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JOBS4TECH

VIRTUAL REALITY INTEGRATED ITINERARY

O1 Joint Results Report

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1 Introduction

The general objective of JOBS4TECH is to align Vocational Training (VET) with the needs of the labour market in the new technologies sector, specifically in virtual reality, and the necessary soft skills to improve the employability of its students.

The ultimate goal of this report is to show and share the results of an analysis that has been carried out by each partner country as a first step towards developing the **integrated itinerary**. This itinerary integrates all the technical knowledge and abilities, together with the main skills required for the VR/AR sector and is aimed to students of different degrees in VET centers. Data has been collected on which are the most demanded skills in the ICT sector and on the professional families and subjects where technical training in VR and employment skills can be implemented.

Through a previous analysis it has been detected that the education sector at European level requires the integration of new technical content in the field of new technologies and cross-disciplinary skills or "soft" skills, as a response to the demands of the market of new technologies. For this reason, this proposal comes up with a consortium of partners at European level in the field of vocational training from different sectors that complement each other under the same objective of promoting employability in terms of vocational training and education, new technologies, and social inclusion.

ICT has become the foundation of every sector in every economy. Therefore, we are addressing not only the ICT field, but also sectors affected and working with strongly implementation of ICT tools and contents; since ICT

- Improves productivity.
- Offers immediate connectivity, and improves efficiency, transparency and accuracy.
- Substitutes for other more expensive means of communication and transacting.
- Provides access to otherwise unavailable goods and services, increases choices in marketplace, widening geographic scope.

Each partner carried out an analysis of the professional families and the subjects where the technical training contents on virtual reality should be integrated, as well as the training in skills for employment and entrepreneurship delivered in the VET centers in the new technologies sector. Additionally, we asked the opinion of experts and companies of all the partner countries regarding competencies considered as most needed in this sector, being

able to prioritize and/or add others. Teachers, employers and experts were asked to participate in the survey; their feedbacks were analyzed, and outcomes are reported for each partner country.

The interviews were divided in two parts. The first on focuses on Virtual Reality (VR) skills; the second part on entrepreneurial and social skills.

The interviews' report and the VET offer analysis will help the identification and development of contents of the integrated itinerary of virtual reality.

The questionnaires we developed to interview teachers in Vet centers, employers and experts are given in Annexes 2-4 to this report.

2. Main results of the VET training analysis.

2.1 VET training titles analysis in all partner countries

Spain

VET diplomas in the Spanish education system are divided in three levels:

- Basic Vocational Training
- Intermediate Vocational Training
- Advanced Vocational Training

With regard IT Sector, diplomas are more oriented towards the use of new technologies and those whose syllabus may have room for virtual reality subjects, which are:

- Image and sound
- Computer science
- Construction and Civil Works
- Electricity and Electronics

Germany

In the VET dual system there are around 326 professions which can be assigned to either the professional field of craft or the professional field of industry & commerce
Out of these professions there are four accounted ICT-professions:

- IT Specialist
- IT System Electronics Technician
- IT System Support Specialist
- Information Technology Officer

The syllabus of these trainings combines technical IT skills with business and managerial competencies. We can say these study plans are transferable to craft, industry and commerce professional fields. Specific contents regarding new technologies development were introduced in 1997 in a brief and generic way.
In the last years the ICT professions have been under scrutiny and going under a process of modernization and reorganization, specifically the IT System Electronics and IT System Support Specialist degrees.

The following contents have been acknowledged be reinforced:

- IT security, virtualization, cloud computing, big data, mobile computing and mobile devices.
- Production-related contents (such as robotics, sensors, production control, 3D printing, virtualization, embedded systems).

- Soft skills such as willingness to learn, personal responsibility, ability to communicate and problem-solving.

Estonia

There are two professional standards for ICT competencies at the European Qualification Level (EQF) level 4 - IT-systems specialist and junior software developer.

Three years of studies means 180 credits, including at least 60 credits of general education.

Lithuania

Vocational schools provide both training leading to a qualification, and basic or secondary education. VET programs are registered in the Study, Training Programs and Qualifications Register (Studijų, mokymo programų ir kvalifikacijų registras) and delivered as:

- Programs at lower secondary education (ISCED 2 level) for learners having no lower secondary education;
- Programs at upper secondary education (ISCED 3C level) for learners having completed lower secondary education and not seeking to complete upper secondary general education;
- Programs at upper secondary education (ISCED 3A level) for learners seeking to complete upper secondary general education;
- Programs at post-secondary education (ISCED 4 level) for learners having completed upper secondary general education.

Vocational education in Lithuania offers five specialization directions in ICT area.

- Computer basic usage training program.
- Computer-aided-design operator program.
- Computer technician of business enterprise.
- Computer graphics design operator training program.
- Java developer training program.
- Computer equipment specialist training program.

2.2. Training titles analysis in the VET centers to implement the pilot

Spain

Three VET centres providing training in Computer Sience have been selected to participate in the piloting: Tomillo Foundation, Jose Ramón Otero, San Gabriel.

Germany

In Germany it will be the EBG centres the ones piloting the itinerary. EBG operates in the metal and technical sector and the following training titles will be considered for this:

- Industry mechanics

- Cutting machine operator
- Mechatronics engineer

These professions have at least some content related with ICT, such as

- Programming of motion sequences;
- Programming of pneumatic and hydraulic control functions;
- 3D-computer simulations
- Machinery and technical systems continue to develop and therefore working tasks as well – dealings with new technologies should also be considered on an early stage.

Estonia

Kuressaare Ametikool has 70-80 students per year studying on the level 4 programme Junior software developer, both on 2-years and 3-years programs.
The pilot training in VR/AR will take place in two learning groups during the schoolyear 2018/19 in Kuressaare Ametikool.

Lithuania

The pilot will be implemented in the Smart Tech Academy and Young Computer Users School. In this educational institution VET participants can gain new skills exclusively oriented to digital competence and will get certificates.

2.3 Extracted conclusions for developing the virtual and augmented reality integrated itinerary

Current stage regarding VR in VET

The national points of views go from “VR plays a less important role in companies” to “VR in industry is key for training risk scenarios simulations”. Nevertheless, in all partner countries VR is acknowledged as a technology that could gain importance within the next years.

The partner teachers that were interviewed have either “no experiences with VR” or “low/basic level knowledge”. The problems to overcome are mostly how to integrate VR in the teaching process as well as a teaching subject, and the lack of the necessary equipment (Hardware, software to create content for VR). Another hurdle for using VR in classroom is financial.

Also, teachers agree that using VR requires more extensive/ time consuming preparation and they do not have enough experience in using VR for teaching. For them is very important to know/learn how to produce something (prototype).

VR in industry is key for training risk scenarios simulations and offers the potential to significantly improve practical and job-related learning in vocational training. Components and internal processes can be made visible like thanks to this technology as in the case example “maintenance of a machine”. Simulations offer the possibility of multiple repetition with direct visual and auditory feedback, allowing learning from mistakes without concern for real consequences.

Current stage regarding entrepreneurial skills in VET

The other main aspect of the project is not only improving the technical level of proficiency in the use of ICT/VR but also to foster the employment and entrepreneurial skills that will help students better fit in the labour market. Beyond subject related knowledge the training should introduce the specific on-the-job skills with broader, transversal and transferable skills, since work is getting more complex and requires employers to be flexible and have initiative, creativity, the ability to take on many different tasks - and to learn from their own experience. Employers emphasize skills as being important in turning technical skills into economically productive ones and the key of demonstrating entrepreneurial skills and work habits. The transversal and transferable skills are defined in contrast to technical skills, as not being tied to any particular firm, sector or work process but as being applicable to a wide range of educational and professional situations and thus having an impact in the students’ employability beyond the specific degree they’re in.

To address the improvement of these entrepreneurial skills, all actions will be based on the Entrepreneurship Competence Framework (EntreComp). This framework proposes a shared definition of entrepreneurship as a competence and develops 15 broad competences along an 8-level progression model, providing a comprehensive list of 442 learning outcomes. EntreComp is going to be a central instrument for the promotion and uptake of entrepreneurship education across Europe and has formed the basis for the revised definition of Entrepreneurship Competence in the recently adopted Council Recommendation on Key Competences for Lifelong Learning.

For this, we found this common framework as a great tool to share concept, terms and make sure that across all the partner countries the same skills are being developed and assessed.

Skills already detected as relevant for the ICT sector
(according previous studies, tools, projects, experiences within the VET centers).

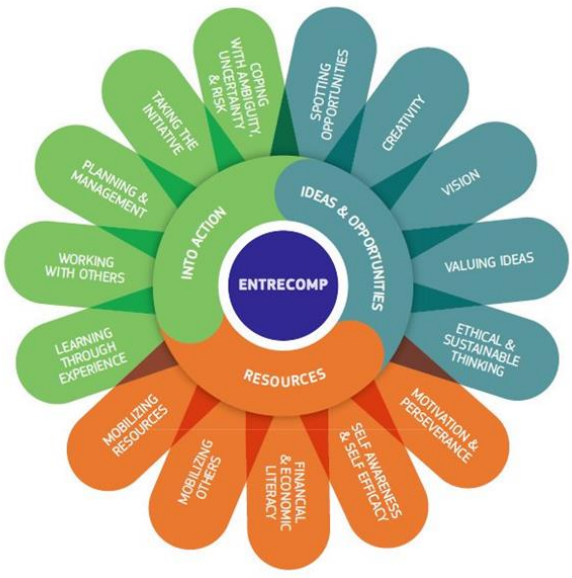
The VET offer analysis is considered very important in order to decide about the skills that should be included in the integrated itinerary, as we would have more information from previous researches, studies and projects in all countries that will help us to prioritize the entrepreneurship and employment skills that should be developed.

In 2006 the European Parliament and the Council publish the "Recommendation on key competences for lifelong learning" identified a "sense of initiative and entrepreneurship" as one of the 8 key competences for all citizens. Nowadays, this competence is often referred as "entrepreneurship competence" and is understood as a transversal key competence applicable by individuals and groups, across all spheres of life.

In this context, the Entrecomp Framework define 3 competence areas:

- Ideas and opportunities
- Resources
- Into action

Each area includes 5 competences, which, together, are the building blocks of entrepreneurship as a competence.
These 15 competences unfold along 8 expertise levels.



These 15 competences can be a reference framework for institutions in the development to the entrepreneurship competence.

The surveys and focus groups to experts and companies have been based on this framework and been the guideline to define the 8 skills that are more relevant for the VR/AR sector:

EntreComp	Key Competences
Spotting opportunities	✓
Creativity	✓
Vision	✓
Valuing ideas	
Ethical and sustainable thinking	
Self- awareness and self- efficacy	
Motivation and perseverance	✓
Mobilizing resources	
Financial and economic literacy	
Mobilizing others	✓
Taking the initiative	✓
Planning and management	✓
Coping with uncertainty, ambiguity and risk	
Working with others	✓
Learning through experience	

Implementation of the common itinerary

The team needed for VR is multidisciplinary since most tasks require the combined use of (interdisciplinary) knowledge in different forms ‘‘building/connecting bridges’’. These activities engage students to work on tasks and experience processes of knowledge construction and use, while developing new literacy at the same time.

Based on participatory and project-based methods the itinerary will help students to develop new soft skills that will help them understand why they are doing something, rather than because they have been told so. They will gain insights and generate ideas about new ways of doing things; critical thinking will help develop new insights, connections, possibilities, and helps to discover new directions.

The methodology will be learning by doing, group training, theory-practice sessions, individual and team working on a project which will mean dealing with different views. The project based learning involves both vertical learning (cumulating of subject matter knowledge) and horizontal learning (generic skills). The essence of project-based learning is that a question or prototype (in our case) serves to organize and drive activities; and these activities culminate in a final product that addresses the driving question.

The objectives include developing problem-solving abilities, creativity, flexibility and a capacity for independent work. The most distinctive feature of our project-based learning is working on the elaboration of a prototype.

Based of suggestions and recommendations, an **introduction of basic aspects of VR** could be useful before starting with the training, as:

- What VR is?
- How to introduce this tool in the different business?
- What could be the benefits of it?
- Different usages

2.3.1 Countries conclusions' chart.

The following conclusions are drawn from the questionnaires and interviews with teachers from the VET centres, experts and employers in the VR sector:

	SPAIN	GERMANY	ESTONIA	LITHUANIA
FROM TEACHERS'SURVEY	- **Low knowledge** about VR. - 50% have knowledge about programming (familiar in this language) So we can start teaching with UNITY. - They are very **interested.** - For them is very important to know /learn how to produce something (**prototype**). - VR in industry is key for training **risk scenarios simulations**. - The team needed for VR is **multidisciplinary,** and such profiles will have a high demanded in oncoming years.	- VR is **not part of the syllabus**. - Techers have nearly **no experience** with VR - They lack general knowledge about VR regarding hardware, software, opportunities and limits of VR. - Teachers have a hard time to imagine **how to integrate VR** in the teaching process as well as a teaching subject. - They lack **the necessary equipment** for using VR, but they are interested in learning. - They think VR will be **important** in the future. - Importance of knowing **how to program VR.** - Proactivity, leadership and innovation most important competences.	- Teachers are using traditional media technologies (PCs, laptops, interactive whiteboards). **VR technologies are not widely used.** - Teachers have not used VR in their personal lives, but acknowledge its **benefits for students.** - The biggest hurdle for using VR in classroom is **financial.** - Also teachers agree that **using VR requires more extensive preparation** and they do not have enough experience in using VR for teaching.	Teachers just use VR in a **basic level** but they are willing to teach it property and they want to introduce programming games.
	SPAIN	**GERMANY**	**ESTONIA**	**LITHUANIA**
FROM EXPERTS AND EMPLOYERS	All of the experts agree that VR is a key technology in the present and near future, and they consider it will be more and more related to all domains, and a multidisciplinary trained team is vital for facing this challenge.	At the current time, VR plays a less important role in companies. Nevertheless, VR is acknowledged as a technology that could gain importance within the next years.	Experts & employers – employers should be trained to use VR and to have a soft skillstraining/ Teachers should receive knowledge of VR usage (more important of how to use it instead of how to program it).	Experts and companies agree that VR is a growing field and that professionals need skills such as planning and management. Also the ability to communicate is valued as crucial

From these answers we can agree that the lack of grounded experience with VR is something most teachers share. They all consider it as an emergent sector and something that will have more importance in coming years and believe it is important to train students in this new technology. However, the cost of the required equipment and the need of teachers' training is also a struggle they share.

As for experts and employers in the VR sector, they too believe VR will be playing a larger role in future years and there is a need for proper training in the field.

2.3.2 Compared reports' conclusions

Through this first approach and analysis of the implementation of an integrated itinerary of VR and Soft skills in VET centres we can highlight the following outcomes:

- There is a shared belief among teachers, experts and companies that VR will gain importance in the near future.
- Teachers have none or very limited experience with VR inside or outside the classroom. Therefore, specific training is needed both on the contents and the pedagogical methods to integrate Virtual Reality in VET centres.
- The benefits of VR go beyond having a technical knowledge and are seen as a set of skills and a great opportunity for learners.
- VET centres have nowadays an extensive offer of ICT trainings in which VR contents could be integrated.
- Soft skills have been identified as relevant for the ICT sector and required by companies and experts. These can not be left behind when training successful professionals.

Most relevant perceived competences in each country

	MOST RELEVANT PRECEIVED COMPETENCES
SPAIN	Innovation, search for new solutions, self confidence
GERMANY	Communication, teamwork, problem solving, solution making
ESTONIA	Self-confidence, planning and management, creativity
LITHUANIA	Communication, planning and management, motivation and persistence

- Teachers have little experience fostering soft skills in the classroom although the important role of them is acknowledge and most study plans consider them to some extent.

The asset of Virtual Reality training to ICT students is clear, as well as it is the importance of having professionals that can easily fit in a constantly changing and demanding labour market.

Designing an itinerary that can benefit teachers to update and upgrade their knowledge, companies and experts to count on better professionals in their teams and students to boost their employability, emerges as a challenge and a great opportunity.

3 Country reports

3.1 Country report Spain

3.1.1 Training title analysis in VET and related to VR

The Spanish VET offer is regulated by the LOE, the current Education Law, its VET programs are divided in different areas of knowledge and levels.

VET tittles are gathered in many areas of knowledge, in this document we will only be exploring those where diplomas are more oriented towards the use of new technologies and those whose syllabus may have room for virtual reality subjects, which are:

- Image and sound
- Computer science
- Construction and Civil Works
- Electricity and Electronics

VET diplomas in the Spanish education system are divided in three levels:

- Basic Vocational Training (EFQ-3)
- Intermediate Vocational Training (EFQ-4)
- Advanced Vocational Training (EFQ-5)

It should be noted that while Intermediate and Advanced diplomas have a more extensive training itinerary, Basic VET Diplomas show a more reduced one in terms of content.

Virtual reality subjects or itineraries might not be included in all of them, but we believe it would fit in some of the Advanced, Intermediate and/or Basic syllabus.

Here you will find a table with a summary of the diplomas analysed that includes: their areas of knowledge, level and duration.

TITLE	LEVEL	AREA OF KNOWLEDGE	DURATION
Audiovisual Projects Production and Shows Advanced Technician	Advanced	Image and sound	2000 h
Audiovisual and Shows Producer Advanced Technician	Advanced	Image and sound	2000 h
3D Animations, Games and Interactive Environments Advanced Technician	Advanced	Image and sound	2000 h
Cross-platform Application Development Advanced Technician	Advanced	Computer science	2000 h

Web Application Development Advanced Technician	Advanced	Computer science	2000 h
Construction Projects Advanced Technician	Advanced	Construction and Civil Works	2000 h
Civil Work Projects Advanced Technician	Advanced	Construction and Civil Works	2000 h
Electrotechnical and Automation Systems Advanced Technician	Advanced	Electricity and Electronics	2000 h
Automation and Robotics Advanced Technician	Advanced	Electricity and Electronics	2000 h
Microcomputer Systems and Networks	Intermediate	Computer science	2000 h
Information and Communications Technology	Basic	Computer science	2000 h

Basic VET levels reach a lower level of technical competences, and VR is not directly associated to their curriculum. However, these students are the ones that have higher problems for future employability, and the ones that will benefit more from the added value of having knowledge of a new technology such as VR, that will provide them with an added value for employment. Therefore, we consider these lower levels of VET must be included in the pilot, adapting the deepness of the contents to the different Levels.

Chosen VET centers to implement the pilot:

Action against Hunger has a very close contact with different VET centers in Spain, which are collaborating in other projects. In Madrid, the following centers have been selected to be involved in the teacher training and the piloting experience:

- Tomillo Foundation
- IES José Ramón Otero
- IES Puerta Bonita

The following tables show the summary of the diplomas in the areas of Computer Science and Imagen and Sound in each centre.

Tomillo Foundation		
Title	**Area of knowledge**	**Level**
Information and Communications Technology	Computer science	Basic
Microcomputer Systems and Networks	Computer science	Intermediate

José Ramón Otero		
Title	**Area of knowledge**	**Level**
Information and Communications Technology	Computer science	Basic
Microcomputer Systems and Networks	Computer science	Intermediate
Computer Network Systems Management	Computer science	Advanced
Web Application Development Advanced Technician	Computer science	Advanced

Instituto San Gabriel		
Title	**Area of knowledge**	**Level**
Microcomputer Systems and Networks	Computer science	Intermediate

Puerta Bonita		
Title	**Area of knowledge**	**Level**
Audiovisual Projects Production and Shows	Image and sound	Advanced
Audiovisual and Shows Producer	Image and sound	Advanced
3D Animations, Games and Interactive Environments	Image and sound	Advanced

The VET Centers that have been selected for the pilot experience are those that provide training in the Computer Science area:

- Tomillo Foundation
- IES Jose Ramón Otero

We focus in Computer Science because these diplomas are more oriented towards the use of new technologies and their teachers are more prepared to learn and teach about virtual reality. The syllabus of Computer Science degrees may be appropriate for a coherent integration of VR contents in their study plan.

The Centers provide Computer and Science in all the different levels (High, Intermediate and Basic), which is especially interesting to study the introduction of VR training in all the official curriculums of Computer and Science in Spain.

The IES Puerta Bonita Center will not participate in the pilot since, as mentioned, it will be focused in Computer Science degrees. However, it will be closely involved in the study and project activities, as it is one of the pioneer Centers in Spain starting to introduce VR training. In the VR sector a multidisciplinary team is required; Puerta Bonita's focus in VR is related to Image and Sound, and therefore complementary to the one we intend to develop in the project.

Furthermore, these three Centers provide a complete picture of the reality of education Centers in Spain, including private, state-subsidized, and state-run Centers.

This project's main objective is to improve youth employability, and specially trying to reach groups at risk of exclusion. The selected centers in Madrid are all located in vulnerable neighborhoods of the city, where the highest rates of unemployment have been registered.

3.1.2 Implementation of Virtual Reality

This study has been developed with data obtained through the following activities:

- Questionnaire's development
- Expert's workshop
- Focus groups

a. The **questionnaires for Experts and employees** developed by project Partners were sent to Expert's in the VR Sector, and Employees in enterprises were VR is becoming a domain of increasing importance.

The questionnaire for experts obtained 12 replies. From these the majority were University experts, dealing with research in VR. Also 3 of these replies were from SME's specialized on VR sector, mainly on VR content development for industry and leisure, of special interest also, towards the validation of the entrepreneurship competences in the sector.

The replies to the employees questionnaire, was related to one of the main companies dealing with VR production in Spain. It was difficult however to reach more companies in this sector, as VR is starting to be a reality in many big companies in Spain, related to simulation and training, but still not so introduced in medium term enterprises. It was therefore difficult to obtain replies to this questionnaire.

In what concerns **teacher's questionnaire**, it was answered by 14 teachers, all teaching Computer Science in VET, but in different levels, and many of them in several levels (17% in Basic level, 47% in Intermediate, and 36% in higher levels).

All of these teachers form part of the Centers where we will develop the pilot.

b. An **Expert's Workshop** was also developed, with some of the entities that participated in the Questionnaire, in order to obtain more information, and clarify some of the replies obtained. This workshop was organized as a "VR Expert's Breakfast", dealing on VR training and VET.
Eight entities participated in this breakfast, in between them:

- University of Art and Technology (U-TAD)
- University Rey Juan Carlos
- Distance University of Madrid (UDIMA)
- Vgers
- Beitxu studios
- Transformation 360º

c. Two **Focus Groups** have been developed with the following teachers:

- IES José Ramón Otero: 4 teachers on Computer Science in VET, in all the Spanish VET levels.
- IES Fundación Tomillo: 5 teachers of Computer Science in VET, in Basic and Intermediate levels.

These sessions have served to analyze in detail interview replies, and clarify the use and teaching of VR in the classrooms, as well as the competences identified as priority.

3.1.3 Conclusions on the implementation

The mentioned methodology helped us to collect data regarding the following issues:

- Teachers' status quo of using media technologies and applications.
- Teachers' Status quo of using Virtual Reality
- Benefits of the integration of VR in different contexts
- Barriers in the integration of VR in different contexts

Teachers' Status quo of using media technologies and applications
All the teachers interviewed are teaching on a Face to Face classroom, using group work and some of them applying also project based learning methodologies.

The knowledge of students on 3D and Design Programs is scarce, however there is a 20% of students identified with acceptable levels of knowledge. This is related probably with the higher VET levels teachers interviewed.

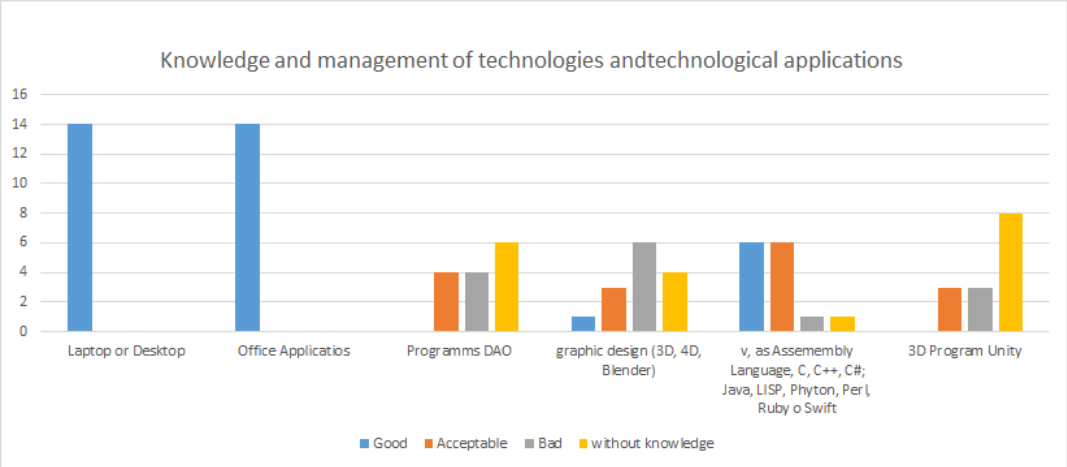
Similar results were obtained when refered to students Programming Experience.

Regarding the surveys conducted to vocational training teachers in Madrid about knowledge and management of technologies and technological applications, the following conclusions were drawn:

- 79% of teachers have bad or no knowledge of programs like Unity 3D environment.
- 71% of teachers has no knowledge or poor knowledge of 3D environment programs

However, in terms of use of computers and office applications, we have 100% knowledge among our teachers.

In summary, the results of the surveys tell us that teachers do not know the tools needed to create environments in 3D or Virtual reality but they are familiar with the technology and its uses.



Teachers' Status quo of using Virtual Reality

Experience with Virtual Reality

The 64% of the interviewed teachers affirm to have used VR, although only a 15% in the have done it in the classroom context, and always in Higher VET levels.

However, all teachers agree on the potential of the training on VR in the official curriculum, as an added value for student's professional future.

Furthermore, they also see the potential on the use of VR for teaching and learning, as a tool in the classroom, and a 23% of them confirm they have already used VR in an educative context to enhance learning.

When asked on the possibility of receiving training on 360º video, all of the teachers agree on their preference on the VR software development training, such as unity, etc.

Curricular integration of VR

In order to be able to integrate VR in the official curriculum in VET Computer Science degrees, as their knowledge of programming and 3D environments is limited, our training will have to be introductory, as an initial level to enter the sector, to continue developing with further training in formal/ informal contexts, or as business training.

From a practical and application based methodological approach, the intention of the training will be that the participant would be able to build a VR environment through creative proposals.

Through content already carried out (library) and the Unity software, the program will delve into resolution activities aimed at achieving a real product in virtual reality and the skills development of the participants.

Objectives:

- Understand Virtual reality (VR) as a tool for the development and improvement of professional skills.
- Know the current state of integration of the Virtual reality (VR) through experiences and projects in different contexts and business situations.
- Know practical applications of Virtual reality (VR) applications in different professional environments
- Create content RV through libraries with ready-made content and Unity as main virtual reality content creation software. Learning to integrate Virtual reality (VR) in education and training within a specific framework.
- Reflecting on the uses of Virtual reality (VR) and awareness of the ethical and moral consequences applied to education.

Benefits of integrating Virtual Reality in different contexts

VR is a tool that can transform companies, especially in the industrial sector. Virtual reality offers an immersive experience that allows to overcome barriers and temporary space and promotes data exchange at an amazing level. Virtual reality creates an environment that fully replaces the physical reality, either playing in a real environment or creating a completely digital one. In the productive sectors of the Business to Business field (B2B), the advantages offered by virtual reality are innumerable.

1. More effective training. With virtual reality, it is possible to simulate virtually real environments that allow operators' training. That facilitates and streamlines the processes of learning, reduces travel costs, and avoids the risks for the employee and the company.

2. It reduces product development costs. This technology can measure performance from the experimentation, particularly in the fields of Aeronautics, automotive, and industrial machinery. In this way, you can correct possible deviations, and improve the product without incurring costs of materials or stop processes affecting production.

3. Sale's best friend: In the commercial side, the contribution of virtual reality is very clear. For example, a client specialized on the of graphic printing of B2B sector must clearly explain the benefits of the machine. At the same time, he/she must be able to specify other facts such as maintenance, inputs, performance, etc. For this type of expensive purchases, product visualization helps to clear doubts easily, saves costs of machinery transfer to B2B fairs or visits to the factory, and thus accelerate the purchase decision.

The companies know more and more all these advantages and claim professionals able to carry them out. This brings a unique opportunity to train students in this new technology. It will open students the opportunity to integrate into the labour market at a time that the technology is still in a piloting phase. The demand in the market is still much greater that the offer.

In addition, being the virtual reality, an emerging market allows students to continue training further on, and to develop new disciplines in their career.

Barriers of the integration of Virtual Reality in different contexts

The integration of the virtual reality in the classrooms is complicated and often implies complex obstacles.

After the surveys and interviews that we have conducted with education centres, universities and teachers, we can highlight two main barriers:

1. Lack of knowledge of teachers in terms of technology. Teachers have little knowledge not only on the creation of content in Virtual reality, but also on what is this technology and its uses in the labour market.

2. Few resources in the classroom: to create content in virtual reality is necessary to have high-performance computers. Currently the classrooms have a computer equipment not sufficient for this purpose.

3.1.4 Final thoughts on the implementation of VR

Virtual reality is without doubt, one of the new sectors that are called to change and revolutionize radically the labour market. Estimates of investment in this sector have soared, reaching historical maximum in Spain during this 2018. It is therefore a reality that current companies and those of the new creation will need of professionals trained in this technology. Not only professionals able to create stage or experiences in VR are needed, but there are also actually non-existent jobs to be created. Specialists in script for Virtual reality, in textures, in art direction… Specialists for special effects in the recreational field and specialists capable of using Virtual Reality as a therapeutic tool.

The possibilities are thousands, we even today, do not achieve to comprehend or imagine. But we know that it is now time to train and take advantage of this market trend that will allow us to place our students in all these openings that the market will create.

Therefore, the implementation of virtual reality in vocational training centres is forced to give a response to the demand of the market.

However, we find that today the know-how of teachers and students in terms of this technology are virtually non-existent, even in areas of study more technological.

It is necessary to train students in specific knowledge that allows them to go to market with a real option, the complexity lies in how to handle the lack of knowledge, with the resources that the centres have with the market demand.

3.1.5 Soft skills approach analysis in training titles

All the VET diplomas in the Spanish Education System include common subjects about employability. We have identified three subjects, in each diploma students have access to at least two of them:

- Training and Career guidance
- Businesses and Entrepreneurship initiative
- Traineeship in Job Centers

It should be highlighted that the contents offered related to employability do mention the words “motivation” and “initiative”. Nonetheless, **they aren’t focused on the development of competencies and skills but on the acquisition of a superficial knowledge about institutions, necessary administrative processes and job search**.

Here is a summary of the usual topics in the VET Employability subjects:

Training and Career guidance	Businesses and Entrepreneurship initiative
Career guidance Labour law Labour agreement Institutions involved: Social Security system, Public Employment Service, etc. Occupational risks Training opportunities within the sector Training opportunities in Europe	Basic guidelines for setting up a business Institutions involved: Social Security system, Public Employment Service, etc. How to create a business plan Types of companies Basic Financial features Entrepreneurial attitude

At a national level, *Accenture Foundation* is a referent in the study of employment and entrepreneurship sector. It is worth highlighting their evaluation tools:
Developed to address the gap in technical, digital and soft skills this tool was created in 2013, in collaboration with the Spanish Ministry of Employment: **Emplea+**.
This online platform helps to assess the level in each of the key competences needed for employment.
In the same way, *Accenture Foundation* developed a similar tool for the entrepreneurship skills: **Emprende+**.

In this field, Action Against Hunger together with the Tomillo Foundation developed the study **"Emerging sectors of entrepreneurship for young people at risk of exclusion",** identifying ICT as one of these sectors, not only emerging for entrepreneurship, but also for employment.

This study makes an analysis of vocational education and training offer in the sector, and an update was detected as an imminent need, since this sector suffers from being one of those whose professional qualifications are less assimilated to the reality of the labour market.

In this same study, another demand of the companies in the sector, with respect to their future workers, is that they have social skills and competencies such as leadership, motivation, perseverance, flexibility, communication, etc. Focusing on the development of skills and abilities aimed at a specific sector, in this case the virtual reality subsector, ensures its better assimilation, greater effectiveness of training and a more complete response to what companies demand in profiles of these characteristics.

The integration of transversal skills required for the sector, as well as technical competencies related to the latest trends, will comprehensively cover the labour market demands of new technologies and will ensure the better inclusion of VET students in the technological labour market of the future.

As part of the aforementioned study: "Emerging sectors of entrepreneurship for young people at risk of exclusion", in which the ICT sector has identified the need to develop the following competencies for employment and entrepreneurship in it:

- Leadership, initiative and decision making
- Creativity and innovation
- Ability to detect needs and problems
- Reaction
- Decision making
- Search for solutions
- Constancy, perseverance and tenacity
- Ability to face adversity and overcome it
- Flexibility
- Communication
- Self-confidence

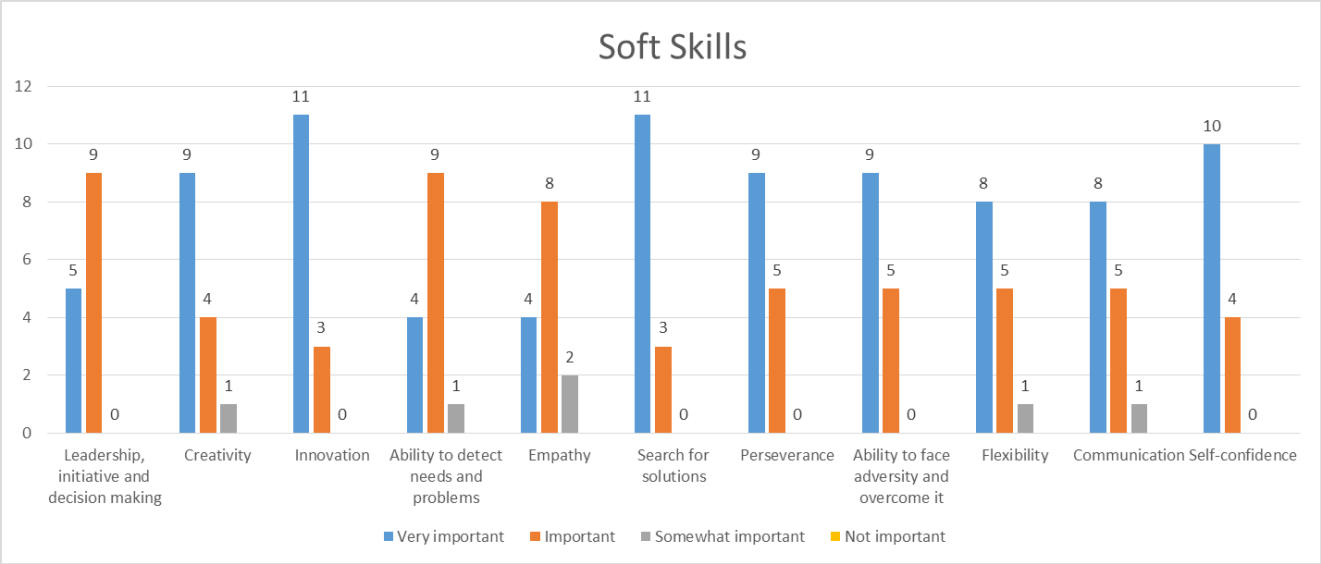
According to teachers

Teachers were asked which soft skills they considered important for a future employment in the ICT sector.

The results of the questionnaire show the following answers:

“Innovation” and **“Search for solutions”** are considered the most important skills for ICT sector, followed by the skills “Self-confidence”, “Creativity”, “Perseverance” and “Ability to face adversity and overcome it”.

In the other hand, “Empathy” and “Ability to detect needs and problems” are considered the least important skills for the teachers.



These results were contrasted with the answers in the teacher interviews. In this case, the teacher focus groups determined the following key competences:

Key competences - Teachers
Working with others
Creativity
Planning and management
Ethical and sustainable thinking (Be accountable and Work independently)

According companies and experts in virtual reality

Results of the questionnaire, in which 12 expert and 1 company have taken part, describes the opinions and knowledges that they have about soft skills.

The information is shown in different bar charts. Each one represents the analysis of one soft skill.

The most noticeable thing about the graphs is the general importance of all soft skills, with a significant majority of affirmations/questions considered "Good" with scores of at least 6 out of 10.

By far, the principal skills detected are "**Creativity**" and "**Working with others**": the ability to co-operate with others to develop ideas and turn them in action, the ability to combine knowledge and resources to achieve valuable effects and the ability to develop several ideas and opportunities to create value prevail over the others.

In the range between 7-9 scores, the graphs also recognize it as "Good" the importance of skills like "**Vision/Association**", "**Mobilizing others / Leadership**" and "**Oral and written expression**".

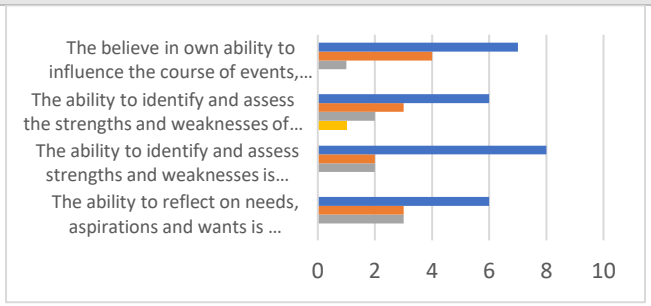
The mean of "**Motivation and perseverance**" is similar to "**Mobilizing resources / reaction**", both collect more answer "no knowledge" than the rest of skills and appear below the "**Self-awareness and self-efficacy / self-confidence**" and **"Planning and management / Adaptation to change**".

In these skills, the bar chart 3: "**Planning and Management / Adaptation to change**", clearly highlights the increase the importance about "Adaptation to change" question compared about "Planning and Management" affirmations.

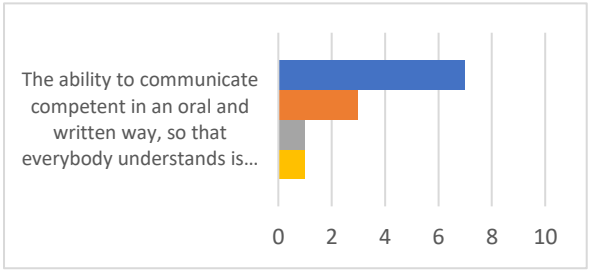
In summary, the main skills, in order of importance for the experts, are as follows.

- Creativity
- Working with others
- Vision / Association
- Mobilizing others / Leadership
- Oral and written expression
- Self-awareness and self-efficacy / Self-confidence
- Planning and management / adaptation to change
- Mobilization resources / reaction
- Motivation and perseverance, tenacity, resilience

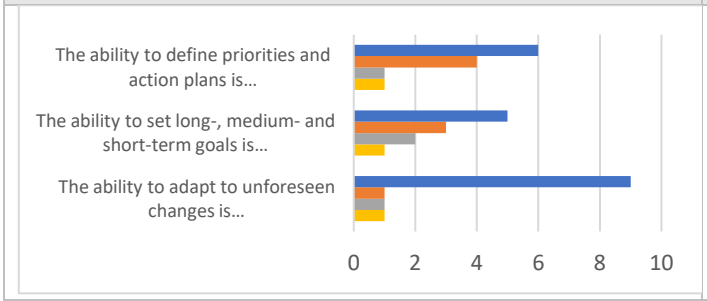
1. Self- awareness and self-efficacy / Self-confidence



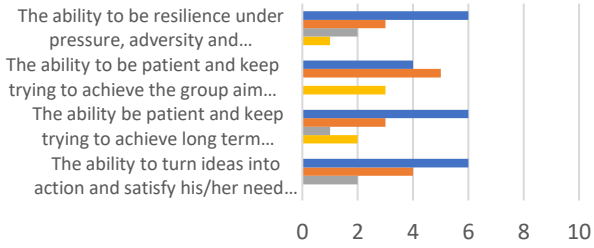
2. Oral and written expression



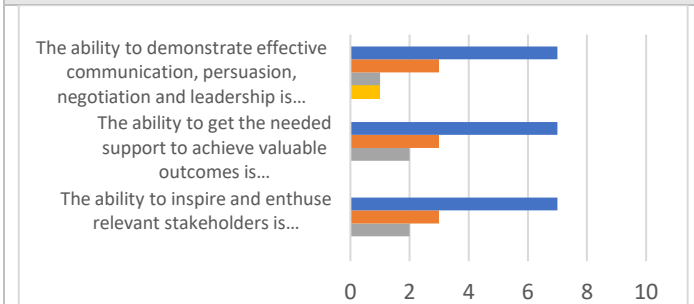
3. Planning and management /adaptation to change



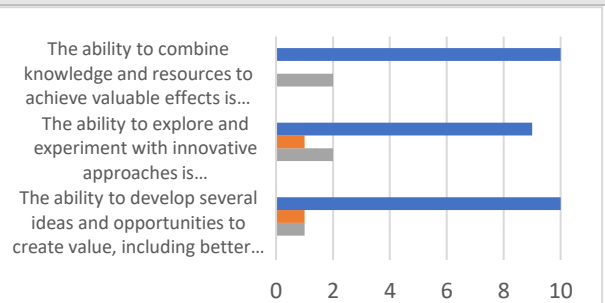
4. Motivation and perseverance/tenacity/resilience



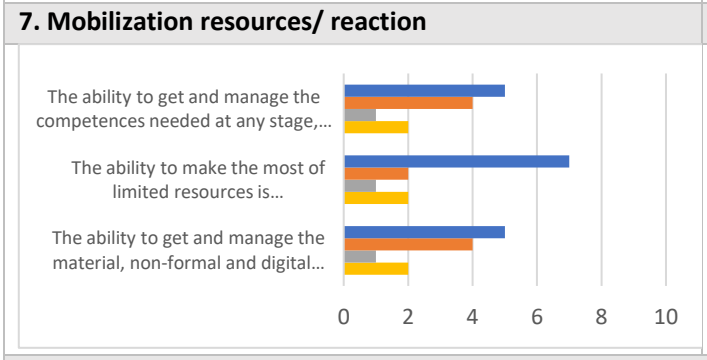
5. Mobilizing others/ Leadership



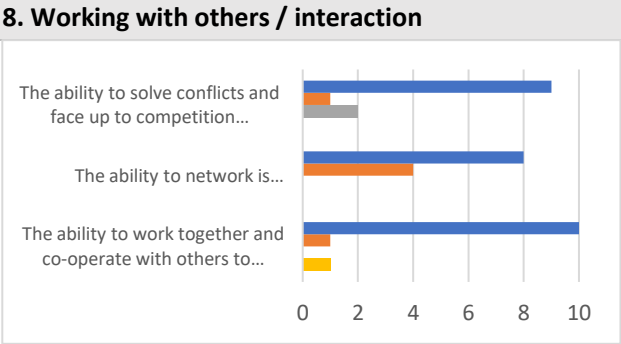
6. Creativity



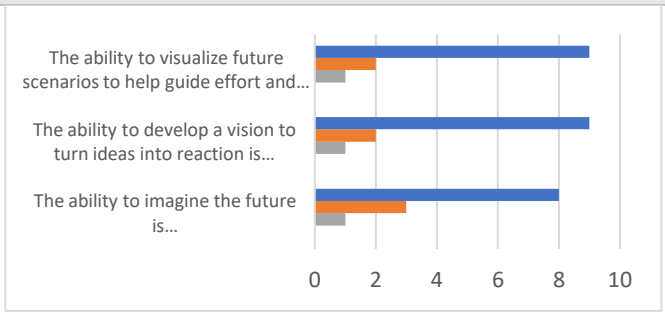
7. Mobilization resources/ reaction

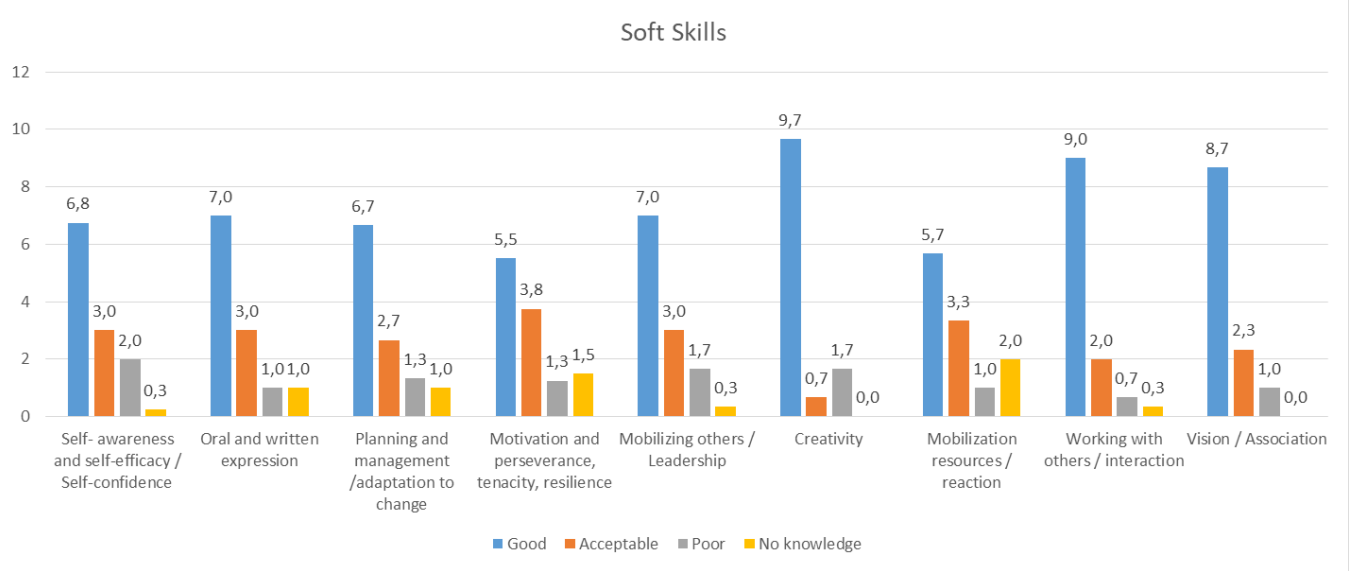


8. Working with others / interaction



9. Vision / Association





Results on the employment and entrepreneurship skills prioritized (conclusion)

Relating the competences indicated in the Study of Emerging Sectors and the used in the project questionnaire, we can identify a close relation with the competences included in the EntreComp Framework.

An exact match can not be obtained, but we can identify important coincidences:

EntreCompt	Emerging sectors	J4T
Spotting opportunities	Ability to detect needs and problems	
Creativity	Creativity and innovation	Creativity
Vision		Vision / Association
Valuing ideas	Search for solutions	
Ethical and sustainable thinking		
Self- awareness and self-efficacy	Self-confidence	Self- awareness and self-efficacy / Self-confidence
Motivation and perseverance	Constancy, perseverance and tenacity	Motivation and perseverance/ Tenacity/ Resilience
Mobilizing resources		Mobilization resources / Reaction
Financial and economic literacy		
Mobilizing others	Communication	Oral and written expression Mobilizing others / Leadership
Taking the initiative	Leadership and initiative Reaction	Mobilizing others / Leadership

	Decision making	
Planning and management	Flexibility	Planning and management / Adaptation to change
Coping with uncertainty, ambiguity and risk	Ability to face adversity and overcome it	
Working with others		Working with others / Interaction
Learning through experience		

This matching allows simultaneously viewing the relation between competences in the different studies. Only 3 competences included in the EntreComp Framework are not represented neither in the Study of Emerging Sectors or the J4T Questionnaire: *Ethical and sustainable thinking, Financial and economic literacy* and *Learning through experience*.

EntreComp	Emerging Sector's Study	J4T
Spotting opportunities	✓	✗
Creativity	✓	✓
Vision	✗	✓
Valuing ideas	✓	✗
Ethical and sustainable thinking	✗	✗
Self- awareness and self- efficacy	✓	✓
Motivation and perseverance	✓	✓
Mobilizing resources	✗	✓
Financial and economic literacy	✗	✗
Mobilizing others	✓	✓
Taking the initiative	✓	✓
Planning and management	✓	✓
Coping with uncertainty, ambiguity and risk	✓	✗
Working with others	✗	✓
Learning through experience	✗	✗

Therefore, it is appropriate to adapt the terminology used in Study of Emerging Sectors and the J4T Questionnaire to the Framework EntreComp.

The result of the Questionnaires and the Focus Groups highlight 8 key competences:

- Creativity
- Working with others
- Vision / Association
- Mobilizing others / Leadership
- Oral and written expression
- Self-awareness and self-efficacy / Self-confidence
- Planning and management / adaptation to change
- Mobilization resources / reaction
- Motivation and perseverance, tenacity, resilience

3.1.6 Final thoughts on the integrated itinerary

The vast majority of the interviewed teachers, expert and companies acknowledge the importance of soft skills as a significant factor for the employment of the students.

Spotting opportunities, Creativity, Vision, Motivation and perseverance, Mobilizing others, Taking the initiative, Planning and management and *Working with others*, are considered key competencies to improve the employability of the students in the area of Virtual Reality.

If we are working towards promoting employability in the ITC sector we cannot leave behind the vital role that these skills play in building better professionals and have to find the way to integrate them in a coherent way so students can understand its role and give them the relevance it actually has.

3.2 Country report Germany

3.2.1 Training titles analysis in VET and related to VR.

Vocational training in the Federal Republic of Germany is provided on the job placement and in vocational training schools. Based on what is referred to as the **dual system**, practical vocational training is given at work, backed up by theoretical training and general education provided in vocational training schools which are generally attended on one or two days a week.

The characteristic featured by this system is that the provision of knowledge and skills is linked to acquiring the necessary job experience. This ensures that training will proceed under the same conditions that the trainee will encounter when practising his/her chosen occupation. Only on the job will a trainee be able to learn to cope with the constantly-changing demands of the position and to appreciate the variety of social relationships that exist in the work environment. In addition, **learning by doing** gives a sense of achievement and provides a special source of motivation for the trainee. It promotes independence and a sense of responsibility, which are indispensable qualities in a developed industrial country, because by tackling concrete tasks under real working conditions the trainee can show evidence of the knowledge and skills he/she has acquired and can himself experience the success of his efforts. This shows that training on the job is more than just a process of institutionalised and organised learning.

In Germany there are currently some 350 officially recognised training occupations, constituting the basis for more than 20,000 adult occupations. They achieve good labour mobility, as the on-the-job training also delivers more general qualifications that can be used in different professions and are not tied to occupational skills.

The training regulations are a central element of the German vocational training system. Although they are incorporated in state law, trade and industry also play a decisive part in their formulation. In preparing these regulations, the responsible Federal minister is assisted by the Federal Institute of Vocational Training, which in turn is advised by committees of experts representing the different occupational groups and appointed at the suggestion of the leading trade, industry and union organisations. The importance of workplace training is reflected in the fact that the standards and rules for this kind of training were set up by the self-governing economic bodies, i.e. mainly by the Chambers. The Vocational Training Act regulates more than just the training of young persons after their period of compulsory school attendance. The concept of vocational training in Germany comprises initial training, further training and vocational retraining.

With the fast development of information and communication technology, which became more and more important with the multiplication of personal computers (PCs) at the beginning of the 1980s and the increasing networking and standardization of hardware and software, four IT professions were introduced in Germany in 1997 (Conein & Schwarz, 2015, p. 58):
IT Spezialist (Fachinformatiker*in),
IT system electronics technician (IT-System-Elektroniker*in),
IT system support specialist (IT-Systemkaufmann*frau) as well as
Information technology officer (Informatikkaufmann*frau).

By combining broad IT-skills with corresponding profiling skills, which include both technical, business and managerial skills, these professions have not been assigned to any professional field (Borsch & Weismann, 2000, p. 9; Conein & Schwarz, 2016, p. 58). Therefore these professions are transversal to the previous professional fields of craft and industry and commerce (Borsch & Weismann, 2000, p. 9).

With the introduction of the four named IT professions, the existing professions in the IT work environment were supplemented or replaced. The range of IT professions and professions in the IT work environment was supplemented once again by the profession "Information electronics technician" (Informationselektroniker*in) and in 2007 by the profession "mathematical and technical software developer" (Mathematisch-technische*r Softwareentwickler*in) (Petersen & Wehmeyer, 2000, p. 14f.; BIBB n.d.a).

In addition to the professions of the dual system, IT professions are also taught and learned in vocational (full-time) schools. The following table shows the main IT professions and professions in the IT work environment that can be trained in the dual system of vocational training as well as in vocational full-time schools (Berufsfachschulen).

	Job title	Duration	Level of the German Qualification Framework
Dual system of vocational training	IT Spezialist	3 years	4
	IT system electronics technician	3 years	4
	IT system support specialist	3 years	4
	Information technology officer	3 years	4
	mathematical and technical software developer	3 years	4
	Information electronics technician	3 years	4

	Electronics technicians in the information and telecommunications technology specialty	3 ½ years	4
Vocational education on vocational schools	Assistant for informatics (specialization: media informatics/ software engineering)	2-3 years	
	Assistant for commercial information technology	2-3 years	4
	commercial assistant (business informatics / information processing)	24-39 month	4
	Technical assistant – electronics and data technology	2-3 years	4
	technical assistant for informatics	2 years, optionally 3-4 years	4

*) The overview does not claim to be complete.

In addition to the main professions listed in the table, there are a variety of training professions in the field of craft and industry and commerce, which are not attributed to the IT work environment, but also have IT-relevant content (such as programming of motion sequences and control functions, computer simulations, etc.) as part of their training. Such training professions are for example mechatronics engineer (Mechatroniker), industrial mechanics (Industriemechaniker).

Since the four dual IT professions were implemented, around 250,000 professionals have been trained in information and communication technology products and services. In recent years the number of new training contracts for these IT professions was between 15,000 and 16,000. In particular, the profession of IT specialist (Fachinformatiker*in) has become a core brand of these dual IT professions. (BIBB, 2017) With just over 13,000 completed training contracts, the profession IT specialist (Fachinformatiker*in) overcompensate the declining training figures of the other three IT professions (BIBB, 2017).

The ICT industry in Germany now employs over 900,000 professionals in more than 86,000 companies. In addition, around 650,000 IT employees will be added from other industries. The ICT industry is characterized by a high degree of dynamism in business start-ups in the areas of ICT services and software. (Conein & Schwarz 2015, p. 58).

With the accelerated digitization and interconnectedness of all production, administration and consumption processes, it can be assumed that the demand for IT professions will continue to rise (BIBB, 2017). According to the Federal Institute for Vocational Education and Training (BIBB), additional demand will be generated in the manufacturing sector, not just in the ICT sector (BIBB, 2017, p. 134). Therefore the focus shouldn't lay only on the ICT sector, but also on other sectors of the economy, in order to be able to grasp and react to changing skill requirements.

Since 2015, the IT professions introduced in 1997 have been under scrutiny. On behalf of the Federal Ministry of Economics (BMWi) and the Federal Ministry of Education and Research (BMBF), the needs for modernization of the four dual IT training professions were examined. As a result of the scrutiny, it was recommended to revise the training profiles and contents of the four dual IT professions (BIBB, 2017).

The professions of IT system electronics (IT-Systemelektroniker*in) and IT system support specialist (IT-Systemkaufmann*frau) are currently in a process of modernization and reorganization (BIBB, n.d.b). Especially with regards of updating learning contents, recommendations of the scrutiny focus on the following aspects (BIBB, 2017):

- The topic of "IT security" (data security, availability, data integrity and data protection and its legal aspects) should be significantly strengthened.
- Up to now, two thirds of IT professionals work outside the ICT sector. In the context of Industry 4.0, production-related contents (such as robotics, sensors, production control, 3D printing, virtualization, embedded systems) should be involved more strongly in the training occupations.

Personal and social skills are becoming more important for IT professionals and their work. Competencies such as willingness to learn, personal responsibility, ability to communicate and problem-solving skills should be involved more strongly in the context of the training professions.

Chosen VET Centers to implement the pilot:
In addition to a variety of occupations in different occupational fields that are subjects of EBG training portfolio, there are also some training occupations in the field of craft and industry like cutting machine operators, mechatronics engineer and industrial mechanic which contain IT-relevant content as part of their training (Programming of motion sequences, programming of pneumatic and hydraulic control functions, 3D computer simulations etc.)

The industrial mechanic
The training focuses in occupational training include operational and technical communication, planning and organizing work, evaluating work results, distinguishing and

allocating and handling workpieces and auxiliary materials, producing, assembling and dismantling, striking, securing and transporting components, assemblies and systems, operability ensure technical systems, build up, extend and test electrical engineering components of control technology, customer orientation, equipment maintenance, control technology, business processes and quality assurance systems in the field.

The cutting mechanic

Training focuses on operational and technical communication, planning and organizing work, evaluating work results, distinguishing and allocating and managing materials and supplies, producing, striking, securing and transporting components, assemblies and systems, ensuring the operability of technical systems, work on turning, milling or boring machines and produce precision parts, program and simulate manufacturing on numerically controlled machine tools.

The mechatronic

The training focuses on mechanics, electronics and information technology and includes the construction of complex mechatronic systems, their installation and their maintenance and repair:

- Read circuit diagrams, construction drawings and operating instructions
- Build mechanical, electrical and electronic components
- Mount components to mechatronic systems
- Commission finished systems: program, install software
- Check systems
- Customer Care
- Maintain and repair mechatronic systems

3.2.2 Implementation of Virtual Reality

Methodological Approach

The survey was prepared as an **online-questionnaire** and took place during the period in the end of April 2018 to the middle of May 2018. The questioning was conducted in form of **personal interviews with VET teachers or trainers, employers and experts of the ICT-sector as well as the technical sector**. The interviews should be conducted with at least two participants each target group.

The focus of the interviews with the VET teachers or trainers laid on the aspects of how much Virtual Reality is already integrated in the VET syllabys, as well as how much these technologies are used in the context of the VET training.

The results of these interviews are specially helpful for the preparation of the first pilot phase of the project. The focus of the interviews with the employers and experts laid on the relevant competences which employers and experts acknowledge as important for future employment in the ICT sector and that young people should bring along.

In general, each of the questionnaires for the VET teachers and trainers, the employers and experts consisted of the following complex of questions:

- Personal information and/or company information
- information on knowledge, use and/or attitudes towards Virtual Reality
- Information about relevant skills of employment and entrepreneurship by the assessment of different competence dimensions

General information about the participants in Germany

For the interviews a total of 12 persons could be reached. Of these, seven teachers, two experts and three employers took part in the interviews.

The target group **"teachers"** was made up of teachers and trainers as well as executives from the technical and metal industry, some of whom already have many years of experience in the training or teaching as well as conducting exams of young adults or trainees. The teachers and trainers participating in the interviews teach VET students in the professions of cutting machine operator and mechatronics engineer. Within the curriculum of these professions, they teach both vocational theory contents (such as CNC technology and CAD as well as programmable logic controllers) and general (nonoccupation-specific) contents (such as contents from computer science).

The **"employers"** who participated in the interviews on the core topic of relevant employment skills as well on the subject of virtual reality came also from the technical and metal industry. These were mainly employers of small and medium sized companies, whose tasks among other things attributable to the ICT-related work environment. Thus, the companies involved in the interviews have up to 10 ICT-related jobs.

For the interviews with **"experts",** people from the ICT sector could be won. These experts are also employers or executives from companies that already have many years of experience in the field of information and communication technology and provide their experience in the form of consulting services, among other things.

3.2.3 Conclusions on the implementation

According to teachers

Teachers' Status quo of using media technologies and applications

The results of the survey on the current use of media technologies and media applications show that the surveyed teachers have primarily relied on media technology and applications that have already been established over the long term and are familiar to them in the context of training and their work experience.[1]

Almost all of the teachers surveyed regularly use workstation PC and laptops with Internet access for their teaching practice. Technologies that more or less complement or replace traditional education and the teaching tools used in recent years and the last decade are now only occasionally, rarely or never used by part of the teachers surveyed. These include, for example, projectors, interactive whiteboards or the use of cameras as part of the teaching process itself. Only individual teachers regularly use these possibilities.

Equally similar is the situation with media technologies such as smartphones, tablets or wearables, which have long since gained a permanent place in several sectors, but are only slowly finding their way into the education and teaching of young people. Here, more than half of the surveyed teachers said they have not used these technologies yet. Only a small proportion of teachers occasionally or very seldom use these technologies for teaching practice.

New and emerging media developments and technology, such as project-focused virtual reality and augmented reality, have so far found no access to the teaching practice of the teachers surveyed. (see Figure 4.2-1)

A similar picture is also evident in the current use of media applications. Here, it is primarily the applications used and established with computers and laptops, such as Internet offers, and the use of office programs, which are regularly used by the majority of respondents. This also applies to work-specific applications such as simulations. On the other hand, applications such as educational videos and video platforms as well as electronic exercise and test systems are occasionally used by respondents as part of their teaching.

Newer media applications, which have only been in the public interest for their use in teaching in recent years, have not yet been used by almost all teachers for educational purposes. These include, in particular, media applications such as MOOCs, virtual classrooms, digital learning games as well as 3D environments. (see Figure 4.2-2)

[1] All diagrams are listed in the Annex.

Although the majority of surveyed teachers have relied on rather already established technology and applications so far, most respondents estimate that new media formats and applications will become increasingly important in the future; in particular, the virtual reality related 3D environments, as well as learning apps and communication applications (like WhatsApp and Skype). The labour-specific applications already used, such as simulations and control software from manufacturers, will continue to play a major role.

In the view of the teachers surveyed, applications that can be called up over the Internet and used on the move, such as online courses, the use of learn management systems and video platforms, will continue to be important and will continue to gain importance in the future. Teachers rate the role of digital learning games and Web 2.0 applications as less important. Less than half of the surveyed teachers rated these applications as important or very important. (see Figure 4.2-3)

Teachers' Status quo of using Virtual Reality

Experience with Virtual Reality

In capturing what experiences the surveyed teachers have already made with Virtual Reality (VR) in general, it has become apparent that almost none of the teachers have had experience with virtual reality in the private sector. The same applies to the use of virtual reality as a subject or as a medium of instruction. Here, even all the teachers surveyed did not yet teach or use this technology. (see Figure 4.2-4)

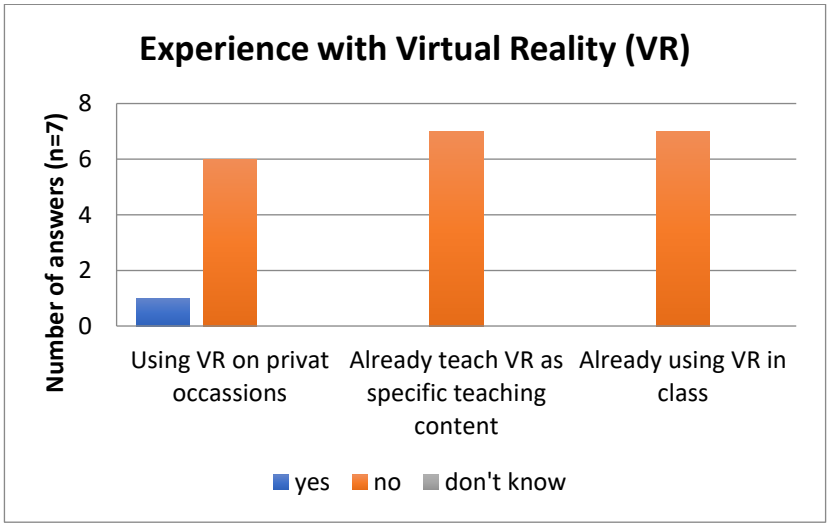


Figure 4.2-4: Experience with Virtual Reality

Curricular integration of VR

When asked if the teachers can imagine teaching VR to their students in the future (VR as a teaching tool): Only a little less than half of the teachers or instructors answered in the affirmative, while about a quarter of the teachers can not imagine teaching VR to their students. Again, a quarter of the teachers surveyed were unable to position themselves on this issue. (see Figure 4.2-5)

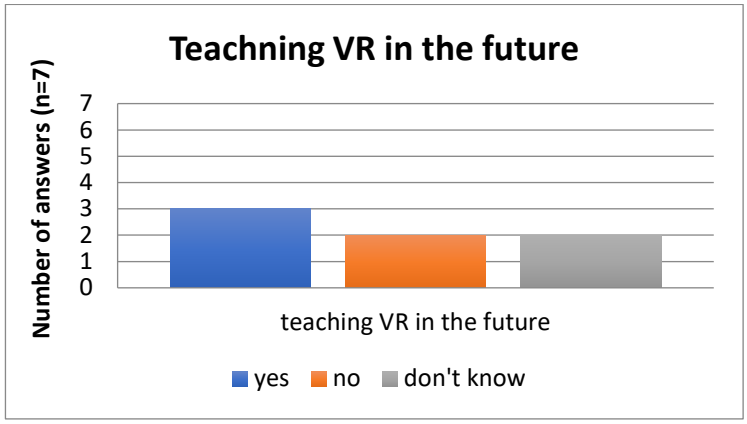


Figure 4.2-5: Teaching VR in the future

The benefits to teach VR to students are mainly seen by making the lessons more interesting and a better visualization of technological steps and processes without additional workshops. Another reason, however, is to meet or comply the technological and future developments.

In the teaching areas "assembling and disassembling of technical units and subunits", "CNC, databases and network technology" as well as "machine control, programming" the teaching staff acknowledged the content-related positioning of VR in the respective curriculum (technical and metal sector) would be an asset.

The reasons given for this were: to be able to "optimize training in the field of maintenance", to have the possibility of "real - time simulation of technical processes" and "visualization of networks", and thus to achieve a "better understanding of facts ".

In addition to the question of whether the teachers could imagine teaching VR in the future, they were also asked if they could imagine using VR in the future (as a tool for teaching materials/ teaching medium). Only about a quarter of teachers surveyed can imagine using VR for their lessons, while a quarter rejects a future use of VR, and the other teachers do not position themselves for this purpose. (see Figure 4.2-6)

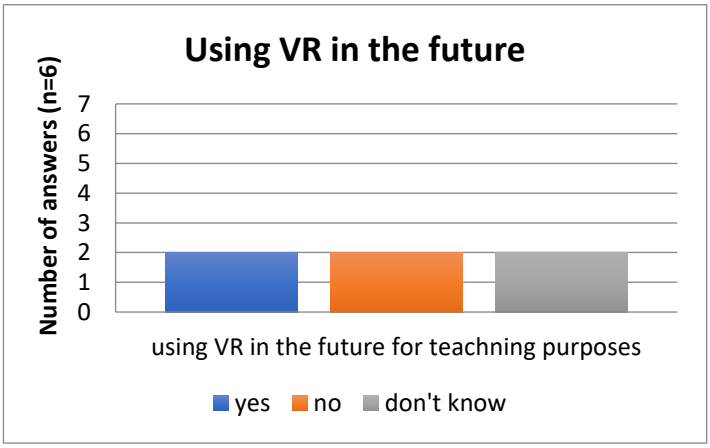


Figure 4.2-6: Using VR in the future.

The reasons for using VR would be "make teaching more interesting" and "better understanding of the implementation of the learning fields".

Regarding the question for which content the teachers would use VR, they indicated the content areas "CNC, network technology and databases" as well as "Technical communication, tool teaching, machine technology". Here, too, the teachers stated that they would then be able to present content more clearly and to improve their understanding of the content on the part of the students.

Benefits of integrating Virtual Reality

Although not all teachers will be able to imagine using VR as a subject or as a medium of teaching in the future, the surveyed teachers estimate that the benefits of VR for teaching, for the development of soft skills and for the opportunities in the labour market would be mostly more or less positive.

1. **Benefits of VR for the teaching process**

With regard to the possible impact of VR on the teaching process, respondents see positive effects, in particular in the variety of teaching, in illustrating facts and in supporting and encouraging discovery learning. However, beside the possible positive influences on the lessons they also show concern about the use of VR. The majority of teachers fear that they would spend much more time preparing their lessons in the future. In addition, half of the teachers also fear that with the use of VR more technical problems would occur. (see Figure 4.2-7)

2. **Benefits of VR for the development of soft skills of the students**

With regard to the assessment of possible positive effects of VR on the development of soft skills on the part of the students, the teachers surveyed mostly agreed upon, but there were also doubts about improving some soft skills. Virtually all teachers see a positive impact from the use of VR, especially in a possible improvement in student motivation and a better understanding of the context of a situation. Two-thirds of teachers also see positive benefits in enabling holistic learning experiences, making it easier for students to develop realistic visual ideas and concepts, that they will gain more confidence in their own abilities, would be more open to face new challenges, to experiment with new approaches as well as be able to convince others of their own ideas and therefore will also be more able to cooperate with others.

Teachers' concerns about the impact of VR on the development of soft skills are more or less reflected in the fact that some of the statements from at least half of the interviewed teachers

tended to be disagreed or not approved. For example, these teachers do not see any positive impact in improving the memory of the content, in appealing to more students' senses, in enabling students to better meet new challenges, or by using VR to enhance student creativity. (see Figure 4.2-8)

3. Benefits for future employment

There is no overall positive view on the question of how teachers assess the future chances of employing students, whether the special knowledge of VR technology would bring benefits. As a clear advantage, two-thirds of the respondents rate the students' specific knowledge or skills regarding VR would become increasingly important in the labour market in the future. On the other hand, the majority of respondents say that VR's special knowledge would not make it easier for students to get a job or to get a job offer, and less likely in cases affected by unemployment in bad economic times. Only the thirds of the teachers surveyed also see advantages for the students in these statements. (see Figure 4.2-9)

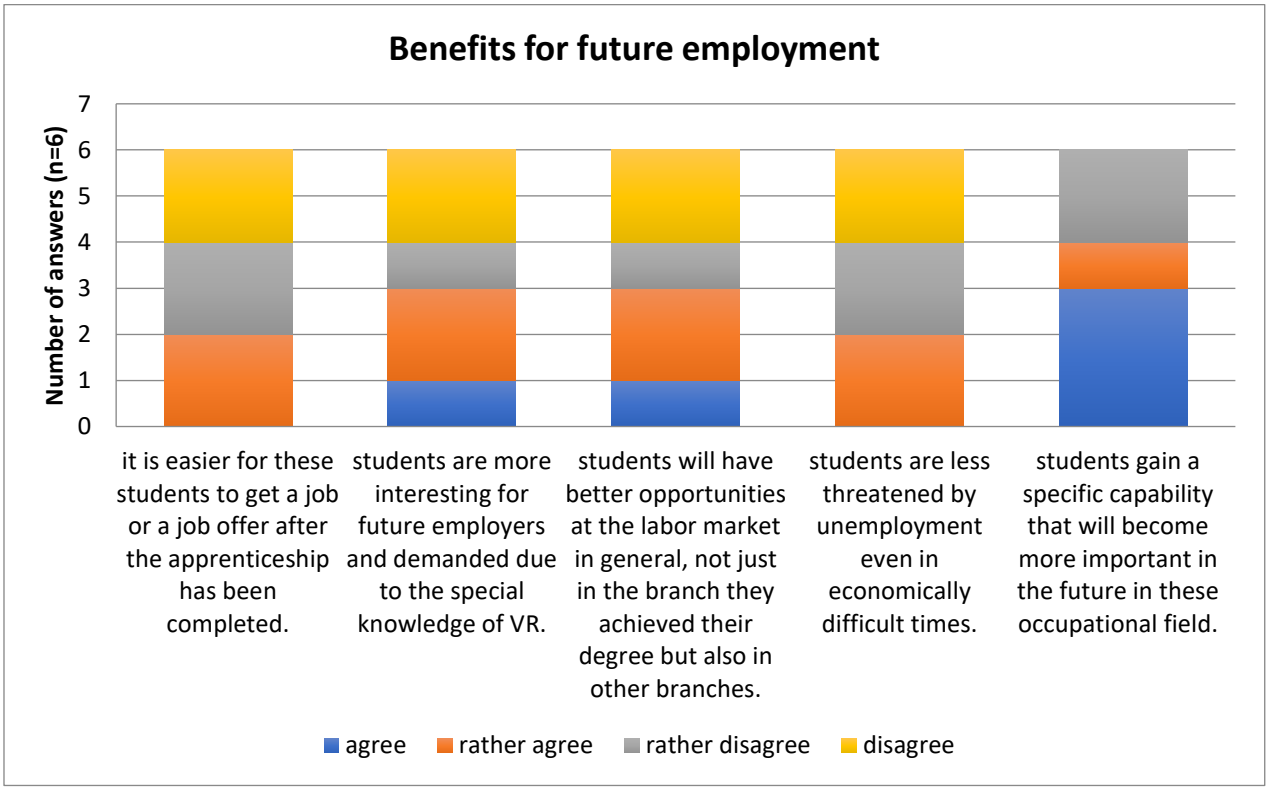


Figure 4.2-9: Benefits for a future employment of students.

Barriers for the integration of Virtual Reality

After assessing the potential advantages of VR in terms of teaching, soft skills and job opportunities for students, teachers were also asked about possible barriers that could hinder the future use of this technology. All teachers stated that there is currently still a lack of suitable concepts for the sensible use of VR as well as suitable content. The majority of

teachers also expressed concerns about the cost of acquiring VR technology and a lack of contact to help with the task of maintaining or assisting with problems. In addition, the majority of teachers stated the lack appropriate courses to teach VR and that in order to use and teach VR, further training is needed.

On the other hand, about half of respondents said that teachers would not have suitable ideas for the use of VR or that daily tasks would hinder the debate on VR technology. The other half of the teachers surveyed see no obstacles to the future use of VR. (see Figure 4.2-10)

1. Technical requirements for VR

In order to use and deploy VR certain technical or systemic requirements are necessary. Similarly, teachers were asked what technical equipment they currently have to facilitate the transition to using this particular technology. In order to open up alternatives to VR technology in this context, 360 ° videos as such alternatives were included in the survey.

As a result of the survey, it was found that most of the necessary technical equipment for the use of VR either does not exist or the teachers were not able to state with certainty whether the equipment is available in the training center. This information is related in particular to the special VR equipment such as VR glasses and VR programming software. With regard to the necessary computers with the corresponding minimum specifications, only about half of the teachers said that this technique was in place. Overall, the majority of the necessary equipment is missing. (see Figure 4.2-11)

When asked if teachers would want the necessary equipment would be purchased to work in the future, around two thirds voted in favour for it. (see Figure 4.2-12).

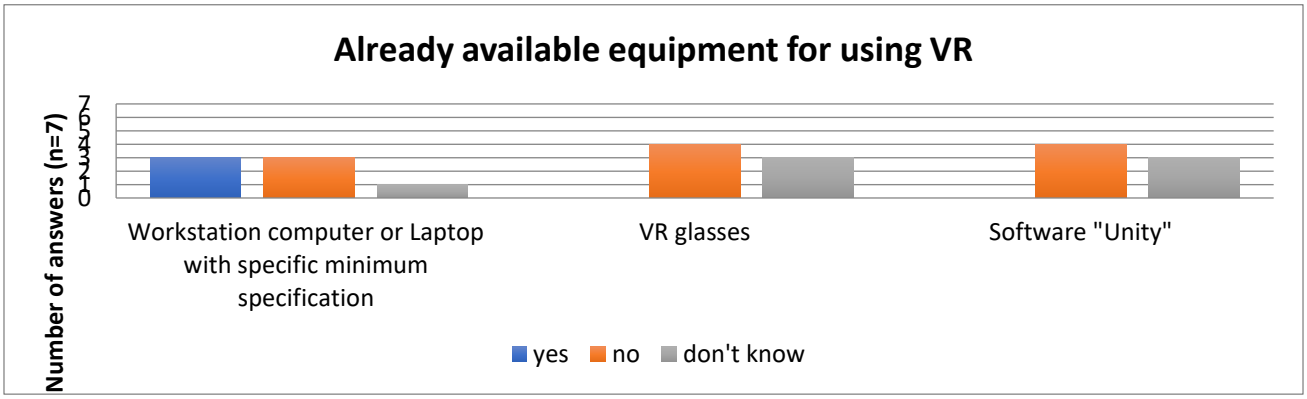


Figure 4.2-11: Already available equipment for using VR

A much more reserved or restrained picture was found in the results for the 360° videos. For example, the surveyed teachers consistently stated that they has not yet used this technology. Even as a subject of teaching this technique has not been discussed. With regard to the

existing equipment to use 360° videos, it shows a similar picture as in the information on VR technology. Thus, only a third admitted to possessing the necessary computers with the minimum specifications. Two thirds of respondents stated they are not available. None of the teachers has additional equipment required to use 360° videos (software and 360 ° camera). (see Figure 4.2-13). The majority of teachers also stated that they are not interested in obtaining the necessary equipment (see Figure 4.2-14).

Asked which technology teachers would ultimately prefer, they consistently chose VR technology (see Figure 4.2-15).

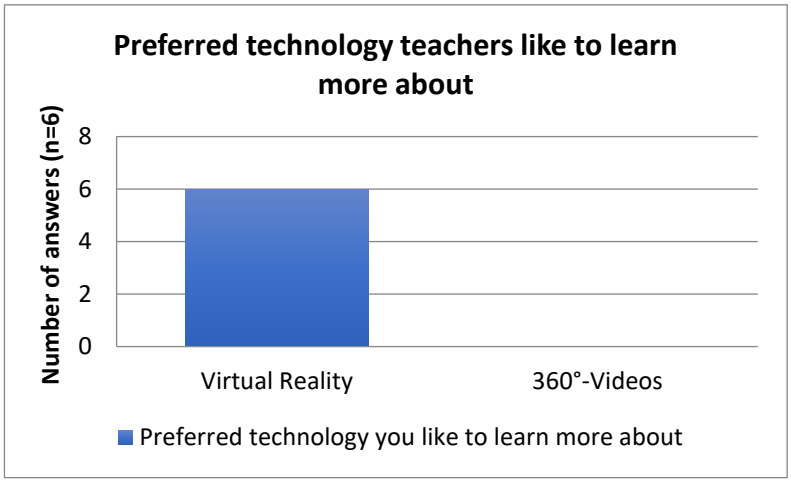


Figure 4.2-15: Technology preferred to learn more about.

2. Technical knowledge and training needs

The use of VR requires that teachers have a minimum of basic technical knowledge. Accordingly, the surveyed teachers should assess their knowledge of specific technologies and software applications that are needed at least for VR. Thus, teachers find that their own knowledge of how to use computers and common office applications is generally good, or at least acceptable. More than half of the teachers also have good to acceptable skills in working with specialized CAD programs used in computer-aided design and simulation of processes and operations in the metalworking sector. The respondents have no knowledge of special programming languages. Here, only slightly less than a third have basic knowledge. Concerning the software program "Unity", which is used for the creation of VR content, none of the interviewed teachers has any knowledge. (see Figure 4.2-16).

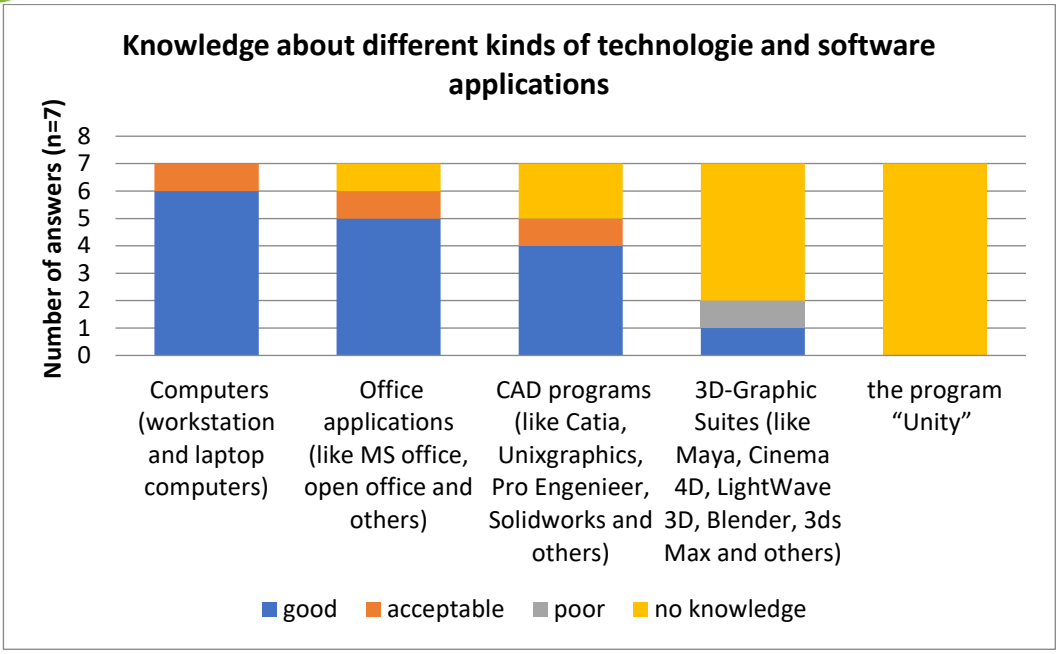


Figure 4.2-16: Knowledge about different kinds of technologies and software applications

In order to be able to impart VR to the students as part of the project as well as to enable those involved to be able to create their own VR content, instruction in a corresponding software program is indispensable. Also, given the limited experience of VR technology teachers, it is essential to present this technology in its capabilities and limitations as a whole, as well as to familiarize teachers with the appropriate hardware.

According to experts

Importance and development of Virtual Reality

First, the experts participating in the interviews should assess the relevance of VR for the ICT industry or the ICT-related work environment, and how they view the development of VR and its importance over the next five years. Overall, there were very different assessments by the experts. While one of the experts considers the importance of VR to be important to the profession, and this is also reflected in the assessment of VR's development over the next five years, attributing good development potential to VR technology, the other expert's assessment tends to fall negative, VR would have no current meaning for the professional field. The development of VR technology within the next five years would tend to be less favourable. (see Figure 4.3-1 & Figure 4.3-2)

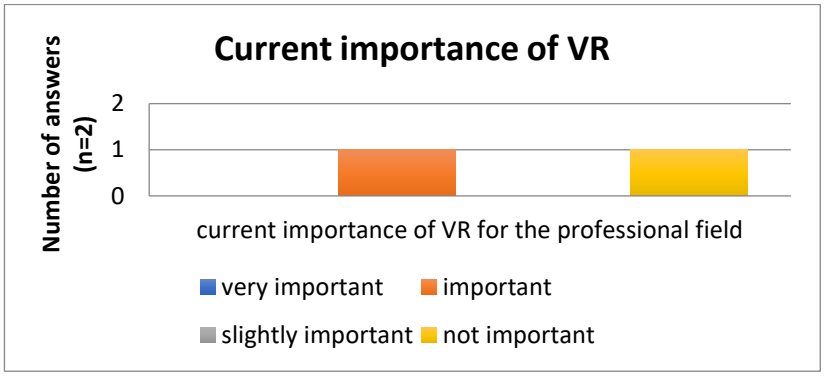


Figure 4.3-1: Current importance of VR in the professional field.

Development and implementation of Virtual Reality in the industry

Although one of the surveyed experts rated the development of VR technology more negative, both experts agree that VR could have a permanent place in the field of work in the future. The experts see the future of VR especially in the field of research and development in general and especially in the professional fields of medicine, biology, maintenance, design, mechanical design & development and the military. In contrast, the experts attach less importance to the use of VR in psychology and early elementary education. (see Table 4.3-1)

Table 4.3.-1: Importance of VR in different professional fields

Profession in which VR is of importance	Profession for which VR is of less importance
Medicine	Psychology
Biology	Education in elementary school
Maintenance	
Construction	
Mechanical design & development	
Military	
Research and Development in general	

In order to be prepared for dealing with VR, the experts were also asked whether they already consider a training or further education of employees on the topic of VR as necessary. For this the experts were again divided opinion. While one of the experts already sees the need for VR training as a given for company employees, the other interviewed expert does not yet see any need for action here. (see Figure 4.3-3)

Asked what types of training the experts would recommend in order to be prepared to deal with VR, the experts suggest that they take advantage of hardware training, programming skills, and psychological preparations. In addition, one of the interviewed experts also recommends the training of hand-eye coordination. (see Figure 4.3-4)

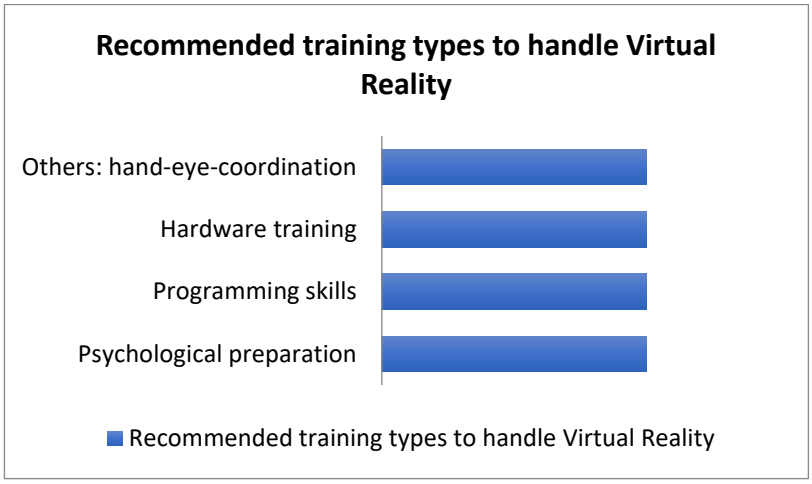


Figure 4.3-4: Recommended training types to handle VR

Development (or implementation) of Virtual Reality in the educational institutions

In addition to the professional orientation, the experts should also give their assessments on the importance and development of VR in education. Thus, the experts were first asked about their opinion on the infrastructural situation at educational institutions for the use of VR. Overall, the experts agreed that educational institutions have been poorly prepared to use VR so far. (see Figure 4.3-5)

Although the infrastructural equipment of VR at the educational facilities still has a lot of catching up to do, both experts consistently stated that VR should nonetheless be taught as a subject of instruction at schools or vocational training centers. (see Figure 4.3-6)

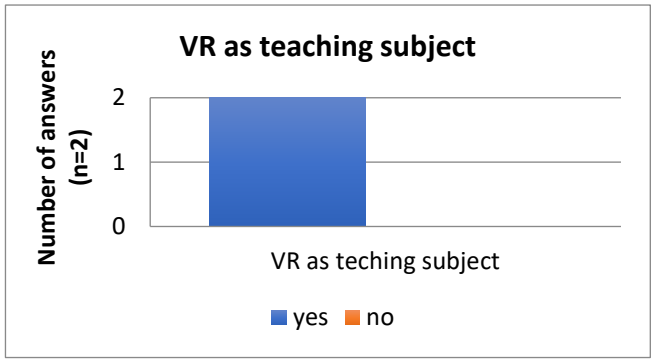


Figure 4.3-6: VR as teaching subject in educational institutions and VET centers.

Furthermore, the experts were asked to provide an assessment of the current state of knowledge of teachers and students regarding VR. Thus, the experts rate the knowledge of the teachers as well as the students in general as less good. However, while experts agree that teachers' existing knowledge is rather poor, statements about student learning are somewhat different. Thus, at least one of the respondents attests to the student at least acceptable knowledge of VR, while the other expert assesses this as rather poor. (see Figure 4.3-7)

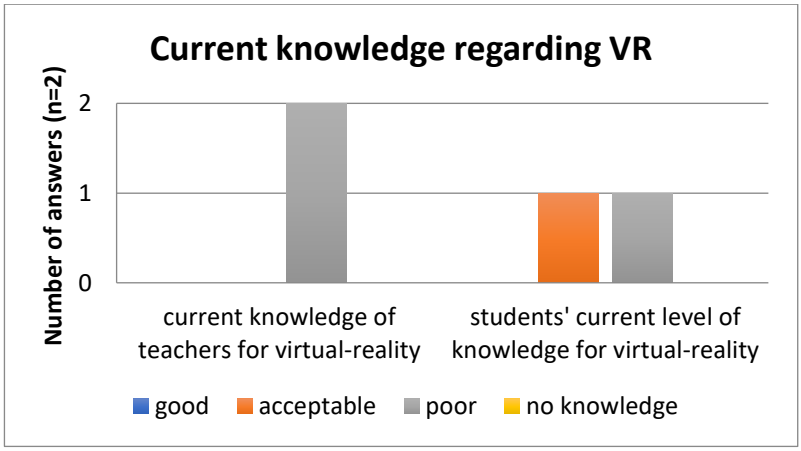


Figure 4.3-7: Current knowledge of teachers and students regarding VR.

When asked if they considered training for teachers on the topic of VR necessary, the respondents confirmed this question in a consistently positive way. (see Figure 4.3-8) Here, both experts recommend choosing special continuing education courses that focus on and convey special educational qualifications for virtual reality (see Figure 4.3-9).

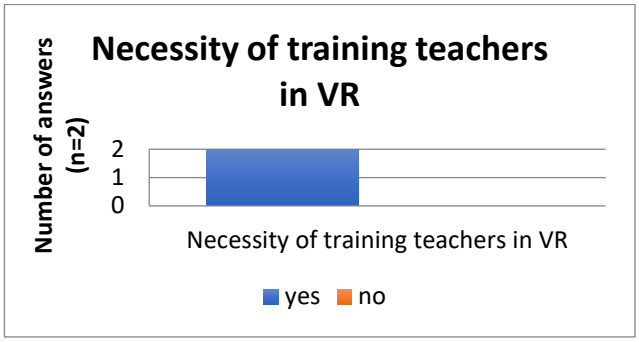


Figure 4.3-8: Necessity of training teachers in VR.

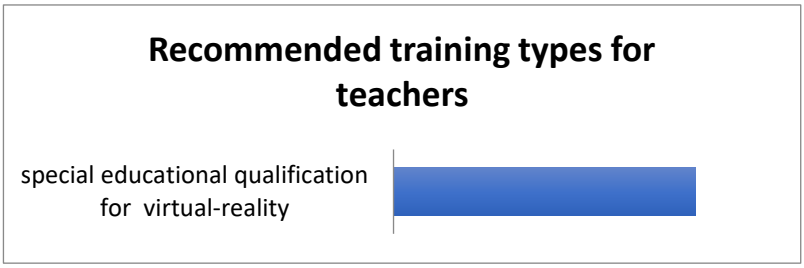


Figure 4.3-9: Recommended training types for teachers regarding VR.

Finally, in addition to teacher training, the experts were also asked to express their expectations regarding student training on VR. Here, the experts stated that as a result of such training, the students should first have gained general experience in the use of VR and, associated with this, also a technical background. In addition, they should also be able to describe different usage scenarios.

According to employers and companies

Status quo of implementing Virtual Reality

To get an impression of the perceived relevance to VR from the entrepreneurial side as well as information on efforts to integrate this technology in the future in their own companies, the employers participating in the interviews were asked about the current possibilities for using VR in the company as well at a time horizon for the introduction of VR.

With regard to the current possibilities for using VR and thus also the importance of this technology for coping with current work tasks, the interviewed employers stated that so far there are only few or no possibilities and therefore also requirements for the use of VR. In this sense, the employers taking part in the interviews find the use of VR in their work environment to be of little importance to unimportant. (see Figure 3.4-10)

Correspondingly, according to the interviewees, no or only very few jobs are currently influenced by the use of VR in the companies. (see Figure 3.4-11)

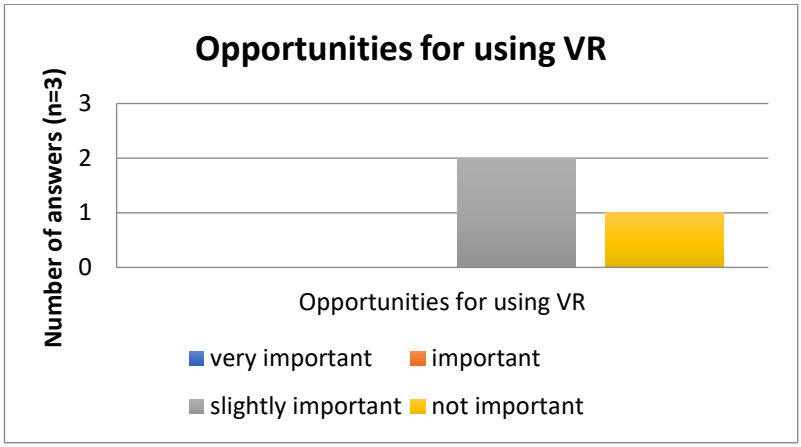


Figure 4.3-10: Opportunities for using VR in one's own company

Despite the fact that VR is currently not playing a key role in managing the work tasks, entrepreneurs were asked to introduce and use this technology in the future. It turns out that companies' plans are very different in this respect. One of the interviewees stated that they did not want to introduce this technology into the company in the future. By contrast, the other employers plan to introduce VR, but at the earliest in 1 to 2 years or in six years. (see Figure 4.3-12).

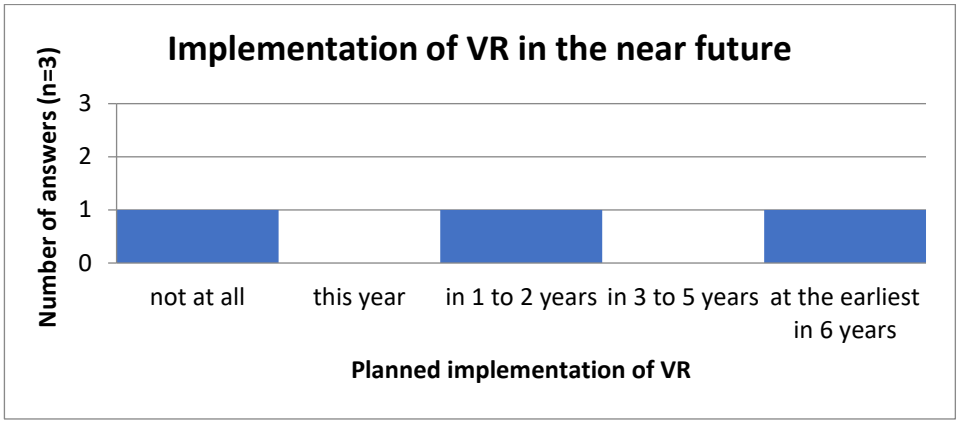


Figure 4.3-12: Implementation of VR in the near future.

The subdued euphoria and willingness to introduce VR from the surveyed companies is also partly reflected in the technical equipment of the companies. Thus, the majority of employers surveyed primarily work with normal workstation computers and laptops as well as 2D monitors. Only one employer already uses 3D monitors to cope with daily work requirements. Although all surveyed employers stated that there is a certain need for 3D visualization of data, none of the respondents see any absolute need to purchase or use VR-glasses specifically. (see Figure 4.3-13 & Figure 4.3-14)

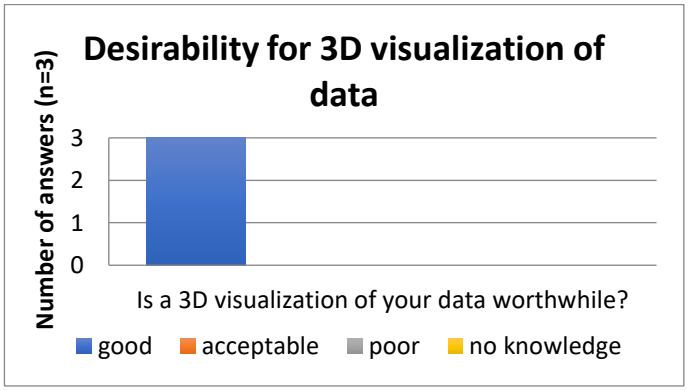


Figure 4.3-13: Desirability for 3D visualization of data.

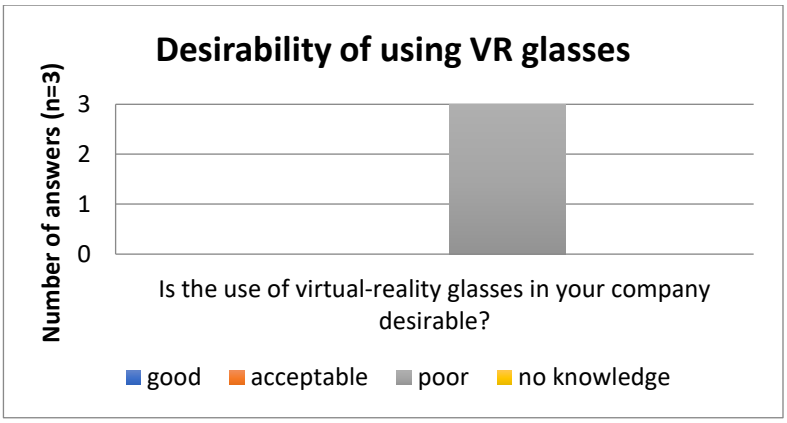


Figure 4.3-14: Desirability for using VR glasses.

Implementation of Virtual Reality in the educational institutions

Likewise the experts, the employers were also asked to express their opinion on the early implementation of VR as a subject or as a teaching tool in the educational and vocational training of young people. While the majority of surveyed employers currently have no need to anchor VR in educational institutions, at least one of the employers is in favour of it. In contrast, the majority of respondents already recognize the need for teachers to become familiar with the development and use of VR. (see Figure 4.3-15 & Figure 4.3-16)

In response to the question as to which training or which type of further training teachers should receive, the majority of employers recommend special educational qualifications for virtual reality as well as programming skills (see Figure 4.3-17).

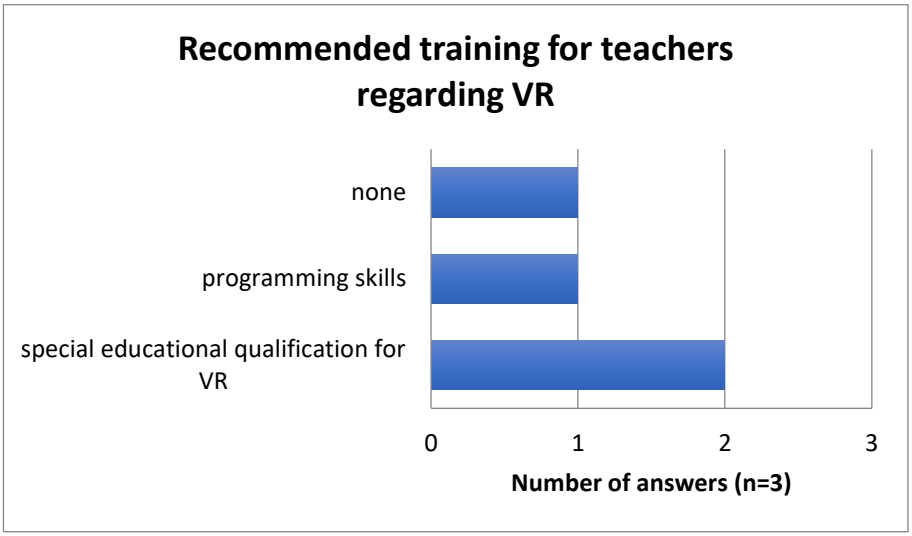


Figure 4.3-16: Recommended training for teachers regarding VR.

Similar to the experts, employers participating in the interview were also asked about their expectations for a training offer for VR students. In the opinion of the employer, the focus of such a training offer should be, in particular, on the imparting of knowledge about the handling of the hardware and the associated software. The interviewees also stated that, as a result of the course, students should be able to harness and use VR technology for their future work or future tasks.

3.2.4 Final thoughts on the implementation

From the survey of the target groups, it became clear that the use and integration of modern technologies (in the technology and metal sector focused here) is lagging behind. This concerns both education and business practice. While established technology such as computers and laptops as well as work-specific applications have a solid place in the education of young VET students and the business working context, new developments such as virtual reality and augmented reality find rarely access in these areas. Although the potential of these

technologies (Virtual reality and augmented reality) for teaching purposes as well as for future employment are recognized by teachers, employers and experts interviewed, yet a current and short term use is considered only conditionally.

Reasons against the integration of VR in VET education is the missing curricular anchoring of VR as a teaching subject on the one hand. On the other hand, teachers lack basic knowledge of VR technology (hardware and software) and programming skills to create VR content. They also have a hard time imagining possible scenarios for the training and teaching process. Moreover, it also lacks on appropriate technical equipment for using VR.

On the part of the employers, reasons for a momentarily reluctance for using VR is that coping with day-to-day work tasks and requirements is achieved with the technologies used to date. In addition, there is also a lack of concrete ideas for using VR to support the completion of work requirements.

For an approach to the subject of VR and also the embedment in the business practice employers as well as experts see mainly VET teachers and trainers in the duty to deal with this topic in the context of further education and in a second step to transfer this knowledge to their students. In this context employers and experts recommend a further education for teachers on topics such as “Hardware training, skills in programming VR content, hand-eye-coordination, as well as a basic pedagogical qualification for VR”.

Against the background of the results of survey and in preparation for the pilot phases, there is a need to familiarize teachers with the basic principles of VR technology (possibilities and limits). This also includes providing teachers with basic knowledge of creating VR content to enable them to include VR as a teaching subject in the classroom.

The teachers involved in the following pilot phases have the necessary basic knowledge in dealing with CAD programs.

Besides basic knowledge of VR technology and the creation of VR content, useful scenarios for practical use and ways of incorporating VR for teaching practice should also be addressed in order to overcome any potential inhibition of teachers regarding VR and encourage them to use this technology.

With reference to the training occupations "industrial mechanic", "cutting machine operator" and "mechatronics engineer" included in the project by EBG, the integration of VR is particularly suitable for the learning arenas (Lernfelder) and training area „assembling and disassembling of technical units and subunits“, „CAD, databases and network technology“ as well as „machine control and programming“. With the knowledge to create VR content teachers may be able to illustrate complex matters in an easy way to understand, such as the

movement and alteration of crystalline metal structures in the metalworking sector, power and energy flows in machinery and equipment as part of maintenance and servicing, or effects on hydraulic and pneumatic systems by changing various parameters, and so on.

3.2.5 Soft skills approach analysis in training titles

The growing internationalisation of products and services value chains requests several international (sectoral) qualifications. Current technological trends and skills demand are evolving rapidly at an aggregate industry level, the degree of changing skills requirements within individual job families and occupations is even more pronounced.

Employers underline beyond subject related knowledge the importance of the specific on-the-job skills with broader, transversal and transferable skills, since work is getting more complex and in flux and requires flexibility, initiative, creativity, the ability to take on many different tasks - and to learn from own doing and experience. Companies emphasize skills as being important in turning technical skills into economically productive ones that allow workers/students/apprentices to excel at effectively learning on the job.

From a skills perspective, the companies need to quickly anticipate the new production/consumer values, to translate them into product offerings and to become ever more knowledgeable about the processes involved in meeting these demands and the impact this may have on their employees' current skill sets and working practices. Transversal and cross sectoral competencies and skills, —such as persuasion, emotional intelligence and teaching others— are in higher demand across industries than narrow technical skills.

Content skills (which include ICT literacy and active learning), cognitive abilities (such as creativity and mathematical reasoning) and process skills (such as active listening, critical thinking, problem solving, teamwork) are growing part of the core skills requirements for many industries.

Most requested employment skills
communication, instructing, team working, decision making
self-direction and learning to learn skills: planning, task discretion, learning, adapting
connecting skills and knowledge from multiple sources and experiences; applying and understanding issues and positions contextually
Solving complex problems (problem-solving)
Skills regarding information and communication technologies

Employability should be established and supported through the acquisition of vocational competences. Identified in the framework curricula of the federal states (the Länder) for the

theoretical part of vocational education and training in the dual system, vocational competence is understood the willingness and ability of the individual to behave appropriately, thoughtfully and individually as well as socially responsible in professional, social and private situations (KMK, 2011, p. 14). The term vocational competence is differentiated or concretized by means of the following competence dimensions (KMK, 2011, p. 14):

Competence dimensions	description
Professional competence / professional skills	Willingness and ability, on the basis of technical knowledge and ability, to solve tasks and problems in a goal-oriented, appropriate, method-based and autonomous manner and also to evaluate the results. (KMK, 2011, p.14)
Self-competence	Willingness and ability, as an individual personality, to clarify, to think through and to evaluate developing opportunities, requirements and restrictions in family, work and public life and also to unfold one's own talents as well as to create and further develop life plans. Self-competence includes features such as independence, ability to criticize, self-confidence, reliability, sense of responsibility and duty. In particular, it also includes the development of well thought-out values and the self-determination of values
Social competence / social skills	Willingness and ability to live and shape social relationships capture and understand gratuities and tensions as well as rationally and responsibly communicate and deal with others. This includes, in particular, the development of social responsibility and solidarity.
Immanent of these three competence dimensions are in turn the following competences (KMK, 2011, p. 15):	
Methodical competence	Willingness and ability to treat tasks and problems purposeful and in a systematic procedure (for example by planning of individual process steps).
Communicative competence	Willingness and ability to understand and shape communicative situations. This includes recognize, understanding and presenting one's own intentions and needs as well as those of the partners.
Learning competence (learn to learn)	Willingness and ability to understand and evaluate information about facts and contexts independently and together with others, as well as to classify them into intellectual structures. Learning competence also includes the ability and willingness to develop learning techniques and learning strategies beyond the profession to use them for lifelong learning.

Methodology used for the analysis

For the selection of relevant skills for employment, that especially had to be answered and assessed by employers and experts regarding their importance for a future employment the

document *"EntreComp: The Entrepreneur-ship Competence Framework"* (see Bacigalupo, Kampylis, Punie & Van den Brande, 2016) published by the European commission was chosen. The competences defined in this document were used as the basis for the questionnaires, in particular for the experts and the employers. Therefore **experts and employers surveyed** had to assess the following competencies:

> *"Self- awareness and self-efficacy / Self-confidence", "Oral and written expression", "Planning and management /adaptation to change", "Motivation and perseverance/ tenacity/ resilience", "Mobilizing others/ Leadership", "Creativity", "Mobilization resources/ reaction", "Working with others/ interaction", "Vision/ Association".*

Each of these competencies was divided in several skill characteristics. In this way, the individual competencies could further define in terms of their characteristics and therefore gave the opportunity for a more specific assessment to their significance for employability and entrepreneurship.

While the chosen and integrated competencies in the questionnaire for experts and employers were more extensive, the selected competencies **to be assessed for the teacher's** questionnaire were integrated in a shortened form. Regarding the importance for employment and entrepreneurship the trainers should only give their assessments to the following competencies:

> *"Leadership", "Creativity", "Innovation", "Detection of needs & risks", "Reactivity ", "Solution oriented", "Perseverance", "Problem solving", "Flexibility", „Communication" and „Self confidence".*

These competencies weren't divided in individual skill characteristics. The shortened questioning for relevant competencies were chosen because the focus of the teacher interviews lay in the first place on gaining information about virtual reality.

According to teachers

Importance of transversal skills for the future employment and entrepreneurship in the ICT and technology sector

Teachers were asked which transversal (soft) skills they consider to be important for young adults to acquire to improve their chances for a future employment or entrepreneurship in the ICT sector as well as the IT related work environments.

The following figure shows the answers of five of the seven teachers surveyed. Two of the teachers provided no answer on this subject.

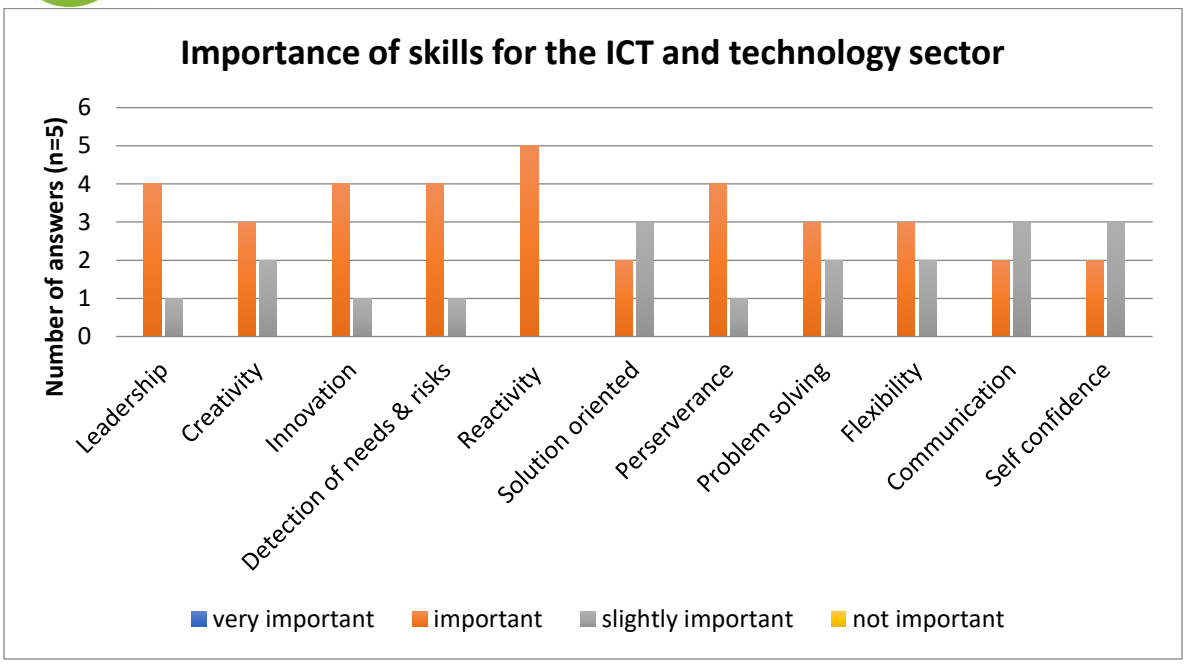


Figure 8.2-1: Importance of selected transversal skills for the ICT and technology sector.

All teachers that answered this question stated that ***"reactivity"*** is an important skill to improve the chances of a future employment for young people, closely followed by the skills *"leadership"*, *"innovation"* as well as the *"detection of need and risks"* and *"perseverance".*

The competences *"self-confidence"*, *"communication"* (with others) and *"solution oriented"* (behavior) were rated as less important.

Transversal skills as key factor for employment

The interviewed teachers where asked about the importance of transversal skills. Half the teachers acknowledge them to be key, while the other half disagreed with the statement.

Methods and tools for developing transversal skills of the students

Contrary to the fact that only a bit more than half of the teachers considered most of the skills listed above to be important, nearly three-quarters of the teachers surveyed confirmed that they are interested in learning about methods and tools which will help them to develop these transversal skills among their students.

According to experts

Relevant employment skills for the ICT and technology sector

In a whole the survey of experts regarding important skills for future employment showed no clear preference for one of the inquired competences or competence dimensions. Rather, experts estimated that each of the competencies as a whole is relatively significant for the future employability of young adults in the ICT and technology sector, and therefore students

should be able to master the skill characteristics assigned to the individual competences at a good or at least acceptable level.

A more precise examination of the competences and their assigned skill characteristics provided a differentiated image. Thus, the experts rated the following skill characteristics as more important than the others:[2]

- the ability to *"reflect need, aspirations and wants"* as part of the competence "self-awareness and self-efficacy / self-confidence"
- the ability to *"communicate in an oral and written way, so that everybody understands"* as part of the competence "oral and written expression"
- the ability to *"adapt to unforeseen changes"* as part of the competence "planning & management /adaption to changes"
- the ability to *"inspire and enthuse relevant stakeholders"* as part of the competence "mobilizing others / leadership"
- the ability to *"work together and cooperate with others to develop ideas and turn them into action"* as part of the competence "working with others / interaction"

In addition to the skill characteristics of the individual competencies, which were considered to be significant, there were also skills that the experts rated as less significant. These are listed below:[3]

- the ability to *„be patient and keep trying to achieve the group aim"* as part of the competences "motivation & perseverance/ tenacity/ resilience"
- the ability to *"demonstrate effective communication, persuasion, negotiation and leadership"* as part of the competence "mobilizing others/ leadership"
- the ability to *"develop several ideas and opportunities to create value, including better solutions to existing and new challenges"* as part of the competence "creativity"

The other skill characteristics of the individual competence dimensions were rated from one half of the experts surveyed as significant while the other half rated these skill characteristics as less significant. Therefore, a clear assessment regarding the importance of these skill characteristics cannot be made.

A summary of all assessed competence dimensions and their skill characteristics based of the employers' interview results shows the following table 8.3-1.

Table 8.3-1: Overview of the assessed competences and their skill characteristics based of the experts' interview results.

[2]The following skill characteristics were considered as important if all experts stated that this ability or skill should be mastered at a "good" level.

[3] The following skill characteristics were considered as less important if all experts stated that this ability or skill should be mastered at a "acceptable" level.

	Skills characteristics of the individual competences		
Competence	**As important rated skills [a]**	**As less important rated skills [b]**	**Inconsistent rated skills**
Self-awarness & self-efficacy / self-confidence	"reflect need, aspirations and wants"	/	„believe in one's own ability to influence the course of events despite of uncertainty", the "ability to identify and assess one's own strengths and weaknesses" as well as the "ability to identify and assess the strength and weaknesses of the group"
Oral & written expression	"communicate in an oral and written way, so that everybody understands"	/	/
planning & management /adaption to changes	"adapt to unforeseen changes"	/	"to set long-, medium- and short term goals" as well as „define priorities and action plans"
motivation & perseverance/ tenacity/ resilience	/	„be patient and keep trying to achieve the group aim"	"to be resilience under pressure, adversity and temporary failures", the "ability be patient and keep trying to achieve long term individual aim" and the "ability to turn ideas into action and satisfy his/her need to achieve"
Mobilizing others / leadership	"inspire and enthuse relevant stakeholders"	"demonstrate effective communication, persuasion, negotiation and leadership"	„to get the needed support to achieve valuable outcomes".
creativity	/	"develop several ideas and opportunities to create value, including better solutions to existing and new challenges"	"to combine knowledge and resources to achieve valuable effects" as well as the ability "to explore and experiment with innovative approaches"
Mobilization resources / reaction	/	/	„to get and manage the material, non-formal and digital resources needed to turn ideas into action", "to make the most of limited resources" as well as "to get and manage the competences needed at any stage, including technical, legal, tax and digital competences"
Working with others / interaction	"work together and cooperate with others to develop ideas and turn them into action"	/	„to network" and „to solve conflicts and face up to competition positively when necessary"
Vision / Association	/	/	„to imagine the future", „to develop a vision to turn ideas into reaction" as well as the ability "to visualize future scenarios to help guide effort and action"

a: A skill characteristic was rated as important when all or at least two out of the three respondents rated this characteristic with "good".

b: A skill characteristic was rated as less important when all or at least two out of the three respondents rated this characteristic with "acceptable" or "poor".

According to employers

Relevant employment skills for the ICT and technology sector

Like the survey of experts regarding relevant employment skills, the interviews with employers were also based on the competences and their skill characteristics defined in the document "EntreComp: The Entrepreneurship Competence Framework" (Bacigalupo, Kampylis, Punie & Van den Brande, 2016).

With the participation of three employers in the interviews, the result of the survey reveals a much clearer trend towards relevant and less relevant competences (including the skill characteristics defined under these competencies) for a future employment of young adults. In total it can be noted that on part of the employers surveyed especially the competences *„Planning and management / adaption to change“, „Motivation & perseverance/ tenacity/ resilience“* and *„Creativity*“ were rated as important.

In contrast, employers rated the competence dimension *"Mobilizing others / leadership"* as less important. Most respondents indicated that it would be sufficient for students to master at least an acceptable level for the skills bundled under this competence dimension.

At the end of the survey, the interviewed employers should state in specific which competences they consider most important for an employment in the ICT and technology sector and as well in the ICT-related working environment, independently of the previously inquired transversal competences and skill characteristics. Regarding this the employers stated that they consider the competences *„communication“, „flexibility“, „adaptability“* and *„motivation“ a*s particularly important.

The following table 8.4-1 provides a summary of all assessed competence dimensions and their skill characteristics based of the employers’ interview results.

Table 8.4-1: Overview of the assessed competences and their skill characteristics based of the employers' interview results.

	Skills characteristics of the individual competences		
Competence	**As important rated skills [a]**	**As less important rated skills [b]**	**Inconsistent rated skills**
Self-awarness & self-efficacy / self-confidence	"ability to identify and assess the strength and weaknesses of the group" and the "ability to reflect need, aspirations and wants"	„ability to identify and assess strengths and weaknesses"	"believe in own ability to influence the course of events, despite of uncertainty, setbacks and temporary failures"
Oral & written expression	/	/	"communicate in an oral and written way, so that everybody understands"
planning & management /adaption to changes	"ability to define priorities and action plans", "ability to set long-, medium- and short-term goals" as well as the "ability to adapt to unforeseen changes"	/	/
motivation & perseverance/ tenacity/ resilience	"ability to be resilience under pressure, adversity and temporary failures", "ability to be patient and keep trying to achieve the group aim", "ability be patient and keep trying to achieve long term individual aim" as well as the "ability to turn ideas into action and satisfy his/her need to achieve"	/	/
Mobilizing others / leadership	/	"ability to demonstrate effective communication, persuasion, negotiation and leadership", "ability to get the needed support to achieve valuable outcomes" as well as the "ability to inspire and enthuse relevant stakeholders"	/
creativity	"ability to combine knowledge and resources to achieve valuable effects", "ability to explore and experiment with innovative approaches" as well as the "ability to develop several ideas and opportunities to create value, including better solutions to existing and new challenges"	/	/
Mobilization resources / reaction	"ability to get and manage the competences needed at any stage, including technical, legal, tax and digital competences"	"ability to make the most of limited resources"	"ability to get and manage the material, non-formal and digital resources needed to turn ideas into action"
Working with others / interaction	"ability to work together an co-operate with others to develop ideas and turn them into action"	"ability to network"	"ability to solve conflicts and face up to competition positively when necessary"
Vision / Association	"ability to visualize future scenarios to help guide effort and action"	"ability to develop a vision to turn ideas into reaction"	"ability to imagine the future"

a: A skill characteristic was rated as important when all or at least two out of the three respondents rated this characteristic with "good".

b: A skill characteristic was rated as less important when all or at least two out of the three respondents rated this characteristic with "acceptable" or “poor”.

3.2.6 Final thoughts on the integrated itinerary

In Germany, the grounded experience in dual training and learning by doing methodologies show that the importance of transverse skills as key to adapting to different job placements have somehow been present. However, there is not specific experience on explicit training on these skills as an integrated part of the Vocational Training.

Experts, companies and teachers agree on the broad benefits that VR training would have for learning and employment purposes identifying the need of specific training on the topic for young adults. They all do agree as well, although differences in this point are wide, that mastering soft skills such as innovation, vision, planning and persistence would be a great asset to the professionals working on the field.

Thus, focusing on an integrated itinerary that leaves time for mastering both soft and technical skills come out as something needed.

3.3 Country report Estonia

3.3.1 Training titles analysis in VET and related to VR

VET offers in Estonia

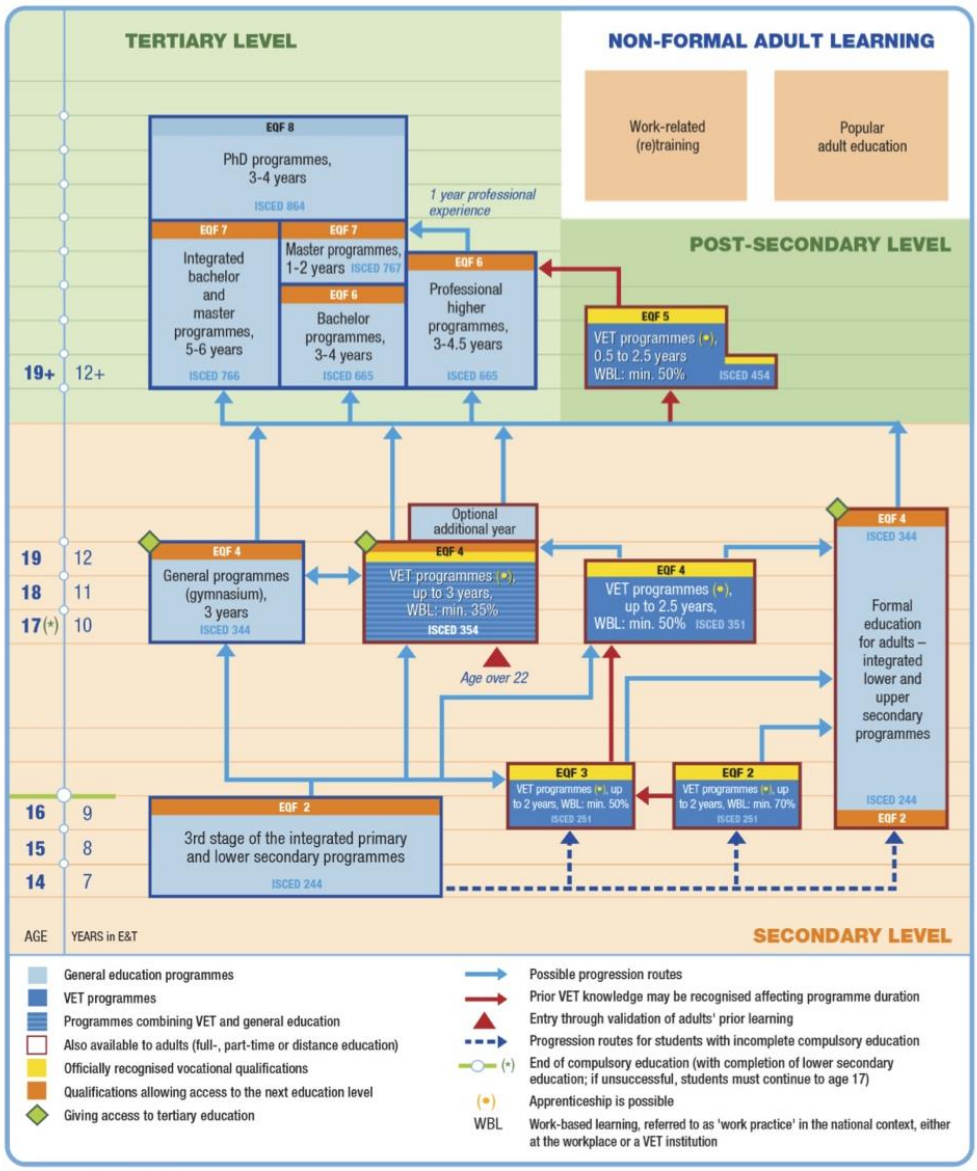
Vocational education serves the purpose of fostering the knowledge, skills and attitudes, occupational know-how and the social readiness required for working, participating in social life and in the lifelong learning process.

Vocational education system in Estonia is regulated by the Vocational Educational Institutions Act which provides the basis for the establishment, maintenance, transfer, reorganisation and closure of vocational educational institutions, as well as the foundation for the right to provide instruction, management, organisation of studies, state-commissioned education and financing, the rights and obligations of members of schools, and state supervision over the activities of schools.

In 2013, the parliament passed the Vocational Educational Institutions Act that fundamentally changed the regulation of the vocational education system. The most notable aspects are the following:

- Defining new categories of vocational training directly linked to the Estonian Qualifications Framework.
- Extensive use of outcome-based principles in the evaluation and establishing of qualification criteria for types of vocational training, curriculums and for personnel working in the teaching and pedagogical profession;
- Establishing the right to provide instruction;
- Defining and implementing the use of the new unit (Estonian vocational education credit points) for measuring study volumes.
- Uniform requirements for vocational training are regulated by the Vocational Education Standard.

Figure 11. **VET in the Estonian education and training system in 2017**



NB: ISCED-P 2011.
Source: Cedefop and ReferNet Estonia.

Curricula

Formal vocational training curricula is divided between national and school curricula.

National curricula form the blueprints for providing upper secondary vocational training. National curricula is implemented by regulations signed by the Minister of Education and Research.

School curricula is compiled for every individual vocation or profession that can be acquired at the school. The schools' formal study curricula (excluding vocational secondary education curricula) is compiled based on vocational education standards and associated vocational

standards. Vocational secondary education curricula will be formulated based on national curricula.

Vocational training curricula determine the following:

- The goals and tasks of vocational, specialised and occupational studies;
- Attainable learning outcomes;
- Links to the Estonian Qualifications Framework;
- Requirements for commencing and concluding studies;
- curricular modules and their volumes together with learning outcomes and evaluation criteria;
- Options and conditions for choosing modules;
- Especializad opportunities;
- Specific qualifications acquired during studies.

As of 2013, the volumes of vocational training will be calculated using Estonian vocational education credit points. Estonian vocational education credit point is the unit of calculation of study volume which indicates the estimated volume of student´s work necessary for the achievement of the learning outcomes described in the curriculum. One credit point corresponds to 26 hours spent by a student on studies upon the acquisition of skills and knowledge. A single study year in vocational training is equivalent to 60 credit points.

Vocational education institutions

Vocational education can be acquired either in vocational education or professional higher education institutions. At least one vocational education institution operates in every Estonian county. In the 2017/2018 academic year, there are 33 vocational educational institutions and 5 professional higher institutions active in Estonia that offer a range of 160 specialities.

Vocational education institutions are divided based on the ownership status into state, municipal and private institutions. Vocational education institutions operated by the Ministry of Education and Research are considered state schools, numbering a total of 26 institutions in the 2017/2018 academic year.

ICT training in Estonian VET

There are two professional standards for ICT competencies at EQF level 4 - IT-systems specialist and junior software developer. VET programs based on these standards are:

1) IT system specialist, initial VET programme (neljanda taseme kutseõpe, ISCED 351) leads to qualification at EQF level 4, 120 EKAP (credit points), 2 years.

2) IT system specialist, initial upper secondary VET programme (kutsekeskharidusõpe, ISCED 354) leads to qualification at EQF level 4, 180 EKAP (credit points), 3 years.
3) Junior software developer, initial VET programme (neljanda taseme kutseõpe, ISCED 351) leads to qualification at EQF level 4, 120 EKAP (credit points), 2 years.
4) IT system specialist, initial upper secondary VET programme (kutsekeskharidusõpe, ISCED 354) leads to qualification at EQF level 4, 180 EKAP (credit points), 3 years.

Completed basic education is a prerequisite to enrol in these programmes. The share of work practice (practical training at school, in-company practice) is at least 50% for 2-years programme, half of which takes place at school and half at enterprises.

Graduates from initial VET level 4 can enter the labour market or continue in upper secondary general education or a VET programme at ISCED level 354.

Three-years initial upper secondary VET programme give graduates access to higher education, provided the entry requirements are met. Higher education institutions may require passing State examinations (mathematics, foreign language and mother tongue) in addition to VET qualifications.

At the end of the programme, all graduates must pass final examinations; it is also possible to sit professional qualification examinations.

The volume of studies is 180 credits, including at least 60 credits of general education: 30 credits are the same for all programmes and 30 are tailored to the programme. The share of work practice (practical training at school and in-company practice) is at least 35%.

Kuressaare Ametikool has approximately 80 students per year studying on the level 4 programme junior software developer, both on 2-years and 3-years programmes.
Pilot training in VR/R takes place in two learning groups during schoolyear 2018/19.

Chosen VET Centre to implement the pilot
Kuressaare Ametikool (KAK) is an educational institute that provides initial and additional vocational training and retraining in wide area of specialties both for young people and adults.

To serve better the needs of the regional economy, KAK has strong ties with many local companies and Saaremaa labour market office.

Kuresaare Ametikool is providing initial vocational education on following fields: Design and handicraft, Building and construction, Information and communication technologies, Motor vehicles, Small craft and boat building, Materials (plastic, wood, metal), Care of the elderly

and of disabled adults, Child care, Hair and beauty services, Food processing, Hotel, restaurants and catering, Travel, tourism and leisure, Management and administration.

There are 800 regular students on upper and post-secondary level, but also around 800 adult students during a year on different courses. There are almost 115 staff members, including 60 teachers
Kuressaare Ametikool is subordinated to the Ministry of Education and Science.

3.3.2 Conclusions on the Implementation of Virtual Reality

The methodology used in this case is similar to the one used in other countries and based on:

- Questionnaires' development
- Experts' workshop
- Focus groups

This helped us to collect data regarding the following issues:

- Teachers' status quo of using media technologies and applications.
- Teachers' Status quo of using Virtual Reality
- Benefits of the integration of VR in different contexts
- Barriers in the integration of VR in different contexts

According to teachers

Teachers' Status quo of using media technologies and applications
In Estonia teachers use in their lessons usually traditional media technologies, such as workstation PCs, laptops, interactive whiteboards and television. Virtual reality technologies such as wearables, head-mounted displays or data glasses are not used. Cameras and tablets are rarely used, and 3D printers are not used at all.

In lessons Office programs (Word, Excel, PowerPoint), video platforms like YouTube and educational videos are regularly used. Also, information from the internet is often exploited. E-learning applications and web 2.0 is also occasionally used. Newer technology, such as digital learning games, communication applications (e.g. Skype, WhatsApp), learning apps, Virtual classrooms, 3D environments and simulations is less to be used.

Although the new technology is not widely used in classroom studies, yet teachers recognise the importance of such technology for the future. On the other hand, the more common technology like Office programs would still be important.

Teachers' Experience with Virtual Reality

Teachers who answered to this questionnaire have not used Virtual Reality in their private lives, but they can imagine using it their future teachings. The reasoning behind that is that VR is new and interesting concept. In their opinion it gives students the opportunity to try out various things which might peak their interest and motivate them. It was also stated that VR is the future of IT.

Curricular integration of VR

Three areas where the teachers would use VR in classroom are game design, graphic design and competences. They argued that students love playing video games and giving them the opportunity to do something game related in their studies should give them motivation. Also, as VR is the future it is important to give students the knowledge about that.

Benefits of integrating Virtual Reality

Teachers agree that with the usage of Virtual Reality technologies statements can be illustrated, more knowledge can be taught, and variety can be brought into the classroom. VR also helps to make discovery and team learning possible. On the other hand, teachers do not consider that the possibilities of independent work and individual learning with usage of Virtual Reality are so broad. Applying VR technologies to teaching might entail more technical problems. Additionally, more extensive preparation of the lessons is necessary and dealing with the topic becomes more time consuming.

Teachers acknowledge that there are plenty of benefits of using VR technologies in their classroom because it gives a more holistic learning experience and more senses of the student are addressed at the same time. Teachers agree that students can remember the content better and discover and understand connections more easily. It also helps students to develop realistic visual ideas and concepts. Using VR in teaching process could help students to improve their teamwork skills because they are better able to convince others about their ideas and more able to co-operate with each other to achieve defined goal. Teachers also rather agree that the usage of VR in the classroom helps with the motivation and creativity and improve confidence of the students.

Barriers for the integration of Virtual Reality

The biggest hurdle to overcome for using Virtual Reality more in classroom is financial because the cost of technical equipment and maintenance of the needed soft- and hardware is too expensive. Another aspect that teachers pointed out is that there is lack of suitable concepts of reasonable use of Virtual Reality and the development of such content is too complicated and expensive. Also, further training is needed because teachers do not have enough good ideas to integrate VR into their subject.

Technical knowledge and training needs

Teachers that participated in this questionnaire have good knowledge and ability to use computers, both workstation PCs and laptop computers, and office applications such as MS Office and open office. But their knowledge about CAD programs and 3D-Graphic suites is poor. Thus, they see that it is necessary to train themselves in VR.

3.3.3 Final thoughts on the implementation of the itinerary

All the teachers that participated in this survey considered VR as something very interesting, not only for the study plan but also for providing students with a new learning tool through visualizing different and more experimental scenarios. They also agree that students can remember the content better and discover and understand connections more easily if they can use virtual reality.

Overall they have no experience using or teaching VR and see this lack of training as well as the high cost of the equipment as obstacles towards its implementation in the classroom.

3.3.4 Soft Skills approach analysis

According to experts

Importance and development of Virtual Reality

Experts agree that the current use of Virtual Reality is important in their profession and the development of VR over the next 5 years is good. They also agree that current knowledge of VR for both students and teachers is poor. There is disagreement between experts for the situation of the infrastructure for VR in educational institutions. One expert has assessed the situation as acceptable and another as poor.

Development (or implementation) of Virtual Reality in the industry

Experts agree that Virtual Reality will be introduced at work in the future. There are wide range of possible occupations where VR could be introduced, but mostly it has to do with large scale data visualization and modelling. Experts' opinion is that all professions should be ready to embrace Virtual Reality in their working life and therefore employees should be trained for use and development of Virtual Reality. Experts agree that employees should be taught programming skills and should also get hardware training and psychological preparation to use VR technologies and applications.

Development (or implementation) of Virtual Reality in the educational institutions

As stated above, the experts rate the knowledge of students and teachers about Virtual Reality as poor. Therefore, they agree that VR should be taught at VET and teachers need trainings for development of Virtual Reality. Teachers should be taught programming skills and they

should also get special educational qualification for VR. In addition, they would need psychological preparation to use Virtual Reality technology in their classrooms.

According to employers and companies

The employers do not see high importance of VR in their business for the nearest future and therefore it is not affecting many jobs either. Nevertheless, it is in their opinion important to teach Virtual Reality already at VET. Reasoning behind this opinion is that even though there is narrow field where VR could be implemented at the present, teaching VR might rise wider interest for IT. That would benefit economy and society in general. It is also important to educate people in the areas that would get more relevant in the future, as VR certainly is.

Employers who participated in this questionnaire were small companies active in IT and software development. Currently they are using smartphones, workstation PCs and tablets in their companies. Employers assess their hardware suitability for graphic applications as acceptable. On the other hand, in their opinion their hardware is not suitable for 3D visualization as they are using 2D monitors and headsets. They also think that the use of virtual-reality glasses in their companies is not desirable.

Companies that participated in this survey are suing Linux, MS Office and Open Office operating systems. From computer programs they use MS Office, but not any CAD or 3D graphic suites.

Employers expect that persons working with or in Virtual Reality would have knowledge in C#, VB and .Net.

Relevant employment (soft) skills for the ICT sector

The most important soft skills for Virtual Reality and ICT are **high technical knowledge and ability to work individually**. **Empathy, ability to imagine** the future and ability to explore and experiment with **innovative approaches** were also mentioned.

COMPETENCE	RELEVANCE PERCEIVED BY EMPLOYERS AND COMPANIES
Self-awareness and self-efficacy / Self confidence	Employers and experts agree this are important characteristic in the context of Virtual Reality in the ICT sector. It is essential that people who work on the VR area have ability to reflect their needs and aspirations and identify and assess their strengths and weaknesses. It is also important to believe in their own ability to influence the course of events, despite of uncertainty, setbacks and temporary failures.

Oral and written expression	Experts and employers agree that individual's ability to communicate in an oral and written way so that everybody understands is important.
Planning and management / adaption to change	They value this as a vital ability. They agree that the ability to define priorities, set goal, both long- and short-term and to adopt to unforeseen changes is important in the context of Virtual Reality in the ICT sector.
Motivation and perseverance/ tenacity / resilience	It is important to be able to turn one's ideas into action and satisfy his/her need to achieve. It is also important to be patient and keep trying under pressure, adversity and under temporary failure to achieve long term individual and group aim.
Mobilizing others / Leadership	There is difference between opinions whether mobilizing others and leadership is important on not in the context of Virtual Reality in ICT sector.
Creativity	Both experts and employers agree that creativity is important skill. In the area of Virtual Reality, it is essential to be able to develop several ideas and opportunities to create value, including better solutions to existing and new challenges. It is also important to explore and experiment with innovative approaches and combine knowledge and resources to achieve valuable effects.
Mobilization resources / reaction	The ability to get and manage the material, non-formal and digital resources needed to turn ideas into action is important. It is also essential to make the most of limited resources and manage the competences needed.

3.3.5 Final thoughts on the implementation of the itinerary

Companies seem to not yet see the relevance of VR in the Estonian labour market, although they admit that training in this discipline may rise interest in the field. Experts on Virtual Reality, however, acknowledge that all professions should be ready to embrace Virtual Reality in their working life and therefore employees should be trained for use and development this technology that might be gaining importance in the next 5 years.

When it comes to soft skills, companies give more importance to aspects related to the technical knowledge and individual work leaving more personal and social skills in a second place.

3.4 Country report Lithuania

3.4.1 Training titles analysis in the country

Vocational Education and Training (VET) in Lithuania is oriented to people at various age and educational levels.

Primary vocational training is for people not younger than 14 years old who aims at getting a degree in professional education. The primary vocational education is provided at levels of (Qualifications and Vocational Education and Training Development Centre, 2018):

- Basic education (ISCED 2)
- Secondary education (ISCED 3)
- Post-secondary education (ISCED 4).

The Lithuanian education system consists of traditional general education (preschool, pre-primary, primary, lower and upper secondary education), initial VET at lower, upper and post-secondary levels, continuing VET and higher education.

In 2010, the government approved the national qualifications framework (LTQF) which has eight levels and covers all education sectors. At the same time, relating the LTQF to the European qualifications framework (EQF) was started. During this process, a direct correspondence between the eight LTQF and EQF levels was established. Referencing LTQF and EQF levels in this report is based on the theoretical comparison of learning outcomes in training programmes with LTQF and EQF level descriptors.

As stipulated in the Constitution of the Republic of Lithuania, education is compulsory until age 16. Compulsory education is completion of lower secondary education (ISCED level 2) and receiving a basic school certificate at EQF level 2, after which learners can choose upper secondary general education or VET programmes at ISCED level 3 (leading to an EQF level 3 vocational qualification) or to an EQF level 4 vocational qualification and an upper secondary leaving certificate, also known as mature, which allows higher education access. Exams for this certificate can either be administered by the State or by authorized schools.

The vocational education system covers initial and continuing vocational education and training. Learners, who did not finish lower secondary education can enter VET programmes Graduates of upper secondary programmes leading to a mature certificate can enter postsecondary training leading to EQF level 4 or higher education programmes leading to EQF level 6.

There are 74 vocational education and training institutions in Lithuania attended by over 45,000 learners. Vocational education and training institutions are being restructured as self-

governing institutions in order to attract businesses into their management and to bring vocational education and training closer to labour market demands.

The Ministry of Education and Science is responsible for the vocational education system. The Ministry is also the stakeholder of the majority of vocational education establishments. The majority of these are state budgetary institutions and some (20) are self-governing institutions. The main governing body of public vocational education and training establishments is the general meeting of stakeholders in which each stakeholder has one vote. Municipalities, social partners, and other stakeholders may participate in governing a vocational education establishment on equal terms with the main stakeholder (the Ministry of Education and Science, 2018).

Vocational schools provide both training leading to a qualification, and basic or secondary education. The duration of the programmes can be either two or three years depending on whether it is intended to provide basic or secondary education or whether it is adapted to persons with special needs. The duration of studies for learners who have already acquired secondary education is 1 to 2 years. Requirements for vocational education programmes are set out by the General Requirements and Vocational Education and Training Standards of the Ministry of Education and Science (Ministry of Education and Science, 2018). Vocational education programmes are developed by vocational education providers in cooperation with employers.

Using aid from EU Structural Funds, practical training centres for relevant branches of industry (sectoral practical training centres) equipped with modern facilities are being established at institutions of vocational education and training. It is planned to open a total of 42 sectoral practical training centres. They will be used not only by learners of vocational education and training institutions, but also by learners of universities and colleges. Well-equipped workshops will be open to everyone who wishes to enhance or acquire a profession. The sectoral practical training centre – is a vocational education and training institution or a division thereof providing initial and continuing vocational education and training services to all residents of Lithuania and equipped with modern practical training facilities for one or several branches of industry (Ministry of Education and Science, 2018).

VET programmes are registered in the Study, Training Programmes and Qualifications Register (Studijų, mokymo programų ir kvalifikacijų registras) and delivered as:

- Programmes at lower secondary education (ISCED 2 level) for learners having no lower secondary education;

• Programmes at upper secondary education (ISCED 3C level) for learners having completed lower secondary education and not seeking to complete upper secondary general education;

• Programmes at upper secondary education (ISCED 3A level) for learners seeking to complete upper secondary general education;

• Programmes at post-secondary education (ISCED 4 level) for learners having completed upper secondary general education.

Graduation from these programmes leads to the LTQF and EQF levels 3-4 qualifications. Average learning duration, qualification certificates and further learning and career opportunities are summarised in Table 1.

Table 1. VET programmes

	ISCED level	Average duration	Certificates awarded2	Further learning and career opportunities
VET programmes at lower secondary education level	ISCED 2	2-3 years	Qualification certificate; certificate of lower secondary education	Further training in VET institution or general education school; Access to labour market
VET programmes at upper secondary education level	ISCED 3C	2-3 years	VET diploma	Access to labour market
VET programmes at upper secondary education level	ISCED 3A	3 years	VET diploma; maturity certificate	Access to higher education/ college or university study programmes; Access to labour market
VET programmes at post-secondary education level	ISCED 4	1-1,5 years	VET diploma	Access to higher education/ college or university study programmes; Access to labour market

VET (labour market training) programmes	ISCED 2,3,4	Up to 1 year	Qualification certificate	Access to labour market

Those having no general lower or upper secondary education are provided with the opportunity to acquire it together with a vocational qualification. Thus VET programmes help to return early school leavers to the education and training system. After completing general upper secondary education and having gained a vocational qualification VET learner may continue their studies at higher education institutions. In recent years the conditions to apply to higher education were improved for successful VET graduates (Cerneckiene, 2014).

Related to VR

The education programmes in VET sector in Lithuania consists of two parts:

- The first part applies to VET schools in the country and defines the fields of professional activities, competences, teaching goals, and assessment provisions.
- The second part is optional and covers teaching methods, subject programmes, teaching aids, etc. The programme must include Entrepreneurship, Civil Protection, Ecology, *Information Technologies*, and Foreign Language for Specific Purposes as subjects or modules (Ministry of Education and Science, 2018).

VET sector in Lithuania are competence-based, with clearly defined training objectives. Since 2000 VET programmes are developed by VET providers, in cooperation with representatives of employers. When developing programmes, the providers follow VET standards and general requirements approved by the Minister for Education and Science.

Of the total time allocated to vocational subjects 60-70% should be devoted to practical training. Usually, practical training is conducted VET organizations. Training can also be part of a mobility programme. Environment, *IT,* foreign languages should be either integrated into the vocational subjects or developed as separate modules. The final assessment of qualifications is an independent one and is assessed by accredited competences assessment institutions.

Having completed the vocational education programme and passed examinations, learners obtain a vocational qualification. Learners who have completed their secondary education can continue their studies in colleges or universities. Successful graduates as well as graduates who have work experience according to their qualification receive additional points when entering institutions of higher education (Ministry of Education and Science, 2018).
Vocational education in Lithuania offers five specialization directions in ICT area.

Main training programmes chart

TRAINING	GENERAL DESCRIPTION	CONTENT OVERVIEW
Computer basic usage training programme	Designed for people with no experience in working with computer or lack the knowledge of computer literacy.	✓ Understanding of computer systematic block's hardware; ✓ Understanding of computer peripheral equipment; ✓ Understanding of computer systemic software; ✓ Understanding of Microsoft office package; ✓ Basic usage of internal network; ✓ Internet basics
Computer-aided-design operator programme	Designed to train computer-aided-design operators able to use various computer graphic design programs, design plane, spatial, colour compositions, draw drawings of wide range of applications, create graphic design for website, layout various objects.	✓ Operating document management programs; ✓ Using exterior computer devices; ✓ Conveying the colour, forming and materiality of objects; ✓ Portraying objects according to requirements; ✓ Constructing products; ✓ Visual marketing objects layout;
Computer technician of business enterprise	Aimed to train computer technicians who would be able to administer small and medium enterprises computer networks, install information technologies innovations and ensure successful practices of the enterprises.	✓ Installing and regulating technical equipment; ✓ Knowing the variety of software and its purpose; ✓ Working with information on the web and manage company's activity dissemination; ✓ Designing computer system and computer networks; ✓ Administrating computer operating systems and their networks;
Computer graphics design operator training programme	This training is aimed to train operators of computer graphic design and having previous basic education is a must to enrol in this program.	✓ Colour science; ✓ Advertising; ✓ Drawing; painting; design, creation and layout of business cards, adds, signs, and forms, ✓ Reading and processing of illustrations with software;
Java developer training programme	Aimed to provide the learner with skills to develop multilayer information systems, their components what are working on the web by using relational databases, Java programming language and technologies designed based on this language.	✓ Webpages design; ✓ Providing web content by using Linux service stations; ✓ Designing computer programs with Java technologies; ✓ Designing software that uses relational databases; ✓ Using Spring frame while programming complex systems; ✓ Using Linux software;

Chosen VET centers to implement the pilot

The pilot will be implemented in Smart Tech Academy and Young Computer Users School. In these educational institutions VET participants can attain additional vocational training which is exclusively oriented to information technology. After finishing courses in Smart Tech Academy and Young Computer Users School learners attain graduation certificate and can continue education in VET or higher education institutions.

Smart Tech Academy and Young Computer Users School are additional vocational IT training centres that aim to provide opportunity for Vilnius city, Vilnius region, Kaunas city and its region learners to gain qualified computer literacy skills. Smart Tech Academy and Young Computer Users School provide opportunity to familiarize with innovative learning technologies, strengthen gained skills while using advanced information technologies and appeal learners for further vocational training. Institutions' curriculum is designed in collaboration with Kaunas University of Technology. Traditional learning methods are being combined with modern methods, giving the opportunity for learners to participate in traditional practical lectures and also enrol to the alternative distance learning lectures. Smart Tech Academy and Young Computer Users School learners are taught by qualified lecturers who are responsible for implementing international computer literacy standards in curricula for computer basic usage, developing learners' skills of graphic or multilayer environment programs, programming knowledge, structural and logical thinking.

Currently Smart Tech Academy provides 8 programmes for IT vocational training.

- Programming I (computer literacy basics, content management systems, HTML basics, C# programming, programming of electronics);
- Programming II (programming (PHP, MySQL), object-oriented programming);
- Computer networks and cyber security (basic principles of computer networks, administration of computer networks, types of cyber-attacks and basics of network safety, information gathering about network, types of harmful codes and their usage in practice);
- Programming of electronics (smart things designing and programming, printed boards designing and production, image recognition technologies, GIT, ESP8266, ARM Cortex M0);
- WEB website design (HTML, CSS, MySQL, PHP, Javascript+ jQuery, object-oriented programing, Symphony 3);
- Graphic design (visualization of idea, composition of sketch and drawing, designing the prototype);
- Programming with mobile devices, robots (Android devices programming basics, user interface, main components of APPs, designing APPs, exploitation of device accessories).

Young Computer Users School offer:

- Programming Python
- Programming C++
- Programming C#
- Programming with mobile devices
- Robotics

At the present moment in Smart Tech Academy training centre virtual reality is being used as a promotional and stimulating tool for learners to illustrate where programming can be used and how technologies might develop in the future. Smart Tech Academy coordinator is willing to integrate virtual reality in several programmes more as a learning tool which could facilitate more experiential learning. New training program *Unity* is in the plans to be developed, this training program would incorporate virtual reality as a learning tool, however it is very hard to find lecturers who could design learning objects for virtual reality and conclude new curricular.

Young Computer Users School also own virtual reality equipment, however it is being used as a tool. Institution has the potential to implement virtual reality as a learning subject, however its teachers lack time and other resources to prepare new subject and create learning material for students. For these reasons Smart Tech Academy and Young Computer Users School were chosen to implement the pilot in.

3.4.2 Implementation of Virtual Reality

Teachers' status quo of using media technologies and applications.
The results of the analysis in Information and Communication Technologies sector in Lithuania, reveals that teachers and trainers are interested to have training program, based on virtual reality, as well as integrations of video, voice, animation and learning objects.

Robotics
Schools are facing the problems of offering enough robots for all learners and, at the same time, giving continuous assistance and supervision in order to help the learners avoid accidents to themselves and to the robots. This dilemma can be better handled if some sort of specific Robot Simulation package is used.
The use of a VR approach to implementing robot simulators could be very training effective.

Programming
Virtual reality is a false environment created with the help of software, and the user experiences it in such a way that he/she believes it as a real world. In virtual reality instead of jus simple viewing a screen in front of the user, 3D worlds interact. When the user is in a virtual reality world, he/she starts to believe that this world is real. When the user is moving, whole virtual reality world is moving together by making you interactive.

Python is the simplest language of programming for beginners. It is the open source language, in other words- free. It is a flexible, dynamic, and functional programming language. It is easy to understand Python language, so users can easily express their needs and wants in couple lines of code. When using Python, virtual reality creates an isolated environment. It means that all projects have their own dependencies. Python language has its unique and interesting packages which allow the user to create a project in virtual reality quickly. Learners who are studying programming in vocational education and training institutions may program their environment for games. For example, they can create an educational game and then learn from it.

3.4.3 Conclusions on the implementation

According to teachers

Three teachers from Smart Tech Academy vocational training centre in Lithuania submitted their answers to the questionnaire.

All three teachers reported that they are teaching learners in the classrooms in the institution they are employed. During the classes they are most often using methods of individual work and lecture. Less used methods of the teachers are partner work, team work, and project work.

Teachers' status quo of using media technologies and applications

All teachers are familiar with and are able to handle basic instruments for operating informational technologies - computers (workstation and laptop computers) and Office applications such as MS office, open office. Only one teacher is able to handle more complex programs such as CAD programs, 3D-Graphic suites and the program "Unity" others lack skills and knowledge of applications usage.

During the classes most teachers are orientated to supporting learners in exploring and experimenting with different approaches to reach a defined goal and in developing their ideas and turning into action. Since Smart Tech Academy is orientated to IT skill training learning it is very closely related to technology usage. Regularly used media technologies during the lessons are workstation PC or laptop with internet access and projector. Occasionally teachers incorporate smartphones, tablets, television and video, cameras. In Smart Tech Academy currently teachers are not using wearable technology, interactive whiteboard. Most importantly, virtual reality or augmented reality is not yet incorporated in learning process to supplement learning material.

Mostly, lessons are based on operating office programs and internet offered information. Teachers use various kinds of applications, but not as a main learning means incorporate learning apps, communication applications, digital learning games, , simulations, educational

videos, Web 2.0, electronic exercise. 3D-environments are used very rarely or altogether not used at all.

Teachers' Status quo of using Virtual Reality

Experience with Virtual Reality

Two of questioned teachers have already used VR and occasionally teach learners of Smart Tech Academy about it. One teacher introduced learners to VR and the beginning of its content development, another teacher introduced learners to VR principles of operation in this way learners were familiarized with new technology concepts.

Two teachers of three are willing to teach VR in the occupation that they are currently teaching, because it is "like any other technology and should be taught", also learners like it and VR can serve as "opportunity to get interested in them and other things" like programming.

Curricular integration of VR

As Smart Tech Academy is IT orientated vocational training center, VR would be used not as supplementary measure, but could be integrated entirely into learning curricula and even taught as a separate programme. As teachers assert, they would like to "teach the whole development process of VR programs" or VR might by used for teaching "games programming". Moreover, there was stated opinion that VR is a very broad technology which "can be applied in teaching any subject" and provide a chance for learners to "try out their own creations".

Smart Tech Academy already owns workstation computer to run VR, VR glasses and software "Unity", however it is lacking concluded curricula and prepared learning objects to use it as a teaching measure.

Benefits of integrating Virtual Reality

VR is seen by the Smart Tech Academy teachers as a tool to illustrate matters, bring variety into class, enable discovery learning, teach more knowledge. Opinions distinguished in the matters of teaching becoming less effective, if it will implement more individual or team work, reduce conversations between teachers and learners, extend preparation of the lesson.

VR help develop learners' ability to convince others of their own abilities, openness to experiment with new approaches in order to achieve defined goal, creativeness in developing solutions for complex problems, attainment of more confidence in their own abilities, bigger motivation during classes, incorporate all senses of the learners as Smart Tech Academy teachers think. Educators agree that teaching VR is important because it might increase employers interest and demand of learners who have knowledge about VR also these skills contribute in developing specific capability that will become more important in the future in occupational fields learners are studying.

Barriers for the integration of Virtual Reality

However, to fully integrate VR in the learning process few obstacles will have to be overcame. Teachers are concerned about the high price of VR technical equipment and technical problems that might occur. However Smart Tech Academy already has acquired VR equipment and all technical problems can be resolved by IT administrator who maintain all equipment in Academy. More challenging difficulty could be the lack of further training of teachers also they feel shortage of appropriate courses and contents to teach through VR.

Technical knowledge and training needs

In order for Smart Tech Teachers to be able to integrate VR in learning, they would use training that introduce them to „VR technology, its' devices, VR program creation and content development", concerning the VR integration in learning process, methods, material that could be used.

According to experts

Importance and development of Virtual Reality

Experts state that, VR is going to develop rapidly over the next 5 years, however current infrastructure in education cannot satisfy changing needs of labour market and requirements for future employees. At present, teachers are do not have necessary skills to implement virtual reality in learning process and therefore learners' current level of knowledge for virtual-reality is poor.

Development (or implementation) of Virtual Reality in the industry

Virtual reality in the future might be incorporated in various occupation fields, experts suggest that it could be "health, sports, education, training, ..."and "Medicine, military, entertainment, real estate occupations, secondary & higher education, probably fashion, tourism". Virtual reality can affect almost all labour market, as one of the expert predicts: "I don't see professions where VR could not be used (VR can be used at very least in teaching these professions)".

Experts suggest that employees should be trained to use VR hardware and be introduced to its psychological impact as "VR in the near future will be as usable as web browser" however, „serious VR development should be left for professionals".

Development (or implementation) of Virtual Reality in the educational institutions

Same suggestions are applied to educators. They should receive VR training and gain at least main knowledge of VR usage, "…but it should not be mandatory. Teachers should be at least experienced users" also it "depends whether VR applications benefit learning process and there are not that many educational VR applications" teachers should be introduced with "special educational qualification for virtual-reality" and most importantly "…teachers should know how to use VR so it is not detrimental for health".

According to companies

Status quo of implementing Virtual Reality

Two business representatives from IT/ media and game development fields who are already thinking of implementing virtual reality were questioned. Currently smartphones, Workstation PCs, notebooks, tablets are used in the companies as work tools. All hardware is suitable for VR implementation, visualizing data this is why in one company VR is already being used and in other it will be started to use in 1-2 years. In these companies opportunity to use virtual reality is important.

Training needs of employees for handling Virtual Reality

Virtual reality mostly affects employees of companies that participated in survey working in IT and development departments. Employees are requested to be able to use Linus or MS Windows operating system. Advantage is to be able to operate CAD programs Blender, GIMP, Inkscape. Furthermore it is required of them to use at least one of programming languages: C, C++, C#, Python, GLSL.

3.4.4. Final thoughts on the implementation

Virtual reality is rapidly improving technology which is being used in more and more spheres in everyday and work environment. Exactly the same virtual reality enters education by providing opportunity for learners to learn experientially. Even though there is a need to incorporate virtual reality in learning process and use it as a tool, education because of limited resources and slowly altered policies has not incorporated virtual reality in teaching practice yet. VET sector is not an exception.

Conducted research allows to make an assumption that VET teachers, especially those who are teaching subjects related to IT, would be interested in incorporating virtual reality in their subject curricular. However, they encounter difficulties because of the price of virtual reality devices and their maintenance also they lack proper training and contents, learning objects to be able to take advantage of virtual reality.

3.4.5 Soft skills approach analysis in training titles

Skills already detected as relevant for the ICT sector (according previous studies, tools, projects, experiences within the VET centres).

Regarding vocational subjects, the legislation clearly states that key competences should be integrated into VET curricula together with professional competences[4]. In the area of

[4] Ministry of Education and Science (2015). Lietuvos Respublikos 2015 m. kovo 23 d. švietimo ir mokslo ministro įsakymas Nr. V-232 „Dėl švietimo ir mokslo ministro 2010 m. rugpjūčio 27 d. įsakymo Nr. V-1435 „Dėl formaliojo profesinio mokymo programų rengimo ir įteisinimo tvarkos aprašo patvirtinimo“ pakeitimo“ [Legal

vocational subjects key competences are covered by individual subjects or modules or are integrated in several vocational subjects (modules). They are also acquired through work-based learning (15 weeks in three-year programme). There are eight key competences (https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CONSIL:ST_9009_2018_INIT&from=EN):

1. Literacy competence;
2. Multilingual competence;
3. Mathematical competence and competence in science, technology and engineering;
4. Digital competence;
5. Personal, social and learning to learn competence;
6. Citizenship competence;
7. Entrepreneurship competence;
8. Cultural awareness and expression competence.

Most relevant competence for ICT sector is **digital competence**. Digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking. Essential knowledge, skills and attitudes related to this competence Individuals should understand how digital technologies can support communication, creativity and innovation, and be aware of their opportunities, limitations, effects and risks. They should understand the general principles, mechanisms and logic underlying evolving digital technologies and know the basic function and use of different devices, software, and networks. Individuals should take a critical approach to the validity, reliability and impact of information and data made available by digital means and be aware of the legal and ethical principles involved in engaging with digital technologies. Individuals should be able to use digital technologies to support their active citizenship and social inclusion, collaboration with others, and creativity towards personal, social or commercial goals. Skills include the ability to use, access, filter, evaluate, create, program and share digital content. Individuals should be able to manage and protect information, content, data, and digital identities, as well as recognize and effectively engage with software, devices, artificial intelligence or robots. Engagement with digital technologies and content requires a reflective and critical, yet curious, open-minded and forward-looking attitude to their evolution. It also requires an ethical, safe and responsible approach to the use of these tools.

act regarding VET programmes development and approval]. Teisės aktų registras [Register of legal acts], 2015-03-25, Nr. 4247. https://www.e-tar.lt/portal/lt/legalAct/b1d753f0d2b511e4bcd1a882e9a189f1

Table 2. Digital competence integration to VET (Kvalifikacijų ir profesinio mokymo plėtros centras, 2016b):

The acquisition of the key competence at upper secondary VET is promoted at national/regional level	Yes
How is it promoted?	
National/regional policy document(s)	Action plan for introducing information and communication technologies into general education and VET for 2014-16 (2014) aims at developing digital training opportunities for VET teachers, developing accessible digital curricula and infrastructure, assuring the development of integrated digital literacy competences through learning all subjects and to provide opportunities for more targeted and individualized training of information technologies.
National/regional law(s), regulation(s)	Generic education plan is approved annually by the Minister for education. It specifies that learners may choose information technologies course as a general education subject (69 hours or 138 hours for extended course in two years). Occupational information technologies (70 hours in 3 years) is an obligatory subject in the area of general VET subjects that may be offered as an individual subject or integrated into other subjects. Generic upper secondary education programme for teaching information technologies has been approved by the order of the Minister for education in 2011 together with generic programmes for other subjects.
National/regional curricula, standards and qualifications	Digital competence is developed through general education and VET subjects of information technologies. Content of occupational information technologies course differs by school. For example, learners practice working with Microsoft Word, Excel and other software, apply them in their subject area, develop websites, etc. Generally speaking, digital competence is a part of everyday learning where learners search information, use IT to accomplish tasks, prepare and present their projects. At the moment, when developing new training materials, a priority is given to digital resources. In 2012-15, training tools packages (online training tools and digital manuals) were designed for 14 educational areas and disseminated to VET providers to assist their training process.

Training VET teachers trainers	For their professional development purposes teachers (both, general education and VET teachers) participate in various continuing professional development (CPD) courses offered by accredited teachers training institutions (universities, municipal education institutions). The choice of courses mainly depends on school's and teacher's priorities and needs.
Centralized assessment of the key competence in VET	The assessment of digital competence is done through the examinations in information technologies. Questions to assess digital competences may be also integrated into final qualification exam.
Other instruments (e.g. ways of working, teaching/learning methods)	No

Implementation of new technologies and development of digital skills are very important in VET sector. Due to the needs of employers. VET institutions have to prepare learners for labour marked and provide them with skills necessary to start working right after finishing VET.

According to companies and experts

Methodological approach

Two business (related to VR) representatives and two experts who are working with VR implementation in education have evaluated the importance of different abilities that are important in the context of virtual reality in the ICT sector. Each statement was evaluated from good to poor. Numeric values were assigned to evaluation good – 3, acceptable – 2, poor – 1, no knowledge – 0. In this case, the lower the rating of each statement is, the lesser is its importance according to the questioned entrepreneurs and experts.

Relevant employment (soft) skills for the ICT sector

COMPETENCE	RELEVANCE PERCEIVED BY EMPLOYERS AND COMPANIES
Self-awareness and self-efficacy / Self confidence	Self-awareness and self-efficacy seem more as an individual feature which is expressed through understanding your own capabilities.
Oral and written expression	Oral ability in ICT sector was evaluated as important. Learners should be able to communicate properly in an oral and written way, so that everybody understands this is seen as important capability of ICT employees.
Planning and management / adaption to change	All statements belonging to planning and management / adaptation to change ability were estimated as important to ICT. Entrepreneurs and experts shared the opinion to this question.
Motivation and perseverance/ tenacity / resilience	In virtual reality context ability to motive oneself and remain persistent/ tenant/ resilient was evaluated as important To set up long term goals, plan one's future and purposefully try to reach the goal could be considered to be more important for personal growth, however in the business the ability to implement ideas and take action is the momentum of success.
Mobilizing others / Leadership	The opinion of entrepreneurs and experts coincided on the matter that ability to get the needed support to achieve valuable outcomes and the ability to demonstrate effective communication, persuasion, negotiation and leadership is important in ICT field
Creativity	As can be seen in the tables above creativity as an ability in virtual reality context was estimated as not very important for ICT specialists.
Mobilization resources / reaction	Entrepreneurs exclude ability to get and manage the material, non-formal and digital resources needed to turn ideas into action and ability to make the most of limited resources as important for persons who are seeking to become ICT specialists. In experts' opinion mobilization resources and reaction is acceptable but not very crucial ability to attain for career in ICT field.
Working with others	All ICT field specialists should be able to work with others and generate ideas in team, however entrepreneurs emphasize this ability as more important than experts. Their approach collides on seeing the ability to work together with co-workers, develop ideas and implement them as the most important aspect on the ability to interact in working environment.

Vision / association	Vision / association ability was not assessed as very important to develop for ICT specialist who specialize in virtual reality application. Entrepreneurs and experts distinguish ability to imagine the future as more useful in ICT field, however experts do not agree that ability to develop a vision into reaction and to visualize future scenarios to help guide effort and action should also be developed.

Most important skill regarding Virtual Reality

To sum up, questioned experts and entrepreneurs suggested that the most important skills regarding virtual reality are planning and management which includes the ability to adapt to unforeseen changes, to set long-, medium- and short-term goals, to define priorities and action plans, basically it is an ability that describes employee's capability to manage his own work, develop his skills and independently accomplish entrusted tasks.

Also as very important skill is an ability to communicate competent in an oral and written way, so that everybody understands. ICT specialists usually are working with a group of colleagues, to develop all virtual reality aspect for one person is particularly impossible or it would take too much time and in the end produced technology would not respond to market needs anymore.

This is why it is very important to be able to communicate not just with same sphere specialists but also with associates from other departments.

3.1.6 Final thoughts on the integrated itinerary

A big GAP of IT specialist is in Lithuania, VET sector requires new specialist able to have a virtual job and to have skills related with the digitalization of the content and to work online in team and to create new actions based on new ICT. According to the needs analysis following skills are most required by Lithuanian labour market:

1. The ability to get and manage the material, non-formal and digital resources needed to turn ideas into action (programming, robotic).
2. The ability to work together and co-operate with others to develop ideas and turn them into action (programming, robotic).

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Annex1 Questionnaire teachers

Questionnaire for Teachers

Please select your country: ☐ Spain ☐ Estonia ☐ Lithuania ☐ Germany

Branch (please select): ☐ ICT-Branch ☐ Technical Branch

1. Personal information

1.1 Which occupation (or rather occupational field) do you teach and on which level?

Occupation (occupational field) _____

EQF - level* _____

* Explanation: EQF (European Qualification Framework) = reference framework to translate and compare between different national qualification systems and their level.
Based on your National Qualification Framework, which EQF-level you assign the occupational degree in which you are teaching?

1.2 Which contents do you teach?

_____

1.3 How long are you teaching these contents already?

☐ less than a year (0-1 year)
☐ 1-5 years
☐ 6 years – 10 years
☐ more than 10 years

1.4 What kind of professional qualification do you have? (Please state your highest qualification)

☐ Vocational training
☐ Master certification
☐ Bachelor degree
☐ Master degree
☐ Diploma degree
☐ PhD
☐ Another qualification: _____

1.5 In which format teaching and learning is taking place?

☐ Classroom teaching in the institution
☐ Classroom teaching with occasional E-Learning phases
☐ Online Courses with occasional face-to-face lectures
☐ Online Courses (distance learning), no classroom teaching

1.6 Which of the following working and social methods do you use during your teaching?

	Usage			
	regularly (1)	occasion -ally (2)	very rare (3)	never (4)
Individual work	☐	☐	☐	☐
Partner work	☐	☐	☐	☐
Team work	☐	☐	☐	☐
Lecture	☐	☐	☐	☐
Project work	☐	☐	☐	☐

1.7 Please state your knowledge and ability to handle the following technologies and technology applications.

My knowledge and ability to use ...	good (1)	accep- table (2)	poor (3)	No know- ledge (4)
Computers (workstation and laptop computers) is…	☐	☐	☐	☐
Office applications (like MS office, open office and others) is…	☐	☐	☐	☐
CAD programs (like Catia, Unixgraphics, Pro Engenieer, Solidworks and others) is…	☐	☐	☐	☐
3D-Graphic Suites (like Maya, Cinema 4D, LightWave 3D, Blender, 3ds Max and others) is…	☐	☐	☐	☐
Programming languages (like Assemembly Language, C, C++, C#; Java, LISP, Phyton, Perl, Ruby, Swift) is	☐	☐	☐	☐
The 3D model program “Unity” is	☐	☐	☐	☐

1.8a) How you would rate the knowledge of your students about “3D Model Programs”?

☐ good ☐acceptable ☐ poor ☐ no knowledge ☐ don’t know

1.8b) Which 3D model program you use with your students?

1.9a) How you would rate the knowledge of your students about “Design Programs”?

☐ good ☐acceptable ☐ poor ☐ no knowledge ☐ don’t know

1.9b) Which “Design Program” you use with your students?

1.10a) How you would rate the knowledge of your students about “Programming Languages”?
(e.g. Assemembly Language, C, C++, C#; Java, LISP, Phyton, Perl, Ruby, Swift)

☐ good ☐acceptable ☐ poor ☐ no knowledge ☐ don’t know

1.10b) Which “Programming Language” you use with your students?

1.11 Please rate the following statements

	The Statement			
Please rate the following statements if they apply to you.	applies fully (1)	rather applies (2)	applies to a lesser extent (3)	does not aplly at all(4)
I support students to stay motivated to achieve a defined goal.	☐	☐	☐	☐
I support students to develop the ability to stay focused and keep their patience to achieve long term goals.	☐	☐	☐	☐
I use strategies which help to increase the resilience of the students to perform under pressure.	☐	☐	☐	☐
I am able to assess the strength and weaknesses of the students and support them to develop their strength further	☐	☐	☐	☐
I support students to deal with temporary failures and show them how to learn from these failures.	☐	☐	☐	☐
I support students to gain strategies to differentiate between important and less important things and define priorities.	☐	☐	☐	☐
I support students to gain strategies to adapt to unexpected changes and actively deal with it.	☐	☐	☐	☐
I am able to inspire students for different subjects and encourage them to continue when they show interest for specific contents.	☐	☐	☐	☐
I support students to develop their own ideas and turn them into action.	☐	☐	☐	☐
I support students to explore and experiment with different approaches to reach a defined goal.	☐	☐	☐	☐
I support students to work together and cooperate with each other to develop ideas and achieve defined goals.	☐	☐	☐	☐

1.12 How do you train or support students to gain transversal skills like motivation and resilience, self confidence, adaptability, leadership, creativity, teamwork and communication.

1.13 Which of the following skills and attitudes do you think are especially important in the ICT and technology sector?

	The Statement			
Please rate the following statements if they apply to you.	very important (1)	important (2)	slightly important (3)	not important (4)
Leadership, initiative and decision taking.	☐	☐	☐	☐
Creativity	☐	☐	☐	☐
Innovation	☐	☐	☐	☐
Detection of needs and risk	☐	☐	☐	☐
Reactivity	☐	☐	☐	☐
Solution oriented	☐	☐	☐	☐
Perseverance	☐	☐	☐	☐
Problem solving	☐	☐	☐	☐
Flexibility	☐	☐	☐	☐

Communication	☐	☐	☐	☐
Self-confidence	☐	☐	☐	☐

2. General Information about the use of media technologies in teaching (technology enhanced learning)

2. 1 Which of the following media technologies do you currently use for your lessons?

	Usage			
	regularly (1)	occasion-ally (2)	very rarely (3)	never (4)
Workstation PC with internet access	☐	☐	☐	☐
Scanner	☐	☐	☐	☐
Laptop computer with internet access	☐	☐	☐	☐
Projector	☐	☐	☐	☐
Interactive whiteboard	☐	☐	☐	☐
Cameras	☐	☐	☐	☐
Television and Video	☐	☐	☐	☐
Overhead projector	☐	☐	☐	☐
Smartphone	☐	☐	☐	☐
Tablet	☐	☐	☐	☐
3D printer	☐	☐	☐	☐
Wearables	☐	☐	☐	☐
Head-Mounted Display (used for Virtual Reality)	☐	☐	☐	☐
Data glasses (used for Augmented Reality)	☐	☐	☐	☐
Others technologies (please state):	☐	☐	☐	☐

2.2 Which of the following media applications* do you currently use for your lessons?
* Media applications = Programs, formats or concepts that apply to teaching and learning with media technologies

	Usage			
	regularly (1)	occasion-ally (2)	very rarely (3)	never (4)
Information offered at the internet (e.g. manuals and films)	☐	☐	☐	☐
e-learning applications (WBT und CBT)	☐	☐	☐	☐
Learning platforms / learning management systems (e.g. Moodle)	☐	☐	☐	☐
Educational videos	☐	☐	☐	☐
Video platforms / video offers (e.g. YouTube)	☐	☐	☐	☐
CD-ROMs / DVDs	☐	☐	☐	☐
Electronic exercise and test systems (e.g. software to test learning outcomes)	☐	☐	☐	☐
Web 2.0 (Wikis, web blogs, online forums, podcasts)	☐	☐	☐	☐
Simulations	☐	☐	☐	☐
3D-Environments (Virtual Reality environments)	☐	☐	☐	☐

Digital learning games (e.g serious games)	☐	☐	☐	☐
Virtual classrooms	☐	☐	☐	☐
MOOCs (Massive Open Online Courses)	☐	☐	☐	☐
Communication applications (e.g. Skype, WhatsApp)	☐	☐	☐	☐
Control software from the manufacturer	☐	☐	☐	☐
Learning apps	☐	☐	☐	☐
Office programs (e.g. Word, Excel, PowerPoint)	☐	☐	☐	☐

2.3 How do you assess the future meaning and importance of the following listed learning formats and applications?

	Future importance			
	very important (1)	important (2)	slightly important (3)	not important (4)
Online courses (distance learning)	☐	☐	☐	☐
Information offered at the internet (e.g. manuals and films)	☐	☐	☐	☐
e-learning applications (WBT und CBT)	☐	☐	☐	☐
Learning platforms / learning management systems (e.g. Moodle)	☐	☐	☐	☐
Educational videos	☐	☐	☐	☐
Video platforms / video offers (e.g. YouTube)	☐	☐	☐	☐
Electronic exercise and test systems (e.g. software to test learning outcomes)	☐	☐	☐	☐
Web 2.0 (e.g. wikis, web blogs, online forums, podcasts)	☐	☐	☐	☐
Simulations	☐	☐	☐	☐
3D-Environments (Virtual Reality environments)	☐	☐	☐	☐
Digital learning games (e.g. serious games)	☐	☐	☐	☐
Virtual classrooms	☐	☐	☐	☐
MOOCs (Massive Open Online Courses)	☐	☐	☐	☐
Communication applications (e.g. Skype, WhatsApp)	☐	☐	☐	☐
Control software from the manufacturer	☐	☐	☐	☐
Learning apps	☐	☐	☐	☐
Office programs (e.g. Word, Excel, PowerPoint)	☐	☐	☐	☐

3. Information about teaching and using Virtual Reality

3.1 Have you already used Virtual Reality (VR) privately?

☐ yes
☐ no
☐ don't know

3.2 Have you already taught VR?

☐ yes, once only
☐ yes, occasionally

} continue with question 3.2.a.1

☐ yes, regularly
☐ no
☐ don't know } continue with question 3.2.b.1

If you answered with YES:

3.2.a.1) For which content of the curriculum do you teach VR or you already taught VR? Please name the content.

3.2.a.2) For which EQF level do you teach VR or you already taught VR?

3.2.a.3) Why are you teaching VR for this content or taught VR for this content?

(continue with question 3.3)

If you answered with NO:

3.2.b.1) Can you imagine teaching VR in the occupation that you are teaching?

☐ yes continue with question 3.2.b.1.1
☐ no
☐ don't know } continue with question 3.3

3.2.b.1.1) Please substantiate your decision with a short explanation.

3.2.b.1.2) For which content of the curriculum you would teach VR? Please name the content.

3

3.3 Have you already used VR in class?

☐ yes, once only
☐ yes, occasionally
☐ yes, regularly
} continue with question 3.3.a.1

☐ no
☐ don't know
} continue with question 3.3.b.1

If you answered with YES:

3.3.a.1) For which content of the curriculum do you use VR or you already used VR? Please name the content.

3.3.a.2) For which EQF level do you use VR or you already used VR?

3.3.a.3) Why are you using VR for this content or have used VR for this content?

(continue with question 3.4)

If you answered with NO:

3.3.b.1) Can you imagine using VR in the occupation that you are teaching?

☐ yes — continue with question 3.3.b.1.1
☐ no
☐ don't know
} continue with question 3.4

3.3.b.1.1) Please substantiate your decision with a short explanation.

3.3.b.1.2) For which content of the curriculum you would use VR? Please name the content and the EQF-Level for which you would use VR.

3.3.b.1.3) Why would you use VR for this content?

(continue with question 3.4)

3.4 Teaching and using VR, special system requirements are needed.
Which of the following equipment you already have, to be able to work with VR?

	Available		
	yes (1)	no (2)	don't know (3)
Workstation computer or Laptop (with the minimum specification of Intel®Core™Processor i7-7700HQ-4C/8T; 8GB DDR4 2133 SODIMM; SSD 240GB M.2 550MB/s; Nvidia Geforce GTX 1070 8GB GDDR5)	☐	☐	☐
VR glasses	☐	☐	☐
Software „Unity“	☐	☐	☐

3.5 If you don’t have the listed equipment (with the minimum specifications) or parts of the listed equipment, would you be interested to buy it to be able to work with VR?

☐ yes
☐ no please give a short explanation:_____

3.6 360°-Video* is an alternative format to VR.
Have you already taught or used 360°-Videos? (More than one answer is possible)

*) 360°-Videos are recordings where a view in every direction is recorded at the same time with a special camera. During the playback the viewer has control of the viewing direction like a panorama.

☐ yes, I taught about 360°-Videos
☐ yes, I used 360°-Videos
☐ no, I didn’t taught about 360°-Videos
☐ no, I didn’t used 360°-Videos

3.7 Teaching and using 360°-Videos, special system requirements are needed.
Which of the following equipment you already have, to be able to work with 360°-Videos?

	Available		
	yes (1)	no (2)	don't know (3)
Workstation computer or Laptop (with the minimum specification of Multi-core processor compatible with 64-bit applications; Microsoft Windows7 with Service Pack1 (64 bits), Windos8.1 (64 bits) or Windows10 (64 bits); 8GB RAM (16GB or more are recommended); 8GB of free hard drive space; minimum graphic card requirement: GTX960 or above)	☐	☐	☐
Software for 360°-Videos	☐	☐	☐
360°-camera	☐	☐	☐

3.8 If you don't have the listed equipment (with the minimum specifications) or parts of the listed equipment, would you be interested to buy it to be able to work with 360°-Videos?

☐ yes
☐ no please give a short explanation:_____

3.9 If you have to choose, what kind of technology you would prefer to know more about?

☐ Virtual Reality (VR)
☐ 360°-Videos

3.10 Please state your opinion about the following statements regarding the usage of VR in the occupation you are teaching.

	Agreement			
With the usage of Virtual Reality ….	agree (1)	rather agree (2)	rather disagree (3)	disagree (4)
matters can be illustrated	☐	☐	☐	☐
variety is brought into the class	☐	☐	☐	☐
independent work is made possible.	☐	☐	☐	☐
individual learning is made possible.	☐	☐	☐	☐
discovery learning is made possible.	☐	☐	☐	☐
learning in a team is made possible.	☐	☐	☐	☐
more knowledge can be taught.	☐	☐	☐	☐
conversations between students and teachers are reduced or even destroyed	☐	☐	☐	☐
the proportion of direct experiences will become less.	☐	☐	☐	☐
dealing with a topic becomes more time consuming.	☐	☐	☐	☐
teaching becomes less effecive.	☐	☐	☐	☐
a more extensive preparation of the lessons is necessary.	☐	☐	☐	☐
more technical problems araise.	☐	☐	☐	☐

3.7 Please state your opinion about the following statements regarding the usage of VR.

	Agreement			
With the usage of Virtual Reality ….	agree (1)	rather agree (2)	rather disagree (3)	disagree (4)
Students are able to remember the contents better.	☐	☐	☐	☐
Students are able to discover and understand content connections more easily.	☐	☐	☐	☐
more senses of the students are addressed.	☐	☐	☐	☐
a more holistic learning experience for students is made possible.	☐	☐	☐	☐

it will be easier for students to develop realistic visual ideas and concepts.	☐	☐	☐	☐
Students become tempted to superficiality.	☐	☐	☐	☐
Students are more motivated during the lesson.	☐	☐	☐	☐
Students are able to face new challenges and changes more easily and adapt to them.	☐	☐	☐	☐
Students gain more confidence in their own abilities and more open to face new challenges and tasks.	☐	☐	☐	☐
Students are more creative in developing solutions for complex problems.	☐	☐	☐	☐
Students are more open to experiment with new approaches to achieve a defined goal.	☐	☐	☐	☐
Students are better able to convince others of their own ideas.	☐	☐	☐	☐
Students are more able to cooperate with others to achieve s defined goal.	☐	☐	☐	☐

3.8 Please state your opinion about the following statements regarding learning VR in your occupation and occupational field.

	Agreement			
With the knowledge about VR…	agree (1)	rather agree (2)	rather disagree (3)	disagree (4)
it is easier for these students to get a job or a job offer after the apprenticeship has been completed.	☐	☐	☐	☐
these students are more interesting for future employers and demanded due to the special knowledge of VR.	☐	☐	☐	☐
these students will have better opportunities at the labour market in general, not just in the branch they achieved their degree but also in other branches.	☐	☐	☐	☐
these students are less threatened by unemployment even in economically difficult times.	☐	☐	☐	☐
these students gain a specific capability that will become more important in the future in these occupational field.	☐	☐	☐	☐

3. 9 What challenges and difficulties do you see in connection with the use and training of virtual reality? Please rate the following statements.

	Agreement			
	agree (1)	rather agree (2)	rather disagree (3)	disagree (4)
The costs for the technical equipment (hard- & software) are too high.	☐	☐	☐	☐
The maintenance of the specific devices and applications is too expensive.	☐	☐	☐	☐
It lacks a specific contact person who is entrusted with the task.	☐	☐	☐	☐

Suitable concepts for the reasonable use of VR are missing so far.	☐	☐	☐	☐
Appropriate contents to use VR are still missing so far.	☐	☐	☐	☐
The development of VR content is too complicated.	☐	☐	☐	☐
The development and purchasing contents for VR is too expensive.	☐	☐	☐	☐
I have no ideas how to integrate VR in class.	☐	☐	☐	☐
My daily tasks do not allow me to deal with VR in detail.	☐	☐	☐	☐
Teaching and using VR isn't necessary because VR isn't integrated as a learning topic in the curriculum.	☐	☐	☐	☐
In order to use and teach VR, further training is needed.	☐	☐	☐	☐
Appropriate courses to teach VR are still missing so far.	☐	☐	☐	☐

3.10 What expectations do you have for a training course on VR?

3.11 Do you think the development of transversal competences for employment and entrepreneurship of your students would be key for them to achieve a work?

☐ yes
☐ no please give a short explanation:_____

3.12 Would you be interesting in learning in your lessons, tools, resources and methodologies to integrate the development of these competences in your students?

☐ yes
☐ no please give a short explanation:_____

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Questionnaire for employers

1. Company information

1.1 In which industry is your company active?

1.2 How many IT jobs are there in your company?

- ☐ 0
- ☐ 1 - 10
- ☐ 10 - 20
- ☐ 20 - 50
- ☐ 50 -100
- ☐ more than 100

2. IT Hardware

2.1 What kind of hardware are you using currently in your company?

- ☐ no
- ☐ Smartphone
- ☐ Workstation PC
- ☐ Notebook
- ☐ Tablet
- ☐ Another Hardware:

Is your...	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
Hardware suitable for graphics applications?	☐	☐	☐	☐

2.2 What kind of peripheral hardware are you using currently in your company?

2.2.1 Graphic representation

- ☐ 2D monitor
- ☐ 3D monitor
- ☐ virtual-reality glasses
- ☐ Another graphic representation:

Assesment of hardware regarding VR	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
Is the hardware suitable for visualizing data?	☐	☐	☐	☐
Iis a 3D visualization of your data worthwhile?	☐	☐	☐	☐
Is the use of virtual-reality glasses in your company desirable?	☐	☐	☐	☐

2.2.2 What kind of peripheral audio playback hardware are you using currently in your company?

☐ Headset
☐ Speaker
☐ Another audio playback: _____

2.3 What kind of software are you using currently in your company?

2.3.1 used operating system

☐ Linux
☐ MS Windows
☐ Open Office
☐ Another operating system: _____

2.3.2 Computer programs used - Office applications

☐ no
☐ MS Office
☐ Mac OS
☐ Another Office application: _____

2.3.3 Computer programs used - CAD

☐ no
☐ Catia
☐ Unixgraphics
☐ ProEngenieer
☐ Soldidworks
☐ Another CAD: _____

2.3.4 Computer programs used - 3D-Grafiksuites

☐ no
☐ Maya
☐ Cinema 4D
☐ LightWave 3D
☐ Blender
☐ 3ds Max

☐ Another 3D-Grafiksuite:

2.4 Which programming languages are expected from your employees that are working or will be potentially working with or in VR?

☐ no
☐ Assembly Language
☐ C
☐ C++
☐ C#
☐ Java
☐ LISP
☐ Python
☐ Perl
☐ Ruby
☐ Perl
☐ Swift
☐ Another programming language:

3. Planning for the future

3.1 Opportunities for using virtual-reality in your business

	Future importance				
	very important (1)	important (2)	slightly important (3)	not impoprtant (4)	don't know (4)
Opportunities for using virtual-reality in your business	☐	☐	☐	☐	☐

3.2 How many jobs were affected?

☐ 0
☐ 1 - 5
☐ 6- 10
☐ 11 - 20
☐ more than 20

3.3 In which departments?

3.4 When do you plan to use virtual-reality?

- ☐ not at all
- ☐ this year
- ☐ in 1 to 2 years
- ☐ in 3 to 5 years
- ☐ at the earliest in 6 years

3.5 What would be the main departments affected in your company?

4. Questions about virtual-reality in educational institutions

4.1 Should virtual-reality already be taught at VET?

- ☐ no
- ☐ yes
- ☐ Comments:

4.2 Should teachers be trained for development with virtual-reality?

- ☐ no
- ☐ yes
- ☐ Comments:

4.4 What type of training should teachers receive?

- ☐ none
- ☐ programming skills
- ☐ special educational qualification for virtual-reality
- ☐ Other:

5. Soft Skills

How important are they for you in the context of virtual reality in the ICT sector?

Self- awareness and self-efficacy / Self-confidence	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to reflect on needs, aspirations and wants is …	☐	☐	☐	☐
The ability to identify and assess strengths and weaknesses is…	☐	☐	☐	☐
The ability to identify and assess the strengths and weaknesses of the group is…	☐	☐	☐	☐
The believe in own ability to influence the course of events, despite of uncertainty, setbacks and temporary failures is…	☐	☐	☐	☐

Oral and written expression	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to communicate competent in an oral and written way, so that everybody understands is …	☐	☐	☐	☐

Planning and management /adaptation to change)	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to adapt to unforeseen changes is …	☐	☐	☐	☐
The ability to set long-, medium- and short-term goals is…	☐	☐	☐	☐
The ability to define priorities and action plans is…	☐	☐	☐	☐

Motivation and perseverance/ tenacity/ resilience	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to turn ideas into action and satisfy his/her need to achieve is …	☐	☐	☐	☐
The ability be patient and keep trying to achieve long term individual aim is…	☐	☐	☐	☐
The ability to be patient and keep trying to achieve the group aim is…	☐	☐	☐	☐
The ability to be resilience under pressure, adversity and temporary failures is…	☐	☐	☐	☐

Mobilizing others/ Leadership	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to inspire and enthuse relevant stakeholders is …	☐	☐	☐	☐
The ability to get the needed support to achieve valuable outcomes is…	☐	☐	☐	☐
The ability to demonstrate effective communication, persuasion, negotiation and leadership is…	☐	☐	☐	☐

Creativity	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to develop several ideas and opportunities to create value, including better solutions to existing and new challenges is…	☐	☐	☐	☐
The ability to explore and experiment with innovative approaches is…	☐	☐	☐	☐
The ability to combine knowledge and resources to achieve valuable effects is…	☐	☐	☐	☐

Mobilization resources/ reaction	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to get and manage the material, non-formal and digital resources needed to turn ideas into action is …	☐	☐	☐	☐
The ability to make the most of limited resources is …	☐	☐	☐	☐
The ability to get and manage the competences needed at any stage, including technical, legal, tax and digital competences is…	☐	☐	☐	☐

Working with others/ interaction	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to work together an co-operate with others to develop ideas and turn them into action is…	☐	☐	☐	☐
The ability to network is …	☐	☐	☐	☐
The ability to solve conflicts and face up to competition positively when necessary is…	☐	☐	☐	☐

Vision/ Association	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to imagine the future is …	☐	☐	☐	☐
The ability to develop a vision to turn ideas into reaction is …	☐	☐	☐	☐
The ability to visualize future scenarios to help guide effort and action is…	☐	☐	☐	☐

What are the most important soft skills they consider for VR/ICT?

What are your expectations for training VET students in VR?

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Annex 3 Questionnaire experts

Questionnaire for experts on virtual reality

1. Questions about the company

1.1 In which Fields of application is your company active?

1.2 How many years does your company have experience already using virtual-reality?

- ☐ 0
- ☐ 1 - 5
- ☐ 6 - 10
- ☐ more than 10

1.3 In which department do you work?

1.4. General questions

General questions	very important (1)	important (2)	slightly important (3)	not impoprtant (4)	don't know (4)
How important do you think the current use of virtual-reality in your profession?	☐	☐	☐	☐	☐

General questions	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
How do you assess the development of VR over the next 5 years?	☐	☐	☐	☐
Assess the current infrastructure for virtual-reality in educational institutions.	☐	☐	☐	☐
Estimate the current knowledge of teachers for virtual-reality.	☐	☐	☐	☐
Estimate students' current level of knowledge for virtual-reality.	☐	☐	☐	☐

2. Questions about virtual-reality in the industry

2.1 Do you see a future in the introduction of virtual-reality at work??

- ☐ no
- ☐ yes
- ☐ comments:

2.2 In which occupations do you see a future for virtual-reality in the workplace?

2.3 In which professions do you currently see no particular significance for virtual-reality?

2.4 Should employees be trained for use and/or development of of with virtual-reality?

- ☐ no
- ☐ yes
- ☐ comments:

2.4 What type of training should employees receive??

- ☐ no
- ☐ Programming skills
- ☐ Hardware training
- ☐ Psychological preparation
- ☐ Other:

3. Questions about virtual-reality in educational institutions

3.1 Should virtual-reality already be taught at VET?

- ☐ no
- ☐ yes
- ☐ comments:

3.2 Should teachers be trained for development with virtual-reality?

☐ no
☐ yes
☐ comments:

3.4 What type of training should teachers receive?

☐ none
☐ programming skills
☐ special educational qualification for virtual-reality
☐ Other:

4. Soft Skills

How important are they for you in the context of virtual reality in the ICT sector?

Self- awareness and self-efficacy / Self-confidence	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to reflect on needs, aspirations and wants is …	☐	☐	☐	☐
The ability to identify and assess strengths and weaknesses is…	☐	☐	☐	☐
The ability to identify and assess the strengths and weaknesses of the group is…	☐	☐	☐	☐
The believe in own ability to influence the course of events, despite of uncertainty, setbacks and temporary failures is…	☐	☐	☐	☐

Oral and written expression	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to communicate competent in an oral and written way, so that everybody understands is …	☐	☐	☐	☐

Planning and management /adaptation to change)	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to adapt to unforeseen changes is …	☐	☐	☐	☐
The ability to set long-, medium- and short-term goals is…	☐	☐	☐	☐

The ability to define priorities and action plans is…	☐	☐	☐	☐

Motivation and perseverance/ tenacity/ resilience	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to turn ideas into action and satisfy his/her need to achieve is …	☐	☐	☐	☐
The ability be patient and keep trying to achieve long term individual aim is…	☐	☐	☐	☐
The ability to be patient and keep trying to achieve the group aim is…	☐	☐	☐	☐
The ability to be resilience under pressure, adversity and temporary failures is…	☐	☐	☐	☐

Mobilizing others/ Leadership	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to inspire and enthuse relevant stakeholders is …	☐	☐	☐	☐
The ability to get the needed support to achieve valuable outcomes is…	☐	☐	☐	☐
The ability to demonstrate effective communication, persuasion, negotiation and leadership is…	☐	☐	☐	☐

Creativity	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to develop several ideas and opportunities to create value, including better solutions to existing and new challenges is…	☐	☐	☐	☐
The ability to explore and experiment with innovative approaches is…	☐	☐	☐	☐
The ability to combine knowledge and resources to achieve valuable effects is…	☐	☐	☐	☐

Mobilization resources/ reaction	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to get and manage the material, non-formal and digital resources needed to turn ideas into action is …	☐	☐	☐	☐
The ability to make the most of limited resources is …	☐	☐	☐	☐
The ability to get and manage the competences needed at any stage, including technical, legal, tax and digital competences is…	☐	☐	☐	☐

Working with others/ interaction	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to work together an co-operate with others to develop ideas and turn them into action is…	☐	☐	☐	☐
The ability to network is …	☐	☐	☐	☐
The ability to solve conflicts and face up to competition positively when necessary is…	☐	☐	☐	☐

Vision/ Association	good (1)	accep-table (2)	poor (3)	no know-ledge (4)
The ability to imagine the future is …	☐	☐	☐	☐
The ability to develop a vision to turn ideas into reaction is …	☐	☐	☐	☐
The ability to visualize future scenarios to help guide effort and action is…	☐	☐	☐	☐

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