RoboVet4All

National Report – United Kingdom

Co-funded by the Erasmus+ programme of the European Union.

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Introduction

Description of the Project

RoboVet pioneers to design a COMPLETE TOOL KIT and an EDUCATIONAL PACK for developing, implementing and monitoring various INCLUSIVE strategies for promoting coding and robotics skills in VET schools aiming to bridge the digital gap based on the creation of PARTNERSHIPS/SYNERGIES between the schools, stakeholders and the labour market (policy maker, ICT experts, providers and enterprises)by:

- Utilising the non-working school time (i.e. after school, summertime, afternoon) available in a constructive way to set up ROBOVET LABORATORIES thus ensuring access and participation.
- Creating SYNERGIES between VET schools and the business world in order to bridge the skills-gap between education and the labour market.
- Introducing the OPEN BADGES as a method to VALIDATE and AWARD the coding skills acquired by both the VET students and trainers thus achieving transferability, credibility and transparency.
- Creating transnational cooperation between partners for the organisation of ROBOVET COMPETITIONS, events, KA1 mobility etc thus ensuring sustainability and exploitation of products and results.

Based on the above the DIRECT TARGET GROUP is VET students in need who will learn how to code, whereas an INDIRECT TARGET GROUP is VET trainers, whose profiles will be upgraded and strengthened.

(See Appendix 1 for Aims and Goals of the project)

Importance of the project in the UK

The UK is one of the few countries in the EU with a comprehensive computing curriculum covering compulsory education from the age of 5. It was introduced into schools in September 2014. The UK Cyber Security Strategy, published in November 2016, also outlines that cyber security will be embedded in the school curriculum where needed.

The UK is strengthening its vocational education and training system. It has created new degree apprenticeships, including for digital, and in April 2017 introduced a new apprenticeship levy.22 The Ada National College for Digital Skills provides BTEC courses in digital for upper secondary students and digital apprenticeships for students of 19+. New curricula for 15 technical education routes are being developed.

The UK is taking active steps to address its digital skills gaps. Its new comprehensive digital skills and inclusion strategy and measures taken in support of it should build on its previous efforts and help close these gaps. However, it will become evident from this report that this is not enough and more has to be done to attract attract a younger audience to become interested in computer science.

Connection between UK situation and EU

The 2016 Council Resolution on ‘A New Skills Agenda for an Inclusive and Competitive Europe’ reflects a common vision about the role of skills for jobs, growth and competitiveness. Skills can help to secure jobs and enable people to fulfil their potential. They are the key to social cohesion, they ensure access, participation and social inclusion. People need a broad set of skills to fulfil their potential both at work and in society.

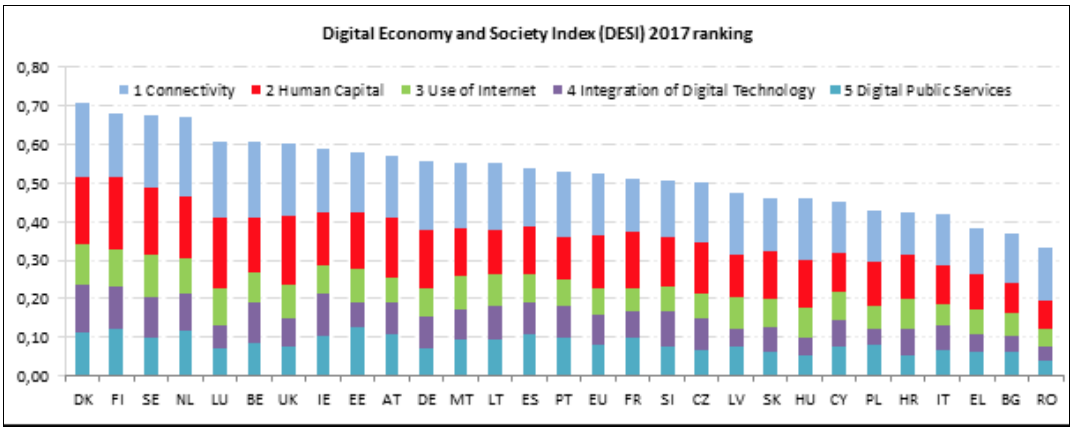
At the same time, 40% of European employers have difficulty finding people with the skills they need to grow and innovate. VET is valued for fostering job-specific and transversal skills, facilitating the transition into employment and maintaining and updating the skills of the workforce according to sectoral, regional and local needs. The 2016 ‘Digital Skills and Jobs Coalition’ reinforces the need of all to help meet the high demand for digital skills in Europe which are essential in today's job market and society.

Europe is lacking digitally skilled people to fill job vacancies in all sectors, missing out on up to 750,000 Information and Communication Technologies (ICT) professional jobs by 2020. Yet unemployment among young people of 15-24 year olds is at almost 20% in the EU.

Computer science skills are increasingly required in many different fields, not only in ICT jobs. Programming and computational thinking skills are becoming ever more important in our society and working life. So far schools have been using ICT to focus purely on computer literacy. There is nowadays an ever growing need to teach students computer science and digital literacy: teaching them how to code, and how to create their own programs; not just how to work a computer, but how a computer works and how to make it work for you.

Demands of the labour market

The Digital Economy and Society Index (DEIS) ranks the UK 7th in Europe to have the most advanced digital economies, after Denmark, Finland, Sweden, Netherlands and Luxembourg.



While its ranking decreased somewhat over 2016, its score increased due to an improved performance in all domains. In particular, important improvements have been made in NGA subscriptions (Connectivity), internet use (Human Capital), and Open Data (Digital Public Services). Conversely, use of Electronic Information Sharing, RFID and eInvoices (Integration of Digital Technologies) remains very low.

UK citizens are well connected: broadband coverage and take-up (fixed and mobile). Most UK citizens are now online and make good use of a variety of online services, particularly for shopping, accessing online entertainment and for social networking.

	United Kingdom					EU
	DESI 2017			DESI 2016		DESI 2017
	value		rank	value	rank	value
2a1 Internet Users % individuals	**93%** 2016	↑	**3**	**90%** 2015	**5**	**79%** 2016
2a2 At Least Basic Digital Skills % individuals	**69%** 2016	↑	**5**	**67%** 2015	**6**	**56%** 2016
2b1 ICT Specialists[16] % of employed individuals	**5.0%** 2015	↑	**3**	**4.8%** 2014	**5**	**3.5%** 2015
2b2 STEM Graduates Per 1000 individuals (aged 20-29)	**23** 2014	→	**3**	**23** 2013	**1**	**19** 2014

In Human Capital, the United Kingdom performs very well but its recent progress has been rather limited. A large proportion of the UK population uses the internet regularly (93% - at least once a week); most people do so daily; and only 4% of the population has never used the internet. These figures are well above the averages for the European Union, 79% and 14%, respectively. Nevertheless, the UK faces some digital skills gaps. In terms of basic digital skills, the UK performs above average in the European Union: 69 % of the population had at least basic digital skills in 2016; the EU average was 56%. However, as such, almost a third of the population does not have basic digital skills.

Shortage of ICT professionals

The UK suffers from a lack of ICT professionals according to the EDPR country report and we are not keeping up with the demand and graduates in Computer Science have steadily declined from 30,520 in 2011/12 to 26,415 for 2015/1617.

There is also a gender divide, with very few women choosing to study ICT and only 19% of Computer science graduated being female. This is prominent in many other EU countries, but the EU is particularly affected. At around 1.5 million, the UK employs the largest number of ICT professionals in the European Union, accounting for around 5% of UK employment.

Which sectors need personnel that possesses skills in ITC and robotics?

The advance of robotics and 3D printing is boosting the demand for highly-skilled, IT literate workers in the UK's advanced manufacturing sector, according to a new study by the government's skills experts the UK Commission for Employment and Skills.

The global advanced manufacturing market is predicted to double in size to £750 billion by 2020, largely driven by developments in new technologies. But the UKCES report 'Skills and performance challenges in the advanced manufacturing sector' warns that the advances achieved through automation are at risk if the right people with the right skills are not available to support them.

The sector is already experiencing difficulties in recruiting the right people – with employers in this sector nearly twice as likely to report a hard to fill vacancy than in the economy as a whole.

Dr Vicki Belt, Assistant Director at UKCES said:

> *"There is a real demand for highly IT literate production managers and production directors with strong technical and business skills. These are the people managing the machines. They are responsible for maximising the production processes and quality assurance of outputs from robotics and 3D printers. It's all about a balance of experience, knowledge, and softer skills."*

IT skills, understanding of complex materials and the ability to translate digital design into real-world production are set to be some of the most important skills for those working in advanced manufacturing sectors – from assembly workers to production engineers. In particular, quality assurance is becoming a key skill, and one that is holding back advances in this sector.

(Gov.UK, 2015)

Current Digital curriculum in the UK

Before we look into the ICT curriculum of the UK, it is important to note that England and Scotland's curriculums differ. England follow 'General certificate of secondary education (GCSE)' and Scotland 'Curriculum for Excellence (CfE)'. Even before the creation of the Scottish Parliament, education in Scotland was run separately from education south of the border. Indeed the fact Scotland had its own distinct system was often a source of national pride.

The national curriculum was never introduced in Scotland when it was introduced in England by the Thatcher government. But since devolution in 1999, the differences between the Scottish and English school systems have widened and the direction of travel is currently different.

ICT curriculum in England

AQA (2018) provides evidence of what a student will learn in regards to ICT through GCSEs. They note:

Students learn:

- what ideas and resources are needed to create the latest technologies, by exploring companies such as Apple or Google
- how people and organisations solve problems using ICT tools and techniques
- by exploring a variety of technologies that interest them, from communication tools, like Facebook and the Internet to tools predicting natural disasters, such as earthquakes and tsunamis
- how to investigate the impact which ICT has on society and develop transferable skills such as problem solving and thinking logically and critically.
- Our new engaging content and interactive activities ensures your students will enjoy learning ICT and achieving their qualification.

Teacher support includes:

- schemes of work
- question papers and mark schemes
- candidate booklets
- teachers notes
- enhanced results analysis.

In 2014, the curriculum in England was changed from an 'ICT' curriculum to a 'Computing' curriculum. However, evidence from teachers themselves shows that, 'not much has changed in the past two years and there remains very little support from the top down' (edtechnology, 2016). This in itself, is evidence that work needs to be done to the curriculum and teachers feel unsupported in their efforts to improve this.

In reality, budget cuts in education means reducing IT spend while implementing a more sophisticated and costly curriculum with skilled teachers in short supply and demanding higher salaries. Added to this, there is a lack of adequate training and resources. Taking a teacher out of the classroom for training can cost as much as £600 per day and schools simply don’t have the budget. Considering these factors, it’s not

surprising that we have yet to see great results from the new Computing curriculum.

Sarah Leanord, an ICT teacher comments:

“From a staff perspective, we’re starting to see more people entering teaching, with computing skills such as coding and programming. They haven’t been taught these at school, but have picked it up themselves in response to an increasing demand for skilled people to enter into jobs in this specialism. From a student perspective, we have pupils that are more talented than we (and they) first knew! They’re often coming to us with ideas. Many of our students are picking up computing very quickly and this has shown us how much interest and potential talent there is among young people for the sector.”

"Children are being forced to learn how to use applications, rather than to make them. They are becoming slaves to the user interface and are totally bored by it," (BBC News, 2012).

A teacher from a school in England provides evidence that, because electronic devices have become such a huge part of young peoples lives, they can be taught basic computer skills much faster than they could before. Therefore, schools have found it hard to adapt to this ever growing, rapid change, stating "The current lessons are essentially irrelevant to today's generation of children who can learn PowerPoint in a week." meaning the curriculum is no longer relevant and there is not enough outcomes. He mentions that these students need to interact and build things, not just 'learn how to use applications'. He feels that Computer science must be taught with a focus on coding and web design.

The lack of teachers that are able to teach a new curriculum for computer science course was mentioned which could be an issue that we face as a consortium. However, pulling our resources together and developing an innovative and creative Educational Pack is sure to gather interest from VET providers, as well as teachers and educational decision makers.

It can be concluded that kids are interested in learning new, challenging skills and although there is a lot of work to be done to the current teaching curriculum, there is certainly a gap in the market for a new training course out with schools to teach this.

See here for curriculum: https://www.gov.uk/government/publications/national-curriculum-in-england-computing-programmes-of-study

ICT curriculum in Scotland

Parentzone Scotland (2018) provides evidence of what a student will learn in regards to ICT through CfE. They note:

“Learning in technologies will allow your child to develop skills, knowledge, understanding and attributes through creative, practical and work-related activities across a range of areas. They will be able to use these skills in business, computing science, digital literacy, food, textiles, craft, design, engineering, and graphics.

Within technologies your child will develop and demonstrate:

- knowledge and understanding of the big ideas and concepts of the technologies
- curiosity, exploration and problem solving skills
- planning and organisational skills in a range of contexts
- creativity and innovation
- skills in using tools, equipment, software, graphic media and materials
- skills in collaborating, leading and interacting with others
- critical thinking through exploration and discovery within a range of learning contexts
- discussion and debate
- searching and retrieving information to inform thinking
- making connections between specialist skills developed within learning and skills for the world of work
- evaluating products, systems and services
- presentation and communication skills
- an awareness of sustainability”

Digital technology is already embedded within Scottish education but does not follow the same curriculum as England.

It has a place within Curriculum for Excellence, Initial Teacher Education and the Professional Standards set by the General Teaching Council for Scotland (GTCS). Despite the pervasive nature of digital technology, its benefits are not always fully felt within the education establishments.

Therefore, a new strategy was implemented in 2016 to improve the current situation by creating the conditions to allow all of Scotland’s educators, learners and parents to take full advantage of the opportunities offered by digital technology in order to raise attainment, ambition and opportunities for all (Gov.scot, 2016).

Research shows however, that Scotland's CfE curriculum is not as advanced as England's GCSE's, therefore, we should use England as an analysis for improvement of our RoboVet project.

Questionnaire

CIVIC as part of the survey based analysis sent numerous emails to schools around the UK asking teachers and students to fill out our two separate questionnaires, to gain an understanding of:

- their experience in certain subjects
- facilities available in their schools
- how/if coding and robotics is taught and how
- If there is a demand for this

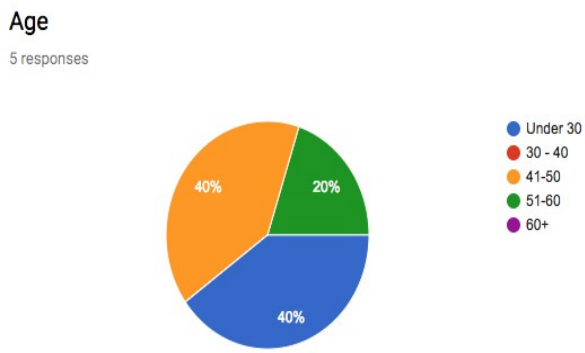
The questionnaire distribution resulted in the collection of 5 answered questionnaires from teachers and 6 from students.

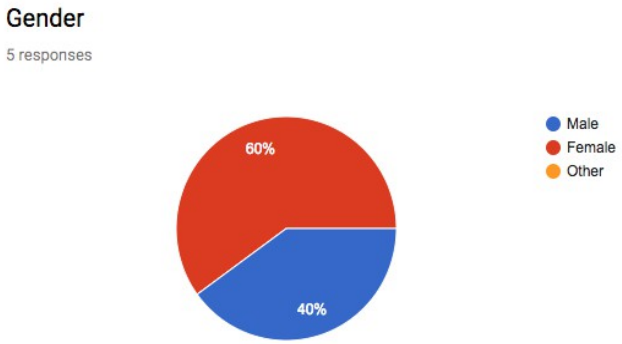
Results for Teachers

Link to survey results - https://docs.google.com/forms/d/1uYSk_d30BwHm4TlpXcDvMsFGHvD6qRnG3qLl96iPSzc/edit#responses

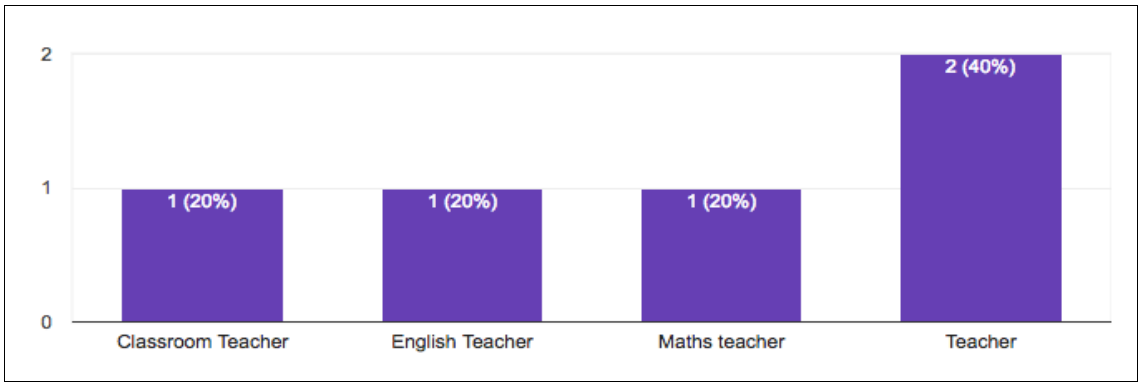
Background Information

The demographics analysis revealed that 60% of the teachers that took this survey were female and 40% were male. 40% of these participants were under 30 and a further 40% were aged 41 to 50, leaving the final 20% aged 51 to 60.





4 out of the 5 teachers taught at upper secondary school and one teacher taught at a primary school. These teachers consisted of:



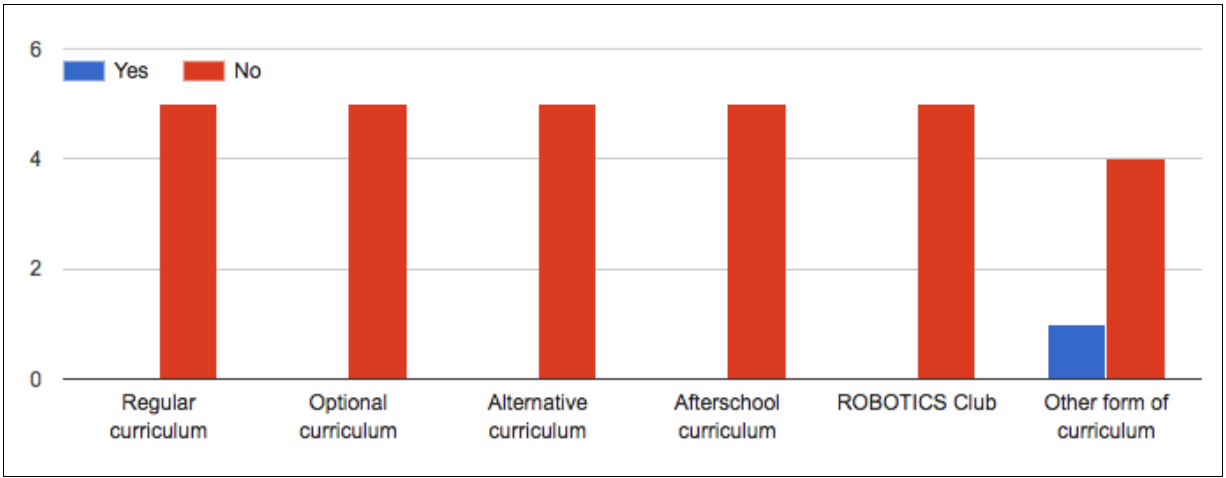
Experience

When asked about their level of confidence in the following classes, Mathematics scored well with 3 teachers noting their experience was good, 1 very good and another excellent. There were mixed scores for Physics, Electronics and ICT, however, 4 out of 5 teachers said they had poor experience in coding and only one noted their experience was good and no teacher had experience teaching robotics.

Facilities

It was noted that all teachers had computers for teachers and students and access to internet, as well as an internal network for computers. 4 out of 5 teachers has a laboratory for physics and ICT, but none had a laboratory for mechanics, electronics or robotics.

Robotics curriculum



It is very clear that Robotics is not something currently taught in UK schools, with one person stating that they learn Robotics in another form of curriculum, but did not state where this was. When asked about training programmes for robotics, all 5 teachers stated that there is no training in their school.

When asked about the training of coding skills, 2 teachers stated that they teacher Elements of office automation: Text Processing, Spreadsheets, Data bases, Presentations and one teacher noted that some

students participate in training for General cpd on software packages.

Training needs identification

It can be identified that teachers though there was a higher need for programming languages, programming methods and internet and networks to be taught at school, with 3 out of 5 teachers noting there is an interest for this. Databases were also noted as an area of interest in schools in the UK.

Training needs for Robotic skills

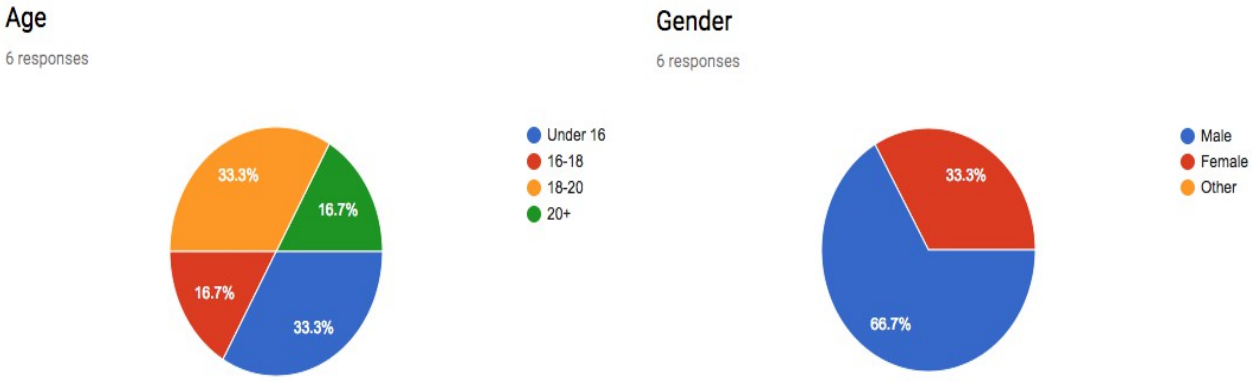
This survey shows that 3 out of the 5 teachers noted that there as a very high need and interest for robotics training in all aspects. 2 out of the 5 stated that there was some need.

Results for Students

Link to Survey results - https://docs.google.com/forms/d/10hoMANBJ-vEIyZNprROUWY_e-SYKdMMHdquiwEUTXSw/edit#responses

Background Information

The demographics analysis revealed that 66.7% of the students that took this survey were male and 33.3% were female. 33.3% were under 16, 16.7 were 16 – 18, 33.3% were 18 – 20 and finally 16.7% were 20+.



33.3% were in lower secondary and another 33.3% were in upper secondary, with the rest attending college.

Experience

When asked about their level of confidence in the following classes, Mathematics and ICT scored well. Physics, mechanics and electronics came close behind with 2 out of 5 stating their experience was very good and one stating it was good. It was very apparent, however, that schools in the UK do not have laboratories for mechanics, electronics or robotics within schools

Training of coding skills

It was noted that 4 out of the 6 students had experience in Databases and 3 out of 6 had experience in algorithms, programming language, programming tools and operating systems. However, 5 out of 6 had no experience in the theory of graphs or web programming and no participants had experience in tools automation.

Needs identification

4 out of 6 participants said they would be interested in learning about Internet and networks and 3 out of 6 said they would be interested in learning about Dynamic memory allocation, general architecture of computer systems and operating systems. 2 out of 6 said they would be very interested in learning about programming languages and methods. It also seems that there is a need for other types of training.

Training of robotics skills

One out of 6 participants has experience in robot's control and command algorithms. For every other robotic skill, participants had no experience.

Needs identification

Only one participant said that there is a low demand for robotics training, everyone other participant though

there was a need for it and 3 out of 6 said there was a high demand, with one person noting 'it would be fun to be able to build a robot'.

Summary

It can be concluded that from investigative research as well as the questionnaire, there is a real need for the development of a course that will teach students about robotics in the UK because there is an interest in this subject, but it is not commonly taught.

Difficulties we may face is the lack of knowledge about coding amongst teachers in schools, as well as the lack of facility space.

Appendices

Appendix 1 - Aims and Goals

"*Everybody should learn how to program because it teaches you how to think...*" Steve Jobs

There is nowadays an ever growing need to teach students computer science: teach them how to code, and how to create their own programs.

Based on the above the project promotes the following priorities of the Erasmus+ Programme:

- To promote the acquisition and achievement of skills and competences, such as basic, soft, digital and language skills through effective and innovative teaching and assessment. (Hor)
- To promote social inclusion through innovative integrated approaches -inclusion, diversity, equality, gender-balance and non-discrimination in VET also combating discrimination, segregation, racism, bullying and violence (Hor)
- To enhance the access, participation and learning performance of disadvantaged learners, reducing disparities in learning outcomes (Hor)
- To further strengthen key competences in VET, including common methodologies for introducing those competences in curricula, as well as for acquiring, delivering and assessing the learning outcomes of those curricula.(Spec)
- Introducing systematic approaches to, and opportunities for, the continuous professional development of VET teachers by developing effective open and innovative education through the use of ICT. (Spec).
- Developing VET business partnerships aimed at promoting work-based learning in all its forms, by involving social partners, companies and VET providers (Spec)
- To strengthen the profile(s) of the teaching professions, including teachers, school leaders and teacher educators, through supporting teachers in adopting collaborative and innovative practices and in dealing with diversity in the classroom through the development of a targeted. (hor)
- To promote open and innovative methods and pedagogies, participatory governance where appropriate, develop learning materials and tools as well as actions that support the effective use of ICTs in VET. (Hor)
- To promote recognition as well as transparency and comparability of learning outcomes and to promote innovative solutions for the recognition and supporting the validation. (Hor)

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