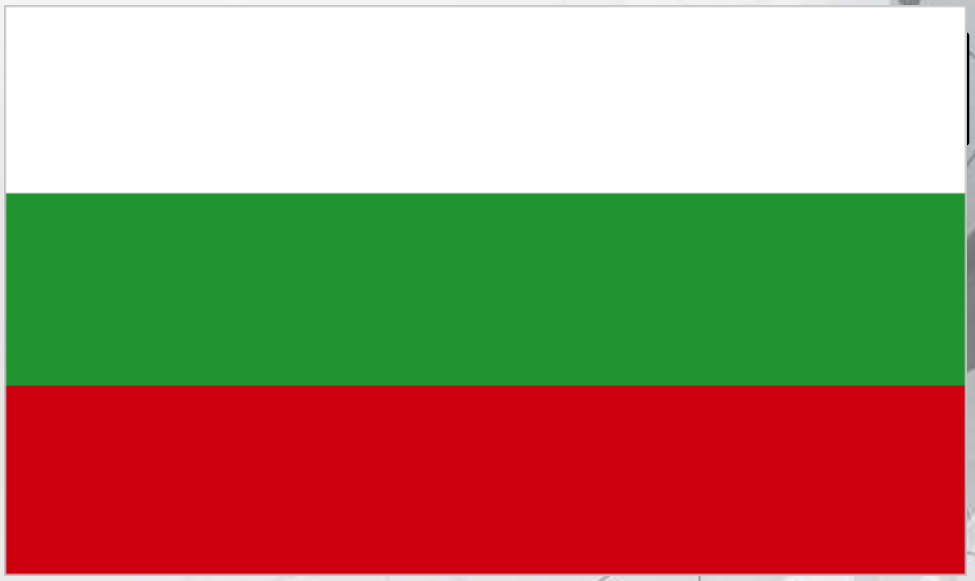


DS and IoT scenery

- Rapid and continuous evolution of DS and IoT technologies and their application in many industries (ICT, banking, energy, marketing, etc.)
- Their value for the EU economy is huge;
  - it is projected that the value of the EU Data Economy will reach 739 billion by 2020
  - IoT with a value of €120 billion will solely contribute to an increase of 7 points of European GDP by 2025
- SKILLS GAP
  - the demand for Data Scientists will increase by 28% in 2020, with the unfilled DS positions at the same time estimated at 485,000
  - the need for IoT skills is huge, as 68% of businesses struggle to hire IoT experts

SEnDIng objectives

- Address the **skills' gap** of ICT professionals in the domains of Data Science (DS) and Internet of Things (IoT)
- Contribute to the **increased demand** of industry's sectors other than ICT (e.g. banking, energy, logistics) for highly-qualified DS and IoT professionals
- Provide the DS and IoT professionals with skills and competences, that are **transferable** and **recognized** among European countries
- Make the vocational trainings more relevant to the actual **needs of the labor market**

Target Groups

- ICT professionals and associations
- VET providers
- Certification bodies
- Higher Education Institutes
- Companies & SMEs
- Policy-makers

SEnDIng

Co-funded by the Erasmus+ Programme of the European Union

Main results (1)

- **Learning outcomes** of Data Science and IoT VET programs
- A **reference scheme** of knowledge, skills and competences for Data Scientists and IoT professionals.
- Two modular learning outcomes-oriented **vocational curricula**
  - *Modularity*: each curriculum is divided into educational modules and each module into training units at three levels of proficiency (introduction, core, advanced)
  - *Personalized learning*: a different learning path for each learner according to the occupational profile
- Each VET program will be delivered in three phases
  - e-learning (100 hours),
  - face-to-face (20 hours) and
  - work based learning (4 months)
  - *we will train at least 75 IT professional in DS and 75 in IoT (from GR, BL and CY).*

Main results (2)

- A **MOOC** that will be used for the online training phase of VET programs
- **Open Educational Resources**
- A **training methodology** incorporating online training, face-to-face training and work-based learning
- A certification framework for the **certification**
- A **survey** for the validation, certification & accreditation of provided VET programs and their alignment with NQFs, EQF and ECVET
- A set of **exploitation toolkits** for Higher Education Institutes, VET providers and enterprises
- **3 Workshops** (Greece, Cyprus and Bulgaria) and a **conference** organized in Greece

Produced results

- Learning outcomes in terms of Knowledge, Skills and Competences (WP2)
  - **Desktop research** on existing Data Science and Internet of Things curricula and courses -> definitions of skills and knowledge
  - The draft version of the DS and IoT Learning outcomes was discussed among partners and **key experts** in the respective fields
  - Design and distribution of an **online survey** among CIOs of IT companies to explore on their plans and needs (skills and knowledge) in the IoT and the Data Science domains (more than 140 companies and organizations).
    - Data received validated the defined skills and knowledge.
    - Received 36 responses for Data Science learning outcomes and 43 responses for Internet of Things learning outcomes
    - from companies all over the world

Co-funded by the Erasmus+ Programme of the European Union

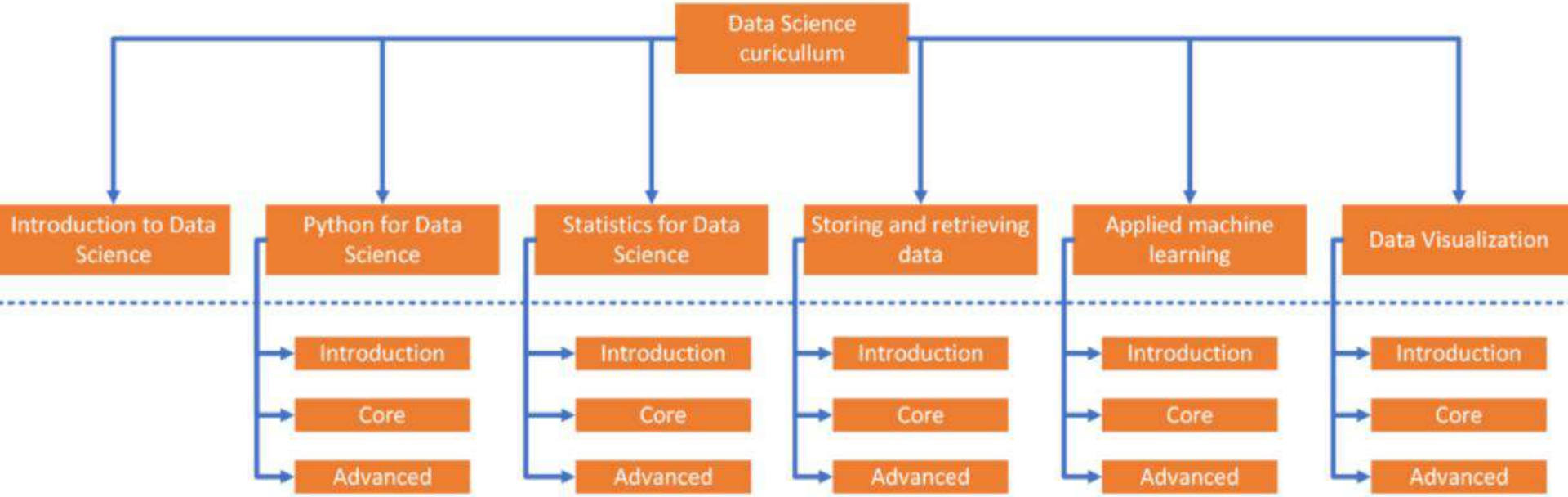
DS learning outcomes

Knowledge	Skills	Competences
▪ Describe the key concepts of Data Science ▪ Describe ICT methods and tools applicable for the storage and retrieval of data ▪ Describe methods and tools applicable for the statistical analysis of data ▪ Explain basic concepts and requirements related to information security and privacy (e.g. how to deal with people profiling in the context of GDPR)	▪ Analyse domain specific trends and present them as structured information ▪ Create code to statistically analyse data ▪ Apply data statistics and data visualization ▪ Deploy simple machine learning techniques ▪ Deploy data storage and retrieval techniques; ▪ Implement data models validation techniques ▪ Ensure that IPR, security and privacy issues are respected	▪ Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are still a subject to change ▪ Supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities

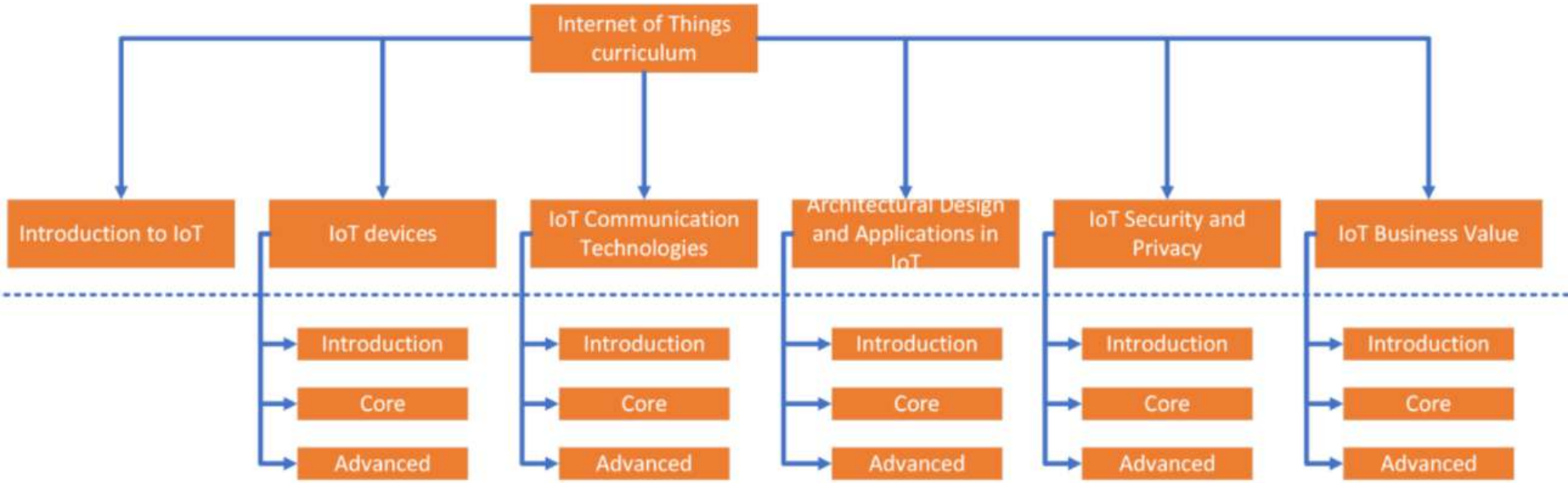
IoT learning outcomes

Knowledge	Skills	Competences
▪ Describe the value that IoT delivers in different business domains ▪ Explain the business processes related to IoT in specific domains ▪ Understand IoT architectures and the related network and communication protocols ▪ Recognize different types of sensors, actuators, displays and related embedded electronics ▪ Design the application level (e.g. use protocols that support different IoT applications) of IoT in the context of big data, cloud technologies and data science ▪ Formulate requirements about IoT information security	▪ Analyse, argue and describe the business value of a particular IoT system ▪ Design an IoT system that includes sensors, controllers, actuators and displays, connected to a cloud platform through internet connection ▪ Develop and deploy workflows and dashboards for an IoT system that includes sensors, controllers, actuators and displays, connected to a cloud platform through internet connection ▪ Develop working code for an IoT system that includes sensors, controllers, actuators and displays, connected to a cloud platform through internet connection ▪ Apply IoT information security concepts	▪ Exercise self-management within the guidelines of work or study contexts that are usually predictable, but still are a subject to change ▪ Supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities

DS Curriculum



IoT Curriculum



Key competences in terms of soft skills

- Communication skills;
- Adaptable to change;
- Team work;
- Ability to present in front of colleagues and clients;
- Goal-oriented;
- Thinking outside the box;
- Agile mindset;

Data scientist roles

[adapted from the proposal done by the EDISON project for the extension of Data Science occupations at ESCO classification]

- **Data Analyst**. Analyses large variety of data to extract information about system, service or organization performance and present them in usable/actionable form.
- **Data Architect.** Designs and maintains the architecture of Data Science applications and facilities. Creates relevant data models and processes workflows.
- **Database Administrator.** Designs and implements or monitors and maintains large scale cloud databases.
- **Machine Learning Engineer.** Designs and applies machine learning algorithms.
- **Data Scientist.** Gathers and interprets rich data sources, manages large amounts of data, merges data sources, ensures consistency of data-sets, and creates visualizations to aid in understanding data. Builds mathematical models, presents and communicates data insights and findings.

Mapping of DS training unit level to professional roles

Data Science Training Units	Data Analyst	Data Architect	DB Administrator	Machine Learning Engineer	Data Scientist
Introduction to DS	I	I	I	I	A
Python for DS	A	C	I	A	A
Statistics for DS	C	C	I	A	A
Storing and Retrieving Data	C	A	A	C	A
Applied Machine Learning	I	I	I	A	A
Data Visualization	A	I	I	C	A

IoT Engineer roles

- **IoT Product Manager**. Supervises the execution part of the project. Collaborates with the development teams to take care of business requirements and implementations.
- **IoT Architect**. Manages the functional requirements gathering, technology (hardware, software, protocols) selection and solution architectural design for IoT systems and applications. The IoT Architect is responsible for creating effective, efficient, scalable, secure, and innovative IoT Solutions.
- **IoT Software Developer.** Implements IoT systems and applications according to approved designs and conducts rigorous testing of the applications. Deploys the systems and applications to the cloud as well as app stores.

IoT Engineer roles

- **Data Scientist.** Finds and interprets rich data sources, manages large amounts of structured and unstructured data, merges data sources, ensures consistency of data-sets, and creates visualizations to aid in understanding data collected from IoT systems and applications.
- **IoT Cloud Engineer**. Deploys the IoT system infrastructure on the cloud, from middleware to data storage (e.g. databases) for collecting, storing and processing data from the IoT devices in the network
- **IoT Industrial Engineer**. Looks into the hardware components involved in IoT systems and applications, programs robots and smart embedded devices.

Mapping of IoT training unit level to professional roles

IoT Training Units	IoT Product Manager	IoT Architect	IoT Software Developer	Data Scientist	IoT Cloud Engineer	IoT Industrial Engineer
Introduction to IoT	I	I	I	I	I	I
IoT Devices	C	C	I	C	C	A
IoT Communication technologies	C	C	C	C	A	C
Architectural design and applications in IoT	C	A	A	C	A	C
IoT Security and Privacy	I	C	C	I	A	C
IoT Business Value	A	I	I	I	I	C

Current project status

- Active core tasks:
  - Finishing up training material & self assessment quizzes
  - Uploading material to the Open edX platform
  - Defining participation prerequisites and selection criteria
  - Specifying the SEnDIng certification scheme and accreditation mechanism
- Upcoming tasks:
  - Delivery of the 2 vocational training programs (3 phases) – start: Nov 2019
  - Certification of participants
  - Work on a sustainability plan for the online training component

Conclusions and future work

- Our main challenge is to reach the target of 150 trained and certified IT professionals
- (In the long-run) to support the online training component and potentially the certification scheme developed after the end of the project
- SEnDIng aims to foster the **sustainability** of its main outputs (i.e. the two VET programs)
  - through its online platform
  - by promoting the flexibility adequately tailored learning paths according to professional roles in both DS and IoT

Thank you!

For further information please contact

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University of Patras
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University of Patras
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or visit
http://sending-project.eu

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Annex 6

Bridging the skills gap in the Data Science and Internet of Things domains: A Vocational Education and Training Curriculum

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Bridging the skills gap in the Data Science and Internet of Things domains
A Vocational Education and Training Curriculum

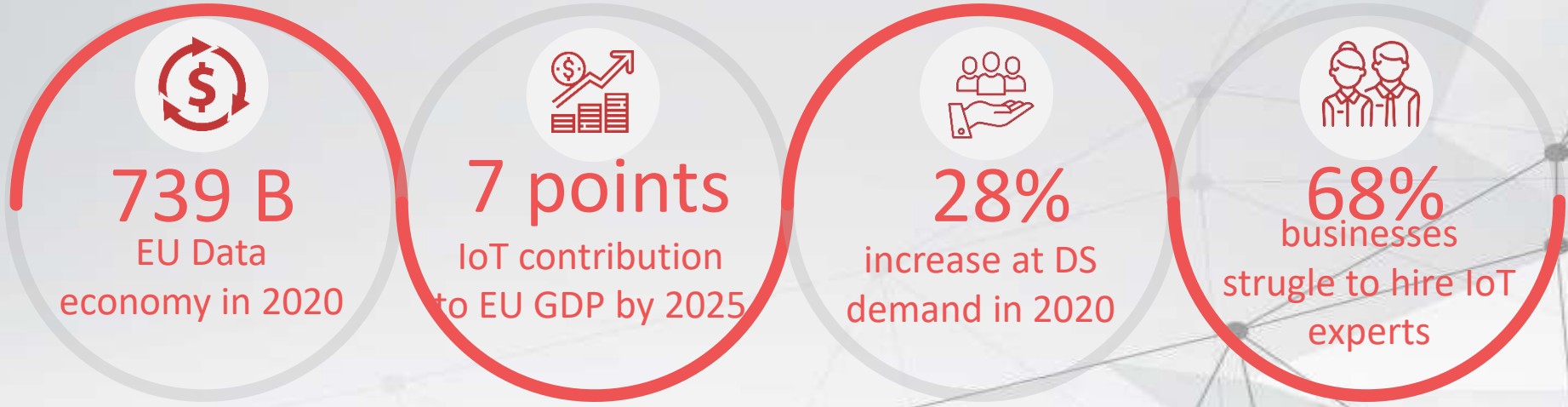
Gkamas V., Rigou M., Paraskevas M., Zarouchas T., Perikos I., Vassiliou V., Gueorguiev I., Varbanov P., Sharkov G., Todorova C., Sotiropoulou A.

28th ICDE World Conference on Online Learning
3-7 November 2019
Convention Centre, Dublin, Ireland

Dr. Vasileios Gkamas
Dept. of Computer Engineering & Informatics
University of Patras, Greece
gkamas@ceid.upatras.gr

DS and IoT scenery

Rapid and continuous evolution of Data Science (DS) and Internet of Things (IoT) technologies with applications in many industries



The challenges

- Variety of the economic sectors exploiting IoT and DS
- Diversity of technical options available in both fields
- Diversity of end users

Challenges faced by stakeholders in the value chain of education and training

- IT professionals in their career orientation
- Organizations designing training programs at several educational levels
- Businesses as recruiters of IT professionals

The problem

1. The current DS and IoT training programs do not match the real needs of enterprises.

2. The current DS and IoT training programs are only technical-oriented and do not commonly provide the learners with transversal skills.

Our contribution

- We present a multi-disciplinary and learning outcomes-oriented VET curriculum that combines technical knowledge and skills at DS and IoT domains with transversal skills and competences.
- The training will be delivered into three phases:

1. Online training on DS and IoT technologies (103 hours for each field)
2. Face to face training on transversal skills (20 hours)
3. Work based learning (4 months)

+ Certification

Curriculum key characteristics

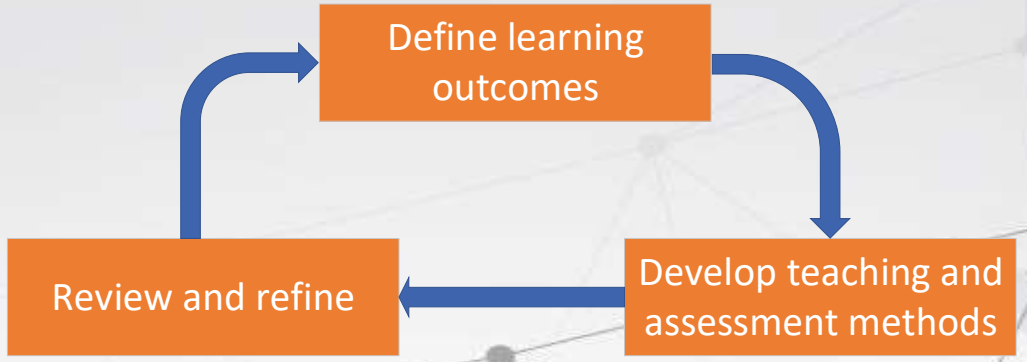
Multi-disciplinar. The modules developed cover both technical knowledge and skills at DS and IoT domains as well as transversal skills and competences

Modular. For each domain, the curriculum is separated in educational modules and training units (Introductory, Core, Advanced)

Learning outcomes-oriented

Curriculum development process

1. Define curriculum goals and design learning outcomes.
2. Develop teaching methods and forms of assessment.
3. Review and refine the curriculum.



Module description

1. Objectives
2. Learning outcomes
3. Content
4. Learning methodologies
5. Assessment methodologies
6. Duration
7. Pre-requisites

Learning outcomes design

- Macro level design (definition of curriculum learning outcomes)
  - Desktop research for the definition of draft learning outcomes
  - Validation of draft learning outcomes among SEnDIng partners and industry key experts in the respective fields
  - Survey among 76 ICT companies (including C-level representatives)
- Micro level design (definition of each training unit's learning outcomes)

Data Science modules (online)

Introduction to Data Science (DS-EM1)

Applied Machine Learning (DS-EM2)

Python for Data Science (DS-EM3)

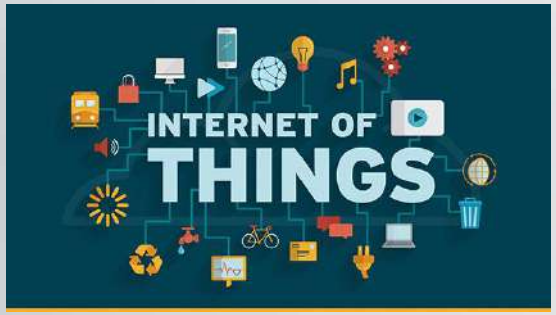
Statistics for Data Science (DS-EM4)

Storing and Retrieving data (DS-EM5)

Data Visualization (DS-EM6)

IoT modules (online)

Introduction to IoT (IoT-EM1)



IoT Devices (IoT-EM2)

IoT Communication Technologies (IoT-EM3)

Architectural Design and Applications in IoT (IoT-EM4)

IoT Security and Privacy (IoT-EM5)

IoT Business Value (IoT-EM6)

Transversal Skills modules (face to face)

Effective communication and presentation (TS-EM1)

Change management (TS-EM2)

Team working (TS-EM3)

Goal setting (TS-EM4)

Creative thinking (TS-EM5)

The SEnDIng training

- It will run from December 2019 to August 2020
- Totally 318 professionals have expressed interest to participate in the 2 trainings
  - 166 IT professionals for DS training
  - 152 IT professionals for IoT training
- We are at the phase of selecting the final list of trainees

The SEnDIng project

- Sector Skills Alliance Erasmus project
- The consortium consists of 12 partners (HEIs, VET providers, IT companies, Associations of IT companies and scientists and a certification body)
- Main objectives
  - Address the skills gap of DS and IoT professionals
  - Design a reference scheme of competences, skills, knowledge and proficiency levels for DS and IoT professionals in accordance with eCF and ESCO.

Thank you!

For further information please contact

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rigou at ceid.upatras.gr

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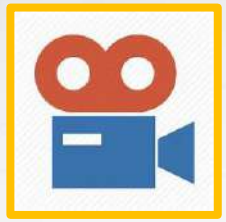

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Annex 7

The SEnDIng project - Data Science and Internet of Things professionals' training

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The SEnDIng project

Data Science and Internet of Things professionals' training

[EVENT: SEnDIng FINAL CONFERENCE, 21/11/2020, online]

Maria Rigou
Project coordinator
Dept. of Management Science & Technology
University of Patras
rigou@ceid.upatras.gr

Project overview

- **Program**: Erasmus+ KA2: Cooperation for innovation and the exchange of good practices - Sector Skills Alliances
- **Call ID**: EACEA-04-2017
- **Lot**: Lot 2, SSA for Design and Delivery of VET
- **Project Number**: 591848-EPP-1-2017-1-EL-EPPKA2-SSA
- **Grant Agreement Number**: 2017-3184/001-001
- **Project Coordinator**: University of Patras
- **Duration**: 36 months
- **Number of Partners**: 12
- **EU grant**: 982.537 €
- **Start Date**: 1st December 2017
- **End Date**: 30th November 2020 – *(just received a 2 months extension)* *31/1/2021*

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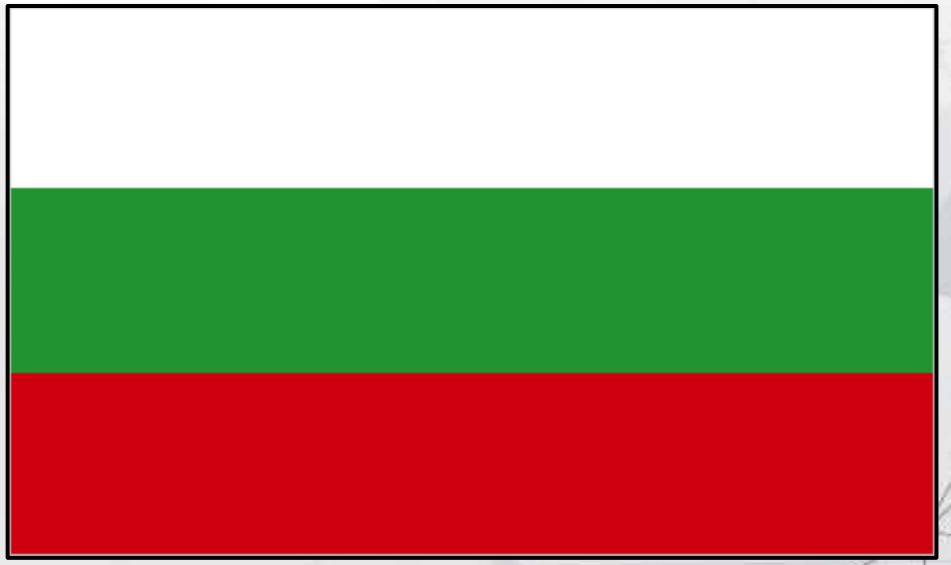
ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ
UNIVERSITY OF PATRAS



DS and IoT scenery

- Rapid and continuous evolution of DS and IoT technologies and their application in many industries (ICT, banking, energy, marketing, etc.)
- Their value for the EU economy is huge;
  - it was projected that the value of the EU Data Economy will reach 739 billion by 2020
  - the total installed base of IoT devices projected to amount to 75.44 billion worldwide by 2025
  - expansion and impact of the IoT will increase, especially when IoT is used in combination with other technologies like AI, machine learning and Big Data, domains closely related to Data Science
- SKILLS GAP
  - the demand for Data Scientists increased by 28% in 2020, with the unfilled DS positions at the same time are estimated at 485,000
  - the need for IoT skills is huge, as 68% of businesses struggle to hire IoT experts

SEnDIng objectives

- Address the **skills' gap** of ICT professionals in the domains of Data Science (DS) and Internet of Things (IoT)
- Contribute to the **increased demand** for highly-qualified DS and IoT professionals coming from industry sectors other than ICT (e.g. banking, energy, logistics)
- Provide the DS and IoT professionals with skills and competences, that are **transferable** and **recognized** among European countries
- Make the vocational trainings more relevant to the actual **needs of the labor market**

Target Groups

- ICT professionals and associations
- VET providers
- Companies & SMEs
- Certification bodies
- Higher Education Institutes
- Policy-makers

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Main results (1)

- **Learning outcomes** of Data Science and IoT VET programs
- A **reference scheme** of knowledge, skills and competences for Data Scientists and IoT professionals.
- Two modular learning outcomes-oriented **vocational curricula**
  - *Modularity*: each curriculum is divided into educational modules and each module into training units at three levels of proficiency (introduction, core, advanced)
  - *Personalized learning*: a different learning path for each learner according to the occupational profile
- Each VET program is delivered in three phases
  - e-learning (100 hours),
  - face-to-face (20 hours) and
  - work based learning (4 months)
  - *train at least 75 IT professionals on DS and 75 on IoT*

Main results (2)

- A **MOOC** supporting the online training phase of the 2 VET programs
- **Open Educational Resources**
- A **training methodology** incorporating online training, face-to-face training and work-based learning
- A methodological framework for the **certification**
- A **survey** for the validation, certification & accreditation of provided VET programs and their alignment with NQFs, EQF and ECVET
- A set of **exploitation toolkits** for IT Professionals, VET providers and Companies
- **3 Workshops** (Greece, Cyprus and Bulgaria) and a **Final Conference** organized in Greece

Curricula design

- Learning outcomes in terms of Knowledge, Skills and Competences
  - **Desktop research** on existing Data Science and Internet of Things curricula and courses -> definitions of skills and knowledge
  - The draft version of the DS and IoT Learning outcomes was discussed among partners and **key experts** in the respective fields
  - Design and distribution of an **online survey** among CIOs of IT companies to explore on their plans and needs (skills and knowledge) in the IoT and the Data Science domains (more than 140 companies and organizations).

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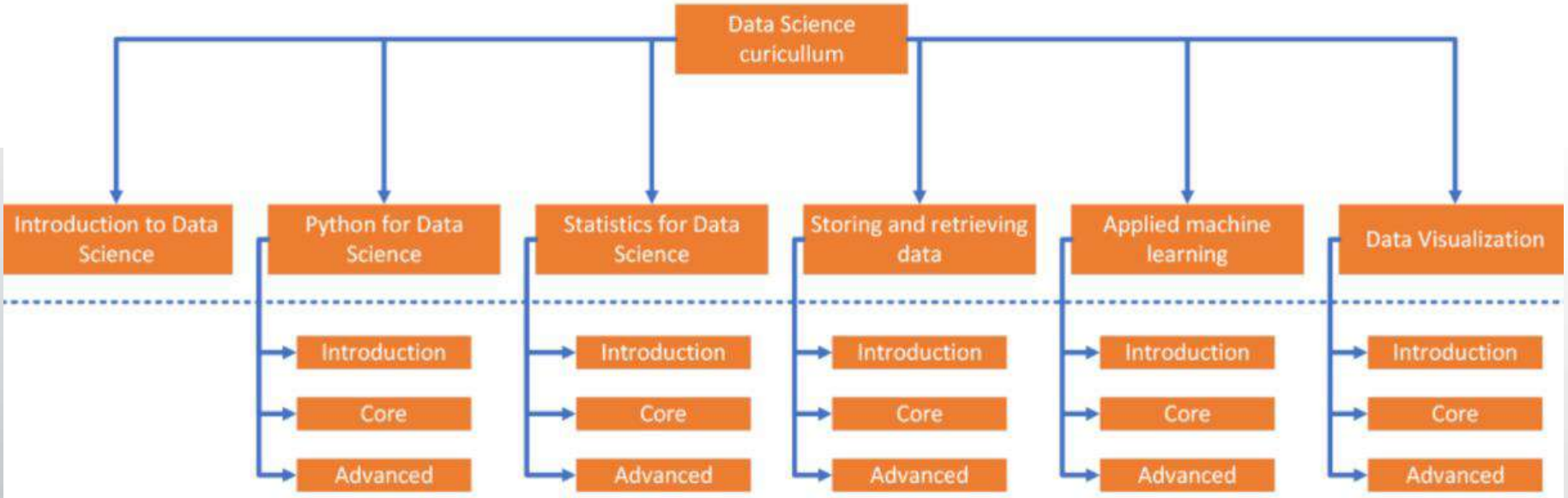
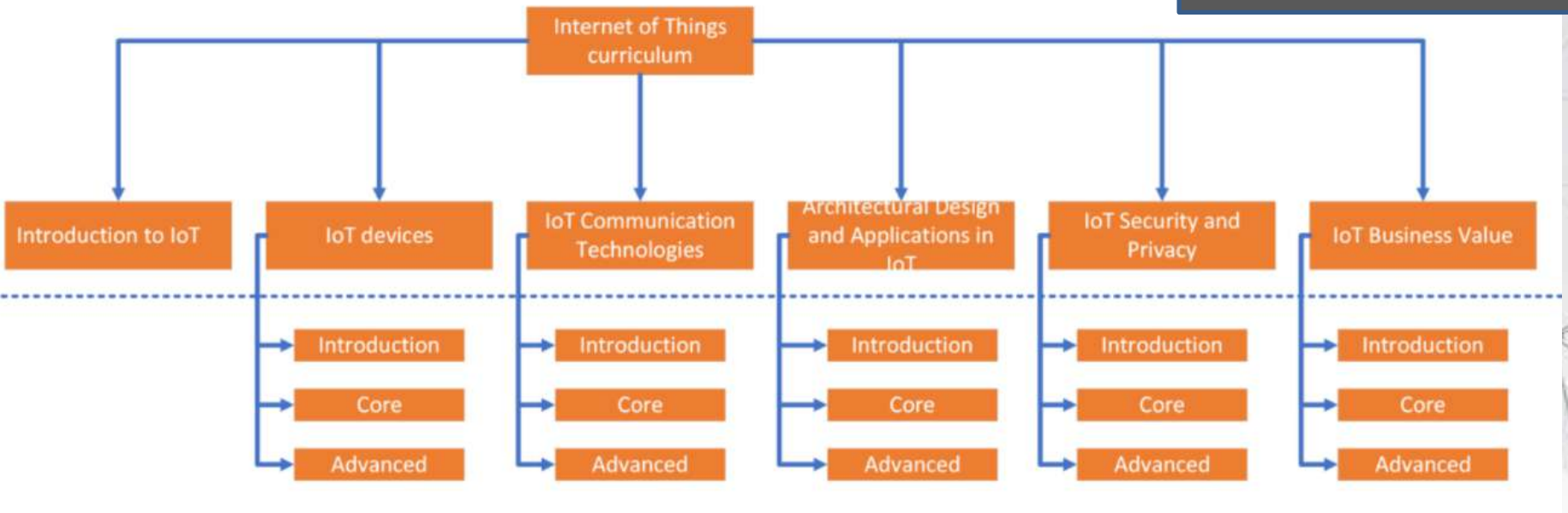




Soft Skills

- Communication skills
- Change management
- Team working
- Goal setting
- Creative thinking

Data scientist roles

[adapted from the proposal done by the EDISON project for ESCO classification]

1. **Data Analyst**. Analyses large variety of data to extract information about system, service or organization performance and present them in usable/actionable form.
2. **Data Architect.** Designs and maintains the architecture of Data Science applications and facilities. Creates relevant data models and processes workflows.
3. **Database Administrator.** Designs and implements or monitors and maintains large scale cloud databases.
4. **Machine Learning Engineer.** Designs and applies machine learning algorithms.
5. **Data Scientist.** Gathers and interprets rich data sources, manages large amounts of data, merges data sources, ensures consistency of data-sets, and creates visualizations to aid in understanding data. Builds mathematical models, presents and communicates data insights and findings.

Mapping of DS training units to professional roles

I: Introductory **C:** Core **A:** Advanced	Data Analyst	Data Architect	Database Administrator	Machine Learning Engineer	Data Scientist
Introduction to Data Science	I	I	I	I	A
Python for Data Science	A	C	I	A	A
Statistics for Data Science	C	C	I	A	A
Storing and retrieving data	C	A	A	C	A
Applied machine learning	I	I	I	A	A
Data Visualization	A	I	I	C	A

IoT Engineer roles

1. **IoT Product Manager**. Supervises the execution part of the project. Collaborates with the development teams to take care of business requirements and implementations.
2. **IoT Architect**. Manages the functional requirements gathering, technology selection (hardware, software, protocols) and solution architectural design for IoT systems and applications.
3. **IoT Software Developer.** Implements IoT systems and applications according to approved designs and conducts rigorous testing of the applications. Deploys the systems and applications to the cloud as well as app stores.
4. **Data Scientist.** Finds and interprets rich data sources, manages large amounts of structured and unstructured data, merges data sources, ensures consistency of data-sets, and creates visualizations.
5. **IoT Cloud Engineer**. Deploys the IoT system infrastructure on the cloud, from middleware to data storage (e.g. databases) for collecting, storing and processing data from the IoT devices in the network
6. **IoT Industrial Engineer**. Looks into the hardware components involved in IoT systems and applications, programs robots and smart embedded devices.

Mapping of IoT training units to professional roles

I: Introductory
C: Core
A: Advanced

	IoT Product Manager	IoT Architect	IoT Software Developer	Data Scientist	IoT Cloud Engineer	IoT Industrial Engineer
Introduction to IoT	I	I	I	I	I	I
IoT Devices	C	C	I	C	C	A
IoT Communication Technologies	C	C	C	C	A	C
Architectural Design and Applications in IoT	C	A	A	C	A	C
IoT Security and Privacy	I	C	C	I	A	C
IoT Business Value	A	I	I	I	I	C

SEnDIng in numbers

250	320	100	25
trainess on MOOC	hours work based learning	trainees on work based learning	enterprises on work based learning
6	6	20	20
online courses on IoT	online courses on Data Science	hours training on transversal skills	hands-on projects

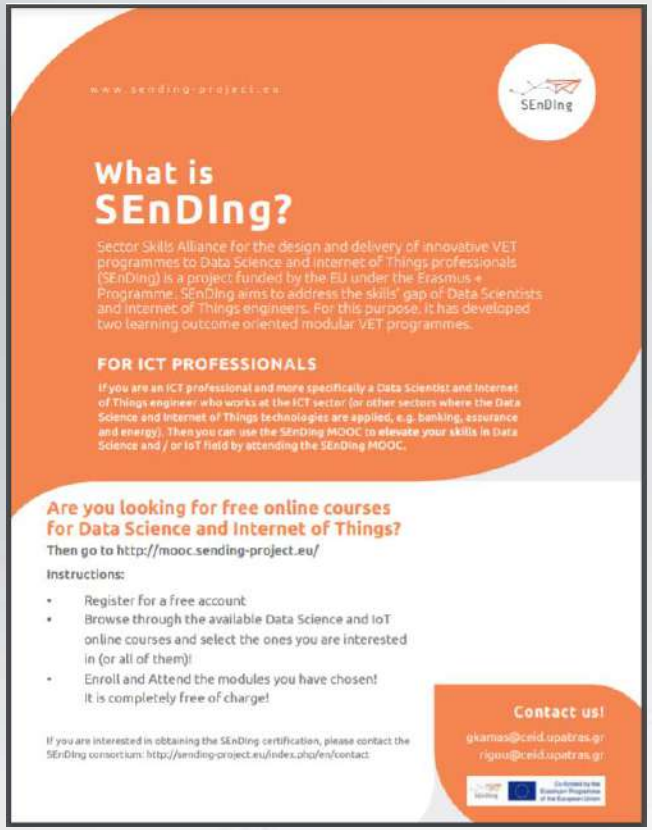
Current status and future plans

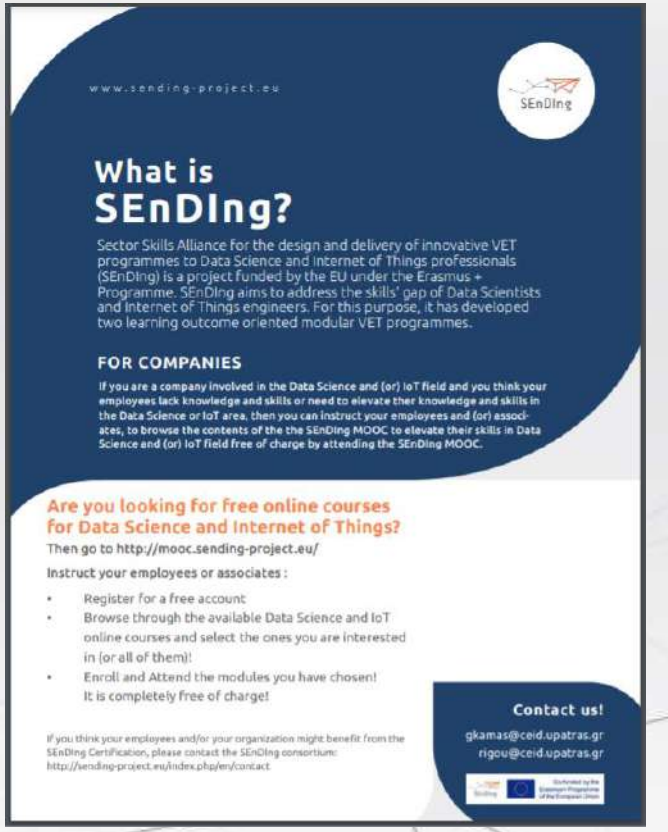
- 2 months to the finish line
- Finishing up the work-based learning (by the end of December)
- Upcoming task:
  - Certification of participants (3 rounds starting in mid Dec until the mid of Jan)
  - Work on a sustainability plan

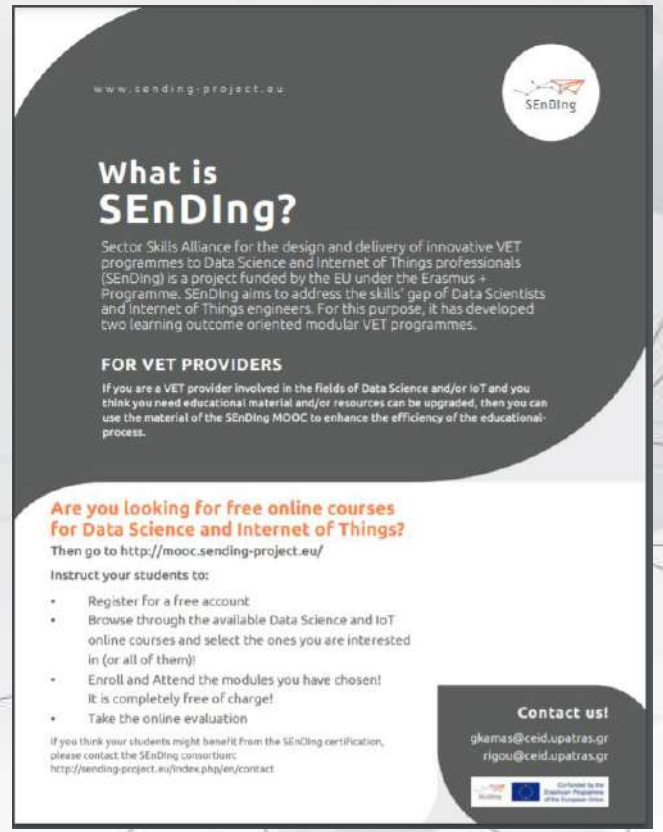
∞

- (In the long-run) support the online training component and potentially the certification scheme developed after the end of the project
- Foster the **sustainability** of the MOOC ideally by establishing an update mechanism
  - Open access to the MOOC and certification of attendance
  - offering flexibility through adequately tailored learning paths (according to professional roles in both DS and IoT)

Toolkits and teaser







Thank you!

For further information please contact

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or visit

The SEnDIng Project website at: http://sending-project.eu

The MOOC at: http://mooc.sending-project.eu/

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Annex 8

Defining learning outcomes for curriculum development in Data Science and IoT domains

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Defining learning outcomes for curriculum development in Data Science and IoT domains

Ivaylo Gueorguiev, Pavel Varbanov, George Sharkov, Christina Todorova

SEnDIng online conference
PCI 2020 Special Session “Education and training on Data Science and IoT”
21 November 2020

Ivaylo Gueorguiev & Pavel Varbanov
European Software Institute CEE

Defining learning outcomes as a part of the curriculum development process

Definition

"Learning outcomes statements help to clarify program and qualifications intentions and make it easier for those involved – learners, parents, teachers or assessors – to work towards these expectations" - CEDEFOP.

Key characteristic

- **Focus on the learner needs,** not on the teaching method.
- **Iterative process** but not one-way journey.
- **The simplicity is important!**
- Rather **generic and wide-ranging for the competence** than exhaustive or specific for any industry or market or use case.

Four-stage process ensured industry-centric Learning Outcomes

1. Verification of the Approach
2. Verification of the first draft of the Learning Outcomes
3. Validation of the Learning Outcomes and the Survey format with leading experts in DS and IoT
4. Validation of Learning Outcomes through a Survey and interviews with industry

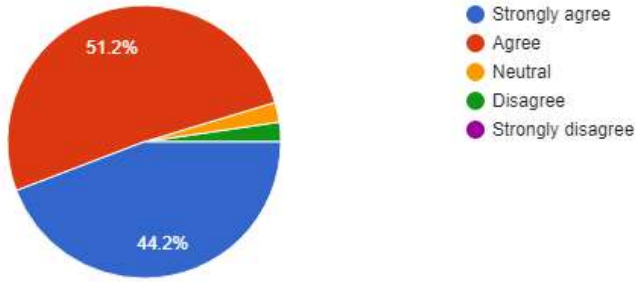
As part of levels 1 to level 3 of this process, we received, discussed and implemented **21 improvements** on the form and/or the content of the learning outcomes.

At Level 4 of the process, we obtained and analysed quantitative and qualitative data from 42 industry leaders companies/experts).

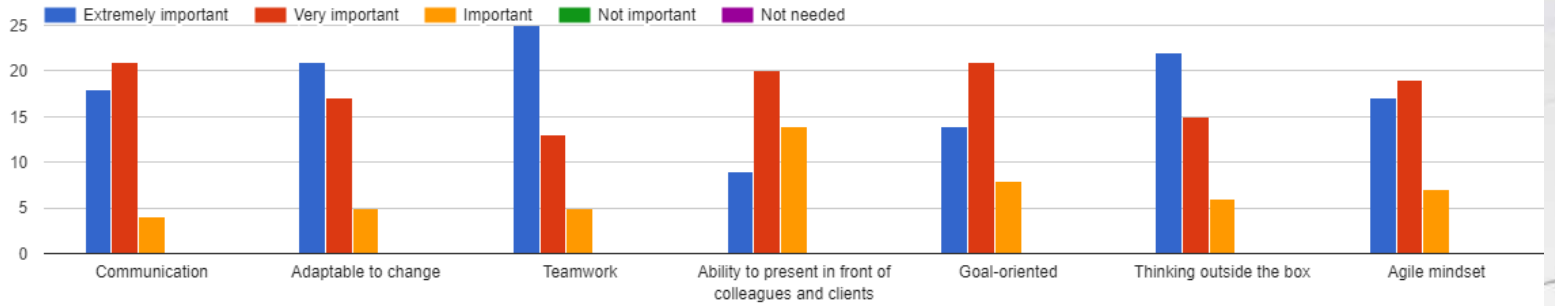
Sample Results

Do you agree with the following definition of IoT: "IoT is a system of distributed networks that facilitate the...controllers, computers, machines, etc."

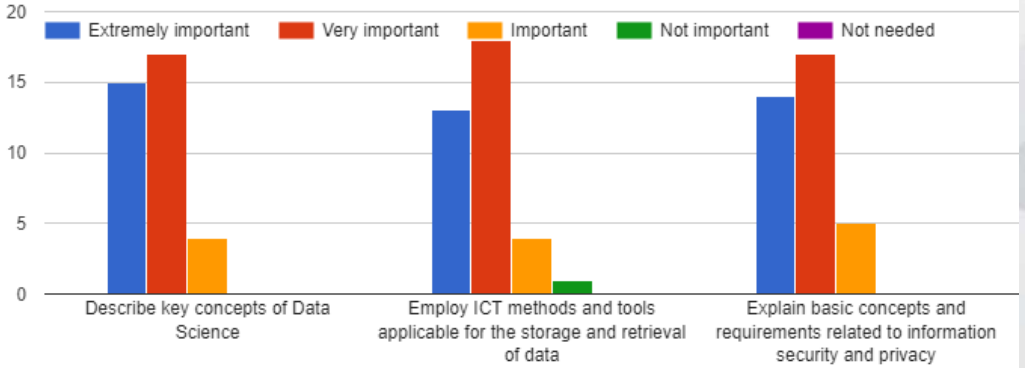
43 responses



Please, rate how important are the following SOFT SKILLS



Please, rate how important is the following Data Science KNOWLEDGE for the learners

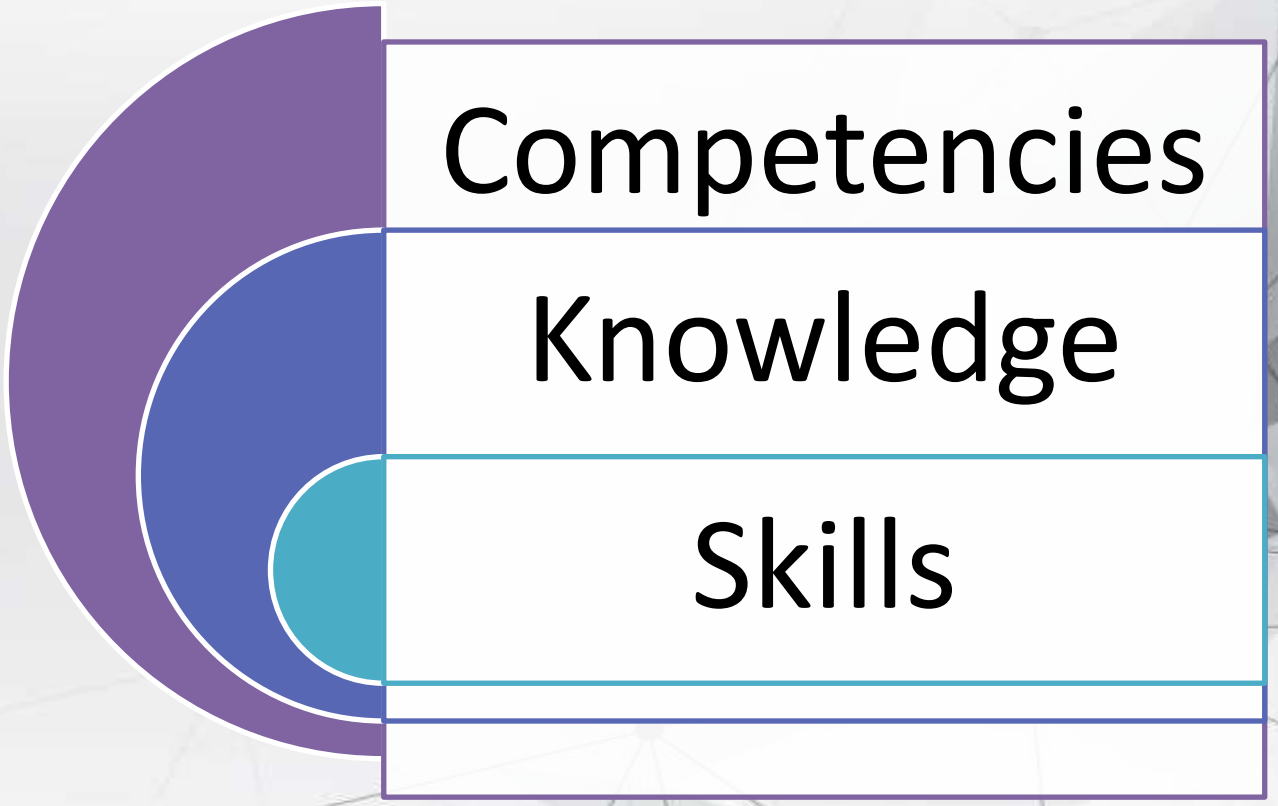


Competencies Level

- Exercise self-management within the guidelines of work or study contexts that are usually predictable, but still are a subject to change;

- Supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities;

Learning outcomes consist of:



Agreed IoT Definition

"IoT is a system of distributed networks that facilitate the communication and collaboration between various IT enabled objects (things) including but not limited to software systems and applications, sensors, controllers, computers, machines, etc."

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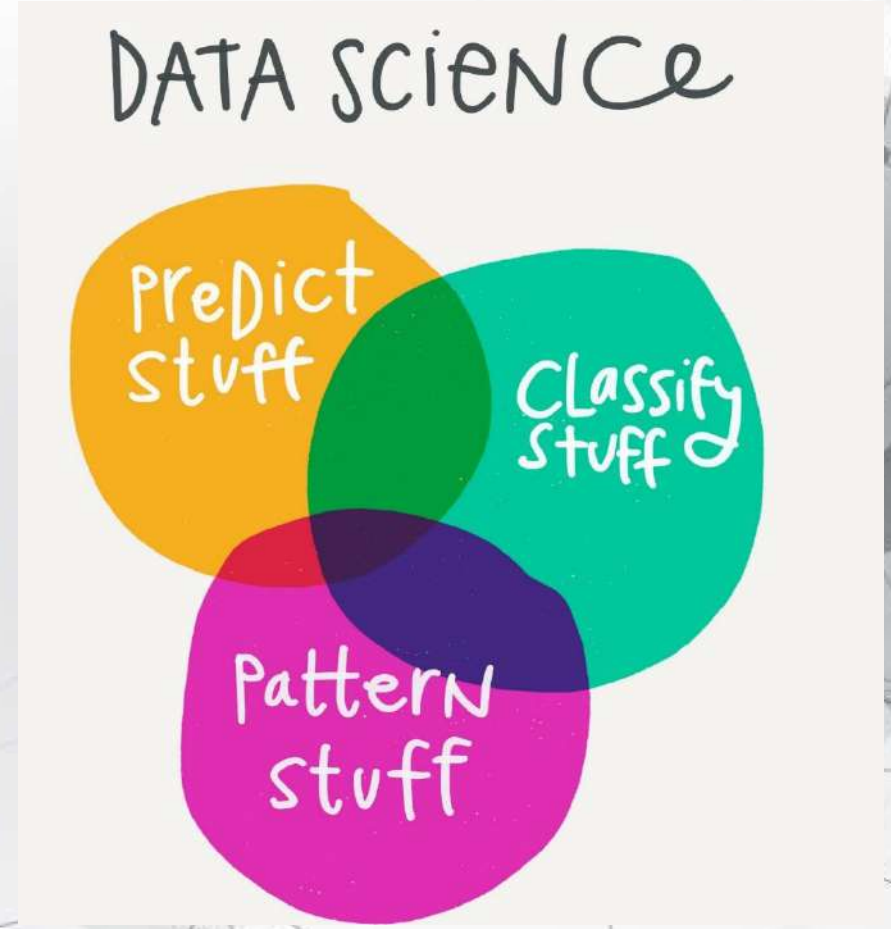
Agreed DS Definition

"A data scientist is a practitioner who has sufficient knowledge in the overlapping regimes of business needs, domain knowledge, analytical skills, and software and systems engineering to manage the end-to-end data processes in the data life cycle."



Key Competences in Terms of Soft Skills

- Communication skills;
- Adaptable to change;
- Team work;
- Ability to present;
- Goal-oriented;
- Thinking outside the box;
- Agile mind-set;

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IoT Knowledge

- Describe the value that IoT delivers in different business domains;
- Explain the business processes related to IoT in specific domains;
- Understand IoT architectures and the related network and communication protocols;
- Recognize different types of sensors, actuators, displays and related embedded electronics;
- Design the application level (e.g. use protocols that support different IoT applications) of IoT in the context of big data, cloud technologies and data science;
- Formulate requirements about IoT information security;

DS Knowledge

- Describe the key concepts of Data Science;
- Describe ICT methods and tools applicable for the storage and retrieval of data;
- Describe methods and tools applicable for the statistical analysis of data;
- Explain basic concepts and requirements related to information security and privacy (e.g. how to deal with people profiling in the context of GDPR);
- Describe business requirements;
- Describe different approaches and different problems, solvable through DS;
- Explain maths and statistical models;

Knowledge added by Industry respondents

IoT Skills

- Analyse, argue and describe the business value of a particular IoT system;
- Design an IoT system that includes sensors, controllers, actuators and displays, connected to a cloud platform through internet connection;
- Develop and deploy workflows and dashboards for an IoT system that includes sensors, controllers, actuators and displays, connected to a cloud platform through internet connection;
- Develop working code for an IoT system that includes sensors, controllers, actuators and displays, connected to a cloud platform through internet connection;
- Apply IoT information security concepts;
- Maintain continuous integration and verification;
- Develop network analysis;
- Operate IoT system;

Skills added by Industry respondents

DS Skills

- Analyse domain specific trends and present them as structured information;
- Create code to statistically analyse data;
- Apply data statistics and data visualization;
- Deploy simple machine learning techniques;
- Deploy data storage and retrieval techniques;
- Implement data models validation techniques;
- Ensure that IPR, security and privacy issues are respected;

Thank you!

For further information please contact

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Annex 9

Upskilling IT Professionals: A MOOC for the Data Science and IoT domains

SEnDIng

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Upskilling IT Professionals: A MOOC for the Data Science and IoT domains

Vasileios Gkamas, Maria Rigou, Alan Bruce, Teemu Patala.

SEnDIng online conference
PCI 2020 Special Session “Education and training on Data Science and IoT”
21 November 2020

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Introduction

- We present a MOOC for Data Science and IoT developed by the Erasmus+ project SEnDIng.
- The MOOC is based on interdisciplinary curricula combining technical knowledge and skills with transversal skills and competences.
- The SEnDIng project aims to address the Data Science and IoT skills gap of IT professionals, by providing them with knowledge, skills and competences that meet the needs of Data Science and IoT industries, are transferable and recognized among EU countries.

Pedagogical principles for MOOC design (1/2)

- **Match to the curriculum**: there must be clear objectives, relevance to the content covered, appropriateness of students' activities.
- **Inclusion**: inclusive practices should be seen in terms of different range of achievement, physical disabilities, different social and ethnic groups and gender.
- **Learner engagement**: learners should be engaged and motivated, activities should have a worthwhile educational aim, not just to occupy the learners, be enjoyable and improving the learning atmosphere.

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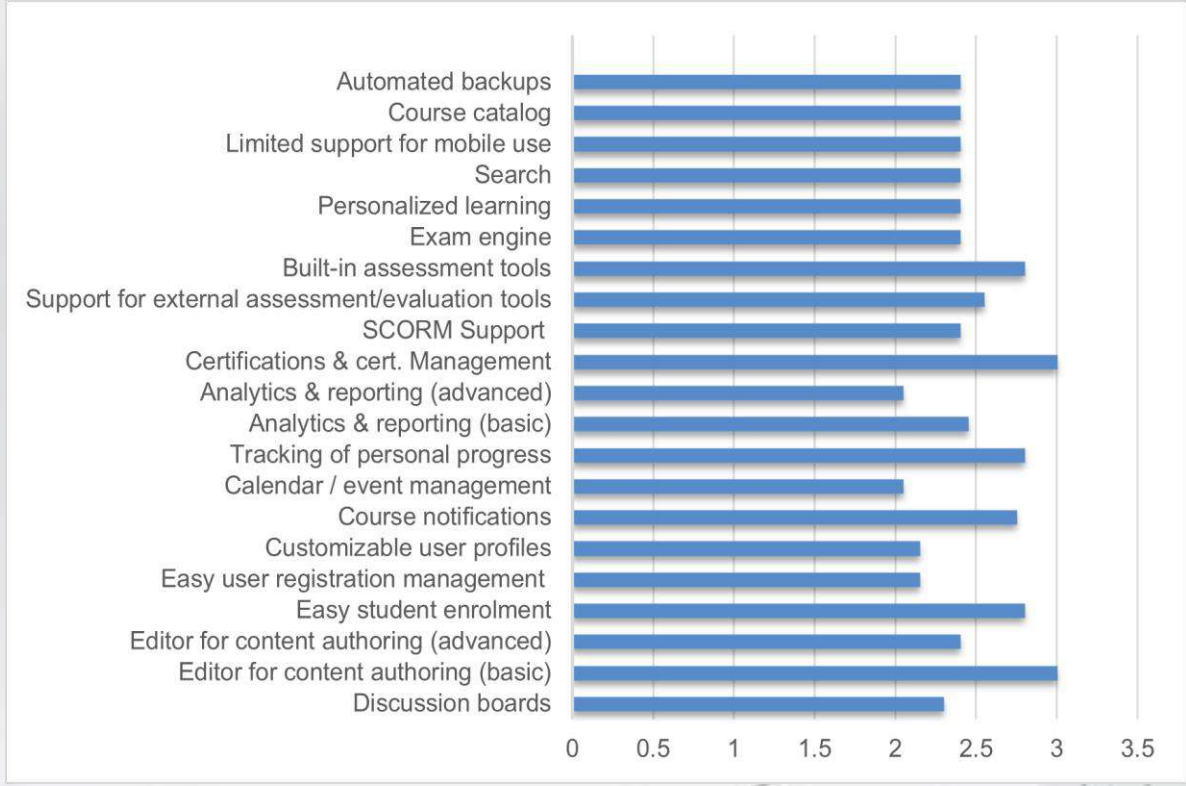
Pedagogical principles for MOOC design (2/2)

- **Effective learning**: promoting personalized learning, learners' autonomy, encouraging metacognitive thinking and collaboration.
- **Provision of formative and summative assessment**: This is essential for the purposes of improving and grading learners.
- **Consistency and transparency**: objectives, content, activities and assessment should match to each other.
- **Ease of use**: being open and accessible and not requiring special guidance on use.

MOOC features (1/2)

- We conducted a survey among SEnDIng project's partners to define the features of the MOOC.
- The weight of each feature takes 4 values: 0 (useless), 1 (nice to have), 2 (useful) and 3 (must have).
- The features were categorized into 4 categories based on the average score they got at the survey
  - Low importance: average score 0.00 – 0.99
  - Medium importance: average score 1.00 – 1.49
  - High importance: average score 1.50 – 1.99
  - Very high importance: average score: 2.00 – 3.00

MOOC specifications (2/2)



Features defined as having very high importance

Survey of MOOC solutions

- **Moodle**. It is the most popular and widely spread open source learning management system, which in principle, has all the required features, at least through extensive customization. It is a stable platform, but some users find the functions a bit unnatural. It is primary used as an LMS.
- **Open edX**. It has better usability features and exploits APIs which foster easier use. Open edX covers most of the required features, at least through add-ons and plugins. Open edX is more oriented as a MOOC environment, compared to Moodle which is more oriented as an LMS environment.
- **Sakai LMS.** It has limited functionalities compared to Open edX and Moodle and a rather limited community in Europe.
- **Cypher Learning NEO LMS.** Commercial LMS with strong features, visuality and clarity.

Open edX has been chosen as the platform for MOOC design

SEnDIng MOOC (1/2)

- Available at http://mooc.sending-project.eu/
- It aims to provide ICT professionals with knowledge and skills at the Data Science and Internet of Things domains + transversal skills.
- It contains
  - 6 Data Science courses
  - 6 Internet of Things courses.
  - 1 Transversal Skills course
- Currently +250 registered users at MOOC

SEnDIng MOOC (2/2)

- Each course, except the introductory courses at Data Science and IoT is divided at 3 learning units:
  - **Introduction**: Covers the most important aspects of the course
  - **Core**: Principles of the course are covered in adequate depth, so that the learner can discuss matters with other stakeholders and acquire additional knowledge when necessary
  - **Advanced**: Advanced aspects of the course are covered in sufficient detail so that the learner can apply the knowledge and skills on the job
- The training material is delivered in the form of text, figures and short videos embedded at each course
- Self-assessment quizzes are provided at the end of each learning unit
- Hands-on projects are provided at the end of each course
- The training material is also provided as OERs for downloading at the end of each course

Data Science online courses

Introduction to Data Science (DS-EM1)

Applied Machine Learning (DS-EM2)

Python for Data Science (DS-EM3)

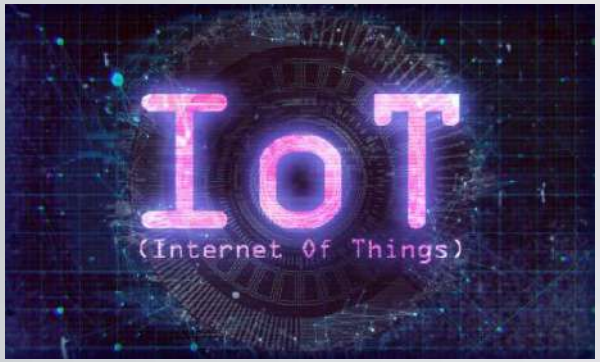
Storing and Retrieving data (DS-EM4)

Statistics for Data Science (DS-EM5)

Data Visualization (DS-EM6)

IoT online courses

Introduction to IoT (IoT-EM1)



Architectural Design and Applications in IoT (IoT-EM2)

IoT Communication Technologies (IoT-EM3)

IoT Security and Privacy (IoT-EM4)

IoT Devices (IoT-EM5)

IoT Business Value (IoT-EM6)

Transversal Skills online course

Effective communication and presentation (TS-EM1)

Change management (TS-EM2)

Team working (TS-EM3)

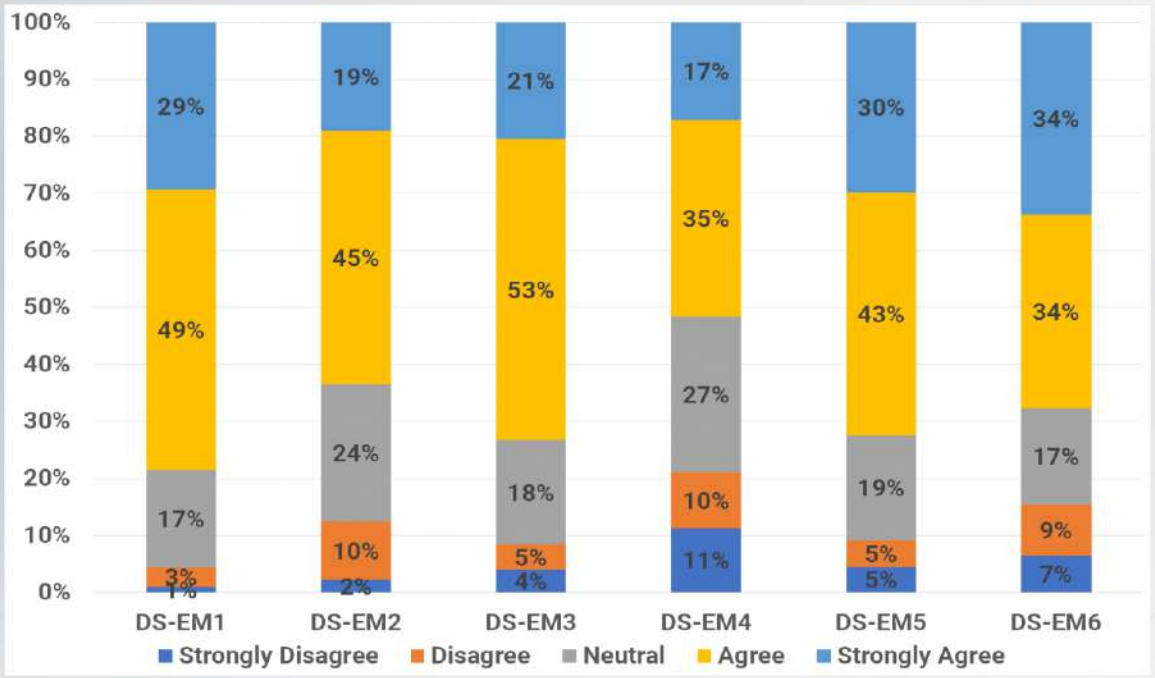
Goal setting (TS-EM4)

Creative thinking (TS-EM5)

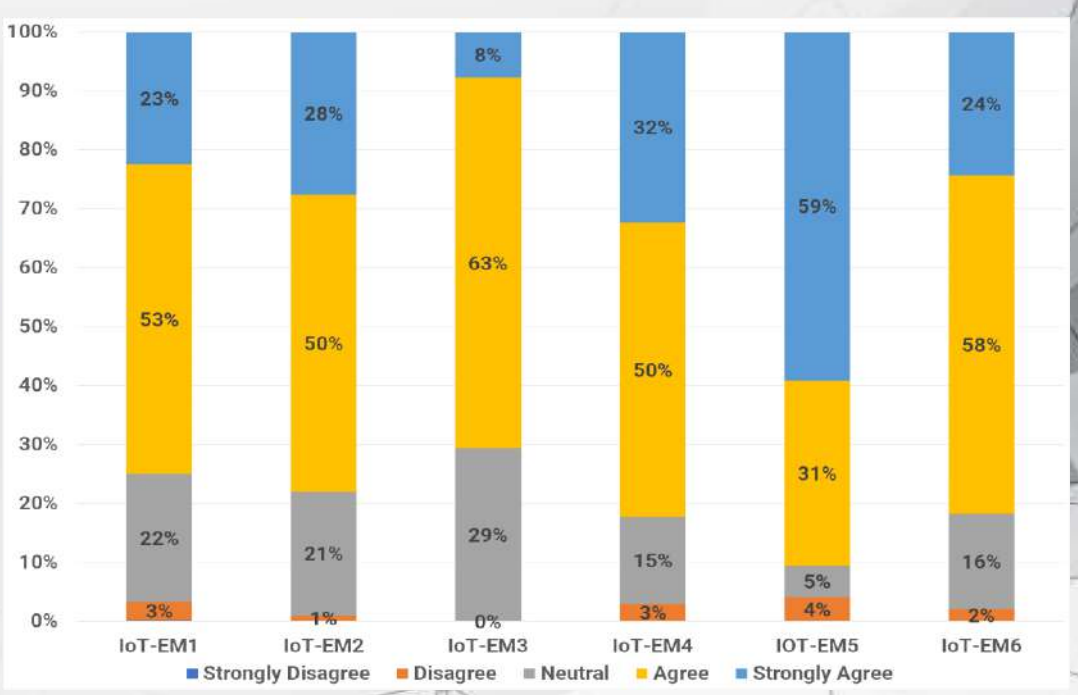
MOOC evaluation by trainees (1/2)

- The trainees have been asked to evaluate the following characteristics of each course at a scale ranging from 1 up to 5 (1: Strongly Disagree, 5: Strongly Agree)
  - I have enjoyed the course
  - This course was challenging
  - The course meets my expectations
  - The quality of the training material was high
  - The content was well organized and easy to follow
  - The course will be useful in my work
  - The objectives of the course were clearly defined
  - The time allocated for the course was reasonable
  - The course enhanced my knowledge of the subject matter
  - In this course, I have been challenged to learn more than I expected.

MOOC evaluation by trainees (2/2)



Evaluation of Data Science online courses



Evaluation of IoT online courses

Thank you!

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Annex 10

Training of ICT professionals in soft skills: the case of SEnDIng

SEnDIng

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Training of ICT professionals in soft skills: the case of SEnDIng

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Purpose of this paper

Presentation of the methodology followed for the design, development and delivery of a VET curriculum on soft skills for ICT Professionals, within the framework of SEnDIng

SEnDIng training in a nutshell

- 2 Curriculums
  - Data Science
  - Internet of Things
- Modular form of the curriculum
- 103 h online courses in Data Science or IoT
- **20 h online training in Soft skills**
- 320 hours of work based learning during 4 months

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Two main categories of skills for ICT Professionals

I. Technical Skills
   - necessary for hiring ICT professionals

II. Soft Skills
   - evaluated later in the frame of HR assessment
   - are linked to a strong performance level of professionalism

(Stal & Paliwoda-Pękosz, 2018)

Research has shown that….

- Specialists in the ICT sector possess well developed technical skills but they have skill gaps in soft skills (Szilárda, Benedek & Cioca, 2018)
- Senior executives in Adecco felt that 44% of their subordinates needed better soft skills (Georgetown University, 2020)
- Among 1,250 HR and line of business executives in the US, 98% of them declared hiring people for IT positions according to their soft skills while 66% of them had rejected IT professionals due to lack of soft skills (Zetlin, 2019)
- In over 25 million online job listings, one in four of the most sought-after skills among IT listings were soft skills (Burning Glass Technologies, 2015)

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But what kind of skills are “soft skills” eventually?

- Lack of consensus for a solid definition (EQAVET, 2015)
- Concern the interpersonal human and behavioural skills needed for the application of technical skills and knowledge in the workplace (Weber et al, 2009)
- Categorized by academics in 5 categories (De Villiers, 2010) :

  communication skills, problem-solving and thinking skills, leadership and team working skills, ethical and moral values, and self-management.
- EQAVET recognizes 3 categories (EQAVET, 2015):

  Communication skills, Interpersonal skills, Problem solving

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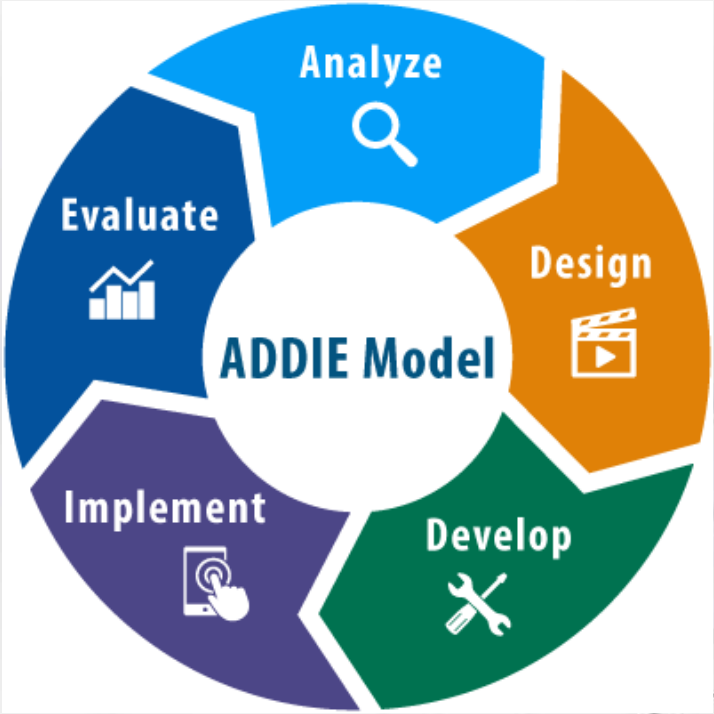
Within the framework of SEnDIng project a 20h training program on soft skills for IT professionals was designed, developed and delivered following the principles of ADDIE model

The ADDIE model

- Is an Instructional Systems Design (ISD) that “is being applied for performance-based learning” (Branch, 2009)
- provides VET curriculum designers with clearly defined, useful stages for developing effective educational products (Peterson, 2003)

The ADDIE model: phases



https://www.edapp.com/blog/the-addie-model/

a. Analyze (1/3)

The 1st phase of ADDIE provides:

- the basis for the definition of learning outcomes,
- the organization and formulation of training objectives,
- the selection of training content, training methods and evaluation in accordance to trainees' needs.

"Need" describes the **gap between current and desired** (or required) results or **the gap in results between what is and what should be**

(Kaufman, 1994; Swedish Civil Contingencies Agency (MSB), 2012; Iqbal & Khan, 2011)

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a. Analyze (2/3)

Training Needs Analysis (TNA):

- Is a process that identifies the learning gaps in compliance with standards or external requirements and that can be resolved wholly or partly by training (Goldstein, 1993)
- Its main purpose is the definition of the performance gap and it consists of surveillance, investigation, and data analysis.

SEnDIng TNA enabled:

a) The identification of the specific soft skills that IT professionals should have

b) The identification of the general content of the training, training methods and material

a. Analyze (3/3)

For a comprehensive TNA, the SEnDIng partnership conducted:

- desktop review of existing studies in IoT and DS formulating the scope of the training in the respective domains
- desktop review of good practices applied for the definition of learning outcomes in VET, including the domain of soft skills and how to apply them to the process of formulating the Learning outcomes of DS and IoT vocational training

The research revealed that (PricewaterhouseCoopers EU Services EEIG, 2017):

- the demand for the acquisition of specific soft skills for IT is growing rapidly
- IoT jobs in Europe will rely on specific human skills such as **creativity, problem-solving skills, design thinking, systems thinking and communications skills**.

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b. Design (1/6)

The main objective of this step is to identify what it should be accomplished and how the learning outcomes (LO) will be defined.

Learning Outcomes are

- statements of what an individual should know, understand and/or be able to do at the end of a learning process" (EP, 2008)
- commonly used to: define the levels of qualifications frameworks, set qualification standards, describe programs and courses, orient curricula and define assessment specifications.
- influencing teaching methods, learning environments and assessment practices (CEDEFOP, 2017)

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b. Design (2/6)

In SEnDIng, the desirable LOs of soft skills for IoT and DS professionals were developed based on the TNA that:

a) Complied with the pedagogies applied in VET and adult education and

b) Involved all the relevant stakeholders in the process (companies that represent the industry's demand for IoT and DS, qualified employees, learners, educators and VET providers, policymakers and other stakeholders)

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b. Design (3/6)

For defining LOs in practical terms:

- desktop research on the state of art in DS and IoT was carried out, to extract the most relevant to the project objectives and indicative topics and definitions
- the definitions were discussed with specialists in both domains and disseminated among DS and IoT companies and organizations in Bulgaria, Greece, Cyprus and other countries
- a validation procedure was established with the industry through comprehensive review implementing direct meetings with domain leaders and a survey among more than 40 organizations

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b. Design (4/6)

The Validation procedure consisted of the following levels:

- **Level 1: Verification of the Approach** among partners.
- **Level 2: Verification of the first draft of the LOs** by project partners.
- **Level 3: Validation of the LOs and the survey's format** in collaboration with leading experts in DS and IoT domains aiming to a) assess the potential value (usefulness) for the companies that would employ IoT and DS professionals and b) improve the format and content of the survey's questionnaires.
- **Level 4: Validation of LOs through an online survey** where quantitative and qualitative data from more than 40 respondents were received and analyzed

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b. Design (5/6)

The proposed LOs related on soft skills were common for both IoT and DS sectors:

- communication,
- adaptability to change,
- teamwork,
- ability to present in front of colleagues and clients,
- goal orientation,
- thinking outside of the box,
- and agile mindset.

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b. Design (6/6)

The received data validated the defined skills and knowledge.

- 36 responses for **DS** learning outcomes were received, where the proposed soft skills were evaluated as extremely important and very important, by 74%-93% of the respondents
- 43 responses for **IoT** learning outcomes were also received, where the proposed soft skills, with one exception, were also evaluated as extremely important and very important by 81%-90% of the respondents. The only exception was the ability to present in front of colleagues and clients, which was evaluated as extremely important or very important by 67% of the respondents

c. Develop (1/2)

The methodology applied was combined with the constructive alignment approach for maximizing the conditions for quality learning throughout the process (Bloomberg, 2009)

The main pillars of the theoretical background for the SEnDIng training methodology were:

a) the constructivist approach,

b) the principles of adult education,

c) the principles of soft skills training,

d) the principles of e-learning and

e) the principles of work-based learning

c. Develop (2/2)

5 Training Units:

Effective communication and presentation (TS-EM1), Change management (TS-EM2), Team working (TS-EM3), Goal setting (TS-EM4) and Creative thinking (TS-EM5)

The structure of each training unit includes the following elements:

- Objectives,
- Learning Outcomes,
- Content,
- Learning Methodologies
- Assessment of methodologies
- Duration

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d. Implement (1/2)

Due to Coronavirus pandemic, the delivery of the soft skills training had to be redesigned in terms of:

- **Method of delivery** - the training program was revised to be conducted online (synchronous) using zoom
- **Modification of self-assessment and further activities**
- **Time of the interventions** - the deadline of the training completion had to be extended
- **The number of participants** - in the online delivery, there was a decrease in the number of attendants so as the groups of learners to be more manageable
- **Number of courses**

d. Implement (2/2)

The components that remained the same and /or had minor adjustments were:

- **Training material** - it was adjusted to the online environment with minimum changes
- **Training methods and techniques** - selected so as to promote experiential, collaborative, active, transformational and self-directed learning; to cater for different learning styles when used in combination; to be differentiated according to the type of learning activity.

  The most frequently used techniques were: brainstorming, case studies, questions, reflections, group discussions, lectures, action plan, group activities, memory activation, working in teams and self-assessment

e. Evaluate (1/5)

Evaluation

- is the systematic process of delineating, obtaining, reporting, and applying descriptive and judgmental information about some object's merit, worth, significance and/or equity (Stufflebeam & Shinkfield, 2007)
- in case of training, it means measure its effectiveness focusing on learning, teaching, outcomes and providing information for improving the learning and teaching process (Academia edu, nd).

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e. Evaluate (2/5)

Within SEnDIng a holistic evaluation procedure is being followed based on:

Formative Assessment

- refers to an evaluation that aims at improving the internal function of the training program and its expected results (Noe, 1999)
- is conducted during the development and the implementation of a program, or intervention and its main purpose is its continuous improvement (Eseryel, 2002; Madaus et al.,2000; Stufflebeam & Shinkfield, 2007;Guerra-Lopez, 2008)

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e. Evaluate (3/5)

Summative Assessment

- is about an assessment undertaken to get a summary judgment on certain critical aspects of a program's performance; for instance to determine if specific goals and objectives are met (Rossi, Lipsey & Freeman, 2004)

Self-Assessment

- is relatively autonomous and deliberate engagement in reviewing and critiquing one's work in an appraisal of progress made over some time (Tillema, 2010)
- is essential since learners can achieve their learning goals if they understand it and can assess what they can do to reach it.

e. Evaluate (4/5)

Within SEnDIng

Formative and Self-Assessment - take place throughout the phase of soft skills training. Tools used: case studies, presentations, peer-evaluation, checklists and portfolio.

Summative Assessment - will be carried out in two ways:

a) the results of the ongoing (formative) assessment are collected in the personal file of each learner, so that the individual learner profile is constructed

b) after the completion of each of the training phases learners will be asked to demonstrate how they will be able to combine and integrate multiple aspects of training in complex situations and also to pass a final test leading to certification

The combination of cumulative assessment and final tasks compiles the final assessment of each learner.

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e. Evaluate (5/5)

The measurement of other aspects of training are employed such as:

- the rate of successful completion,
- the attendance rate,
- the rate of trainees that abandon training

Additional tools for the monitoring of the soft skills training process are observations, checklists, analysis of attendance and complementary data, questionnaires.

Over 100 IT professionals participated in the training with the dropout rate being especially high due to the COVID-19 pandemic

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Conclusion

Advantages of adopting ADDIE for the development of IT professionals' soft skills:

a) the well-designed and clear structure that enhances the training program development,

b) the ability to be applied in multiple forms of learning types (online, face-to-face, work-based learning, blended),

c) the possibility for continuous assessment of the training programs components (objectives, results) that facilitates further improvements,

d) the comprehensive design that fosters learners motivation and engagement.

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