DESK

IO1:

State of the Art Review on Education Using Augmented Reality

PROJECT:
An Adult Digital Education Skills Kit to Foster Employability (DESK)

2018-1-EL01-KA204-047819

http://desk.e-sl.gr

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

Changelog

Revision	Date	Author/Organization	Description
v 1.0	1/10/2019	Maria Malliora / E-school	Initial compilation
v 1.1	10/10/2019	Maria Malliora / E-school	Reviewed version
v 1.2	20/10/2019	Maria Malliora / E-school	Final version

Contents

Introduction

DESK, "An Adult Digital Education Skills Kit to Foster Employability" is a multi-national project in the framework of the Erasmus+ Key Action 2, with code "2018-1-EL01-KA204-047819". Seven partner organizations from seven different European countries participate to this project:

1. MPIRMPAKOS D. & SIA O.E. (Greece - E-SCHOOL Educational Group – Coordinator)
2. UNIVERSITATEA POLITEHNICA DIN BUCURESTI (Romania - UPB CAMIS)
3. MACDAC ENGINEERING CONSULTANCY BUREAU LTD – MECB (Malta - MECB)
4. Archon sp. z o.o. (Poland - Archon)
5. EURO-NET (Italy - EURO-NET)
6. MEDIA CREATIVA 2020, S.L. (Spain – MEDIA CREATIVA)
7. Evropska rozvojova agentura, s.r.o. (Czech Republic – ERA)

The project's duration is 30 months, starting from 1st November 2018. The aim of the project is to provide adult trainers with the means to understand and efficiently use Augmented Reality (AR) applications in education and further integrate their own ideas into the educational practice, as AR provides new ways of teaching and learning. In addition, the project aims to provide better training opportunities to adults who need to obtain/enhance their digital skills for employment.

Project deliverables have been divided into five discrete Intellectual Outputs which are linked with one another and lead to the final creation of the Digital Education Skills Kit. These are:

IO1: State of the Art Review on Augmented Reality Application in Education

IO2: Adult Digital Education Skills Kit (DESK) Curriculum

IO3: Case-Studies of AR for Adult Education

IO4: DESK Tool Kit

IO5: Online Guide for Using DESK Toolkit

In this report, IO1 is described. It consists of three sub-activities:

1. Literature review of recent papers (within the last 6 years) on AR applications in education in peer-reviewed publications

2. Visual material presenting the uses of AR in education

3. Focus Group Meetings

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

Activity 1: Literature review of recent papers on AR applications in education in peer-reviewed publications

Augmented Reality in education

The rapid development of information and communication technology has a deep impact on education, significantly changing learning environment. Such a powerful education tool is AR that can create interactive learning experience for learners (Estapa & Nadolny, 2015).

Augmented Reality is defined as "an enhanced version of reality created by the use of technology to overlay digital information on an image of something being viewed through a device (such as a smartphone camera)"[1]. By bridging virtual and real worlds together, AR creates an environment that is both enhanced and augmented (Bronack, 2011; Klopfer & Squire, 2008).

AR can strengthen access to information, creating new learning experiences (Johnson et al., 2016). It also influences the effectiveness of teaching-learning processes and contribute to adults' learning opportunities. AR applications have been proven particularly useful in increasing student motivation in the learning process (Di Serio et al., 2013; Chen et al., 2017). AR can be applied in all levels of education, especially in Adult and Vocational Education and Training. Trainers who integrate Augmented Reality into their sessions, make learning an intriguing process for their adult audiences (Akçayır, M. & Akçayır, G., 2017). Furthermore, educational exposure to AR prepares learners for the future workplace (Johnson et al., 2016).

Literature review

A considerable amount of research has been carried out during the last years concerning the use of AR in education and how it can influence the learning process. This review aims to provide an insight into state-of-the-art use of AR in education. In order to achieve this, the following three research questions (RQs) should be considered to guide the research:

RQ1: What are the technological tools and types of AR currently used in educational organizations? Identify a) the types of technology (e.g. smartphones, PlayStation, e.t.c) and b) the types of AR triggering used (e.g. location-based)

RQ2: Which are the disciplines of AR applications (e.g. health, tourism, engineering, etc.)?

RO3: In which areas of the educational process does the AR have a positive impact (e.g. learner motivation and performance)?

In order to answer the above RQs, each partner has performed an extensive literature review in large bibliographic databases (like scholar.google.com). The criteria that were used in determining the articles were (a) AR technology being used for educational purposes, preferable in adult education,

[1] www.merriam-webster.com/dictionary/augmented%20reality.

(b) being released in the last six (6) years and (c) answering the research questions. Five (5) recently published papers (within the last 6 years), which are mostly characteristic/representative of the field, were provided by each partner. After examining and analyzing these articles, a total of twenty-five (25) articles that met the criteria were reached to be analyzed. Ten (10) articles were excluded because they were not closely related to the established criteria. This collection of the papers is listed also in bibliography section.

Results

After the above articles were studied, the following results came out, which summarize their basic ideas.

At a first stage of analysis, data relative to the year of publication of each article are presented. The selected articles were published from 2014 to 2019. The interest of the research community in this field is steady all these years. The following table summarizes the list of articles by year of publication.

Year of publication	Number of papers
2014	2
2015	9
2016	5
2017	3
2018	3
2019	3

Table 1: Year of publication of the selected articles

For the purposes of this research, only articles that answer the research questions were selected. The table below shows how the articles answer the RQs.

	Article's title	RQ1	RQ2	RQ3
1	Augmented Reality Experience: Initial Perceptions of Higher Education Students	√	√	√
2	A Survey on Applications of Augmented Reality		√	
3	Mobile Augmented-Reality Artifact Creation as a Component of Mobile Computer-Supported Collaborative Learning		√	√
4	The educational possibilities of Augmented Reality		√	√
5	Augmented reality to promote collaborative and autonomous learning in higher education		√	√
6	The effect of an augmented reality enhanced mathematics lesson on student achievement and motivation	√	√	√
7	Augmented virtual reality: How to improve education systems	√	√	√

8	Augmented reality in medical education and training	√	√	√
9	A Framework for Using Mobile Based Virtual Reality and Augmented Reality for Experiential Construction Safety Education	√	√	√
10	Using augmented reality as a medium for teaching history and tourism	√	√	√
11	Augmented reality for enhancing life science education	√	√	√
12	Systematic review on the effectiveness of augmented reality applications in medical training		√	√
13	Impact of augmented reality lessons on students' STEM interest	√	√	√
14	Augmented reality (AR) technology on the android operating system in chemistry learning	√	√	√
15	Mobile augmented reality learning objects in higher education	√	√	√
16	Augmented Reality in design education: Landscape architecture studies as AR experience	√	√	√
17	Mobile augmented reality in vocational education and training	√	√	√
18	Augmented reality: an enhancer for Higher education students in math's learning?	√	√	√
19	Utilizing mobile-augmented reality for learning human anatomy	√	√	√
20	The use of augmented reality in formal education: A scoping review	√		√
21	Augmented Reality Gaming in Sustainable Design Education	√	√	√
22	A review of Research on Augmented Reality in Education: Advantages and Applications		√	√
23	Application of Virtual and Augmented Reality to the Field of Adult Education		√	√
24	A case study of Augmented Reality simulation system application in a chemistry course	√	√	√
25	Augmented reality for learning English: Achievement, attitude and cognitive load levels of students		√	√

Table 2: Relation among articles and RQs

RQ1 analysis

As Table 3 reveals, most papers (N=17) have used AR technology through mobile devices. It is worth noting that in some articles more than one AR applications/examples are mentioned. Moreover, three (N=3) articles were identified in which AR technology through Computer monitor were used and two (N=2) ones through Projector glasses. However, there are some articles in which do not refer to the type of technological medium used. It is evident that Mobile Augmented Reality (MAR) applications are becoming popular due to the growth of mobile phone industry.

Medium	Number of papers
Mobile devices	17
Computer monitor	3
PlayStation	-
Projector glasses	3
No mention	7

Table 3: Types of technological medium used in augmented reality

Table 4 shows the different types of AR triggering used within the articles that are included into this review. Some of them are mentioned in more than one application/example. Depending on the AR activator used, three types of AR presentation can be identified: (a) Marker-based by using a trigger image or a QR code, (b) Location-based by using a specific location and (c) Markerless where there is no need for a trigger image. The majority of the articles (N=15) utilized marker-based technology for integrating AR applications into learning processes. Moreover, four (N=4) articles were identified in which Location-based technology were used and three (N=3) where no marker is needed. However, there are some articles in which do not refer to the type of AR triggering used. It is obvious that there is a preference in using marker-based technology for integrating AR applications. A possible explanation is that by comparing marker-based AR with markerless AR the accuracy of marker-based AR is much higher and also the complexity is lower (Cheng, Chen & Chen, 2017).

Type	Number of papers
Marker-based	15
Location-based	4
Markerless	3
No mention	8

Table 4: Different types of AR triggering

RQ2 analysis

Table 5 below shows the distribution of papers into disciplines/subjects of the curriculum. It is evident that there are a lot of education fields in which AR technology is applied for training and learning in all educational levels (Bacca, Baldiris, Fabregat & Graf, 2015). Some papers refer only to one specific discipline while others refer to more subjects analyzing, in a general perspective, the various areas in which AR can be applied. According to Fernandez (2017), AR technology can introduce real experiences to educational programs through online channels which will equalize distance learning even more with face-to-face teaching.

According to the results of the research (Table 5), part of the research concerns the fields of "Physics/Chemistry/Math" and the influence of AR on their teaching. These papers mainly concern teaching abstract concepts of these subject (Irwansyah, Yusuf, Farida, & Ramdhani, 2018; Coimbra, Cardoso & Mateus, 2015; Estapa & Nadolny, 2015; Hsu, Lin, & Yang, 2017) and simulation systems application in a chemistry course (Cai, Wang & Chiang, 2014).

In the field of "Health/Medicine" Education, nine papers were identified. These papers concern the field of medical training (Barsom, Graafland & Schijven, 2016; Fernandez, 2017; Herron, 2016; Sanna & Manuri, 2016; Oh, Han, Lim, Jang, & Kwon, 2018) and learning human anatomy (Jamali, Shiratuddin, Wong & Oskam, 2015). According to Sanna and Manuri (2016), scientists and physicians have been provided a huge amount of data through medical AR that can support diagnostic of preoperative and intraoperative data or in training tasks.

In the field of "Architecture/Construction" Education, five papers were identified which concern the development of an AR prototype (Kerr & Lawson, 2019), construction safety education (Le et al. 2015), constructions of electrical machines (Martín-Gutiérrez, Fabiani, Benesova, Meneses & Mora, 2015) and architecture and building design (Sanna & Manuri, 2016; Ayer, Messner & Anumba, 2016).

In the fields of "Assembly/Maintenance/Repair", AR can serve as a mean to replace paper instructions (Sanna & Manuri, 2016) and also provide an immersive experience (Oh, Han, Lim, Jang, & Kwon, 2018).

In the fields of "Cultural Heritage/History/Tourism", identified papers present that AR can serve as a medium for teaching history and as a result to promote importance of cultural heritage (Kysela & Štorková, 2015; Saidin, Halim & Yahaya, 2015; Sanna & Manuri, 2016).

In the fields of "Entertainment/Sport", AR plays an important role (Sanna & Manuri, 2016) and also simulation game technologies can influence learners' performance and support their learning (Ayer, Messner & Anumba, 2016).

In the fields of "Military applications", AR technologies can help create lifelike battlefields (Oh, Han, Lim, Jang, & Kwon, 2018; Sanna & Manuri, 2016).

Disciplines	Number of papers
Physics/Chemistry/Math	9
Health/Medicine	9
Architecture/Construction	5
Assembly/Maintenance/Repair	4
Cultural Heritage/History/ Tourism	3
Entertainment/Sport	2
Military applications	2
Others	4

Table 5: Distribution by subject

RQ3 analysis

The literature review recorded that AR demonstrates a positive impact on a number of factors in the educational and learning process. The main results are summarized on Table 6. It is worth noting that most of the papers demonstrate the impact of AR use in multiple categories on the table.

Findings depict that AR technology use within a training session increases learning outcomes (N=22). The significant added-value of AR-based training in terms of learning outcomes has been highlighted

in several papers (Cabero Almenara & Barroso, 2016; Cai, Wang & Chiang, 2014; Coimbra, Cardoso & Mateus, 2015; Bacca, Baldiris, Fabregat & Graf, 2015; Barrow, Forker, Sands, O'Hare & Hurst, 2019; Fernandez, 2017; Jamali, Shiratuddin, Wong & Oskam, 2015).

AR technology also enhances learners' motivation (N=13) during their learning session (Ayer, Messner & Anumba, 2016; Bacca, Baldiris, Fabregat & Graf, 2015; Barrow, Forker, Sands, O'Hare & Hurst, 2019, Cabero Almenara & Barroso, 2016; Hsu, Lin & Yang, 2017; Jamali, Shiratuddin, Wong & Oskam, 2015).

Moreover, AR supports learners' collaboration (Baldiris, Fabregat & Graf, 2015; Fernandez, 2017; Marcel, 2019) and participation (Barrow, Forker, Sands, O'Hare & Hurst, 2019, Cabero Almenara & Barroso, 2016).

In addition, the literature review has found that AR has a positive effect on learners regarding concentration (Bacca, Baldiris, Fabregat & Graf, 2015), excitement (Barrow, Forker, Sands, O'Hare & Hurst, 2019), satisfaction (Cai, Wang & Chiang, 2014; Bacca, Baldiris, Fabregat & Graf, 2015), and confidence (Bacca, Baldiris, Fabregat & Graf, 2015).

Individual areas	**Number of studies**
Learning outcomes	22
Motivation	13
Collaboration	10
Participation	6
Concentration	5
Excitement	3
Satisfaction	3
Confidence	1
Other	3
No mention	1

Table 6: Areas where AR has a positive impact

Conclusions

Summarizing the overall results, it is evident that AR technology has the potential to benefit the educational process with manifold ways, something that justifies the research interest for this area.

The majority of the papers have used AR technology through mobile devices and utilized marker-based technology for integrating AR applications into learning processes probably because of its accuracy and low complexity (Cheng, Chen & Chen, 2017).

Moreover, there is a wide range of education fields in which AR technology is applied. They are mainly physics/chemistry/math, health/medicine but also architecture/construction is included. In Assembly/Maintenance/Repair a lot applications were also spotted.

The majority of the papers reported that AR applications have the potential to increase learning outcomes, mainly motivation and collaboration among learners.

However, according to Fernandez (2017), educators need to be trained on AR technologies first, as they do not know their prospective use in teaching and learning. After completing their training, they will be able to handle the full potential of AR within their educational practice.

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Activity 2: Visual material presenting the uses of AR in education

Introduction

The use of video technology in the last years has changed the way people communicate and learn (Xu, Aranda, Widjaja & Clarke, 2018; Derry et al., 2010). Video technology can facilitate the better understanding of a subject and also has the potential to support professional learning (Kang & van Es, 2019; Xu, Aranda, Widjaja & Clarke, 2018).

This activity aims to provide adults with a clear understanding of the educational uses of AR by means of video technology. Each partner has performed research to identify free published videos relevant with the subject in question. The established criteria were: (a) AR technology being used for training purposes and (b) being released in the last five years. Two (2) recently published videos were provided by each partner. Finally, ten (10) videos which were considered most representative, were selected.

Digital skills

At the same time, the use of AR as a tool to deliver effective training to adults requires a satisfactory level of digital skills from them. According to UNESCO, "digital skills are defined as a range of abilities to use digital devices, communication applications, and networks to access and manage information"[2]. In this document, the European Digital Competence Framework for Citizens framework will be used as a reference which is also known as DigComp. It summarizes the effort of the European Commission in identifying the key components of digital competence.

The DigComp 2.0 Framework[3] consists of the following 5 specific areas:

- Information and data literacy: determines users' ability to "locate and retrieve digital data"[3], assess the reliability of online information and classify information in a methodical way using files and folders.
- Communication and collaboration: determine users' ability to "communicate and collaborate through digital technologies" [3], participate in the digital society and be aware and use the rules of online communication.
- Digital content creation: determines users' ability to create digital content and "understanding how copyright and licenses are to be applied"[3].
- Safety: determines users' ability to "protect devices, content, personal data and privacy in digital environments" [3].
- Problem solving: determines users' capability to identify and handle problems in digital environment.

[2] https://en.unesco.org/news/digital-skills-critical-jobs-and-social-inclusion
[3] https://ec.europa.eu/jrc/en/digcomp/digital-competence-framework

Videos

The selected videos are listed below. For each one is provided a brief content description, its relevance to the project, its relationship with digital skills, and the conclusions drawn from it.

Video No 1

Title: **Project Esper: Mixed Reality Anatomy Learning**

Source: https://www.youtube.com/watch?time_continue=38&v=3qpgMLzBi30

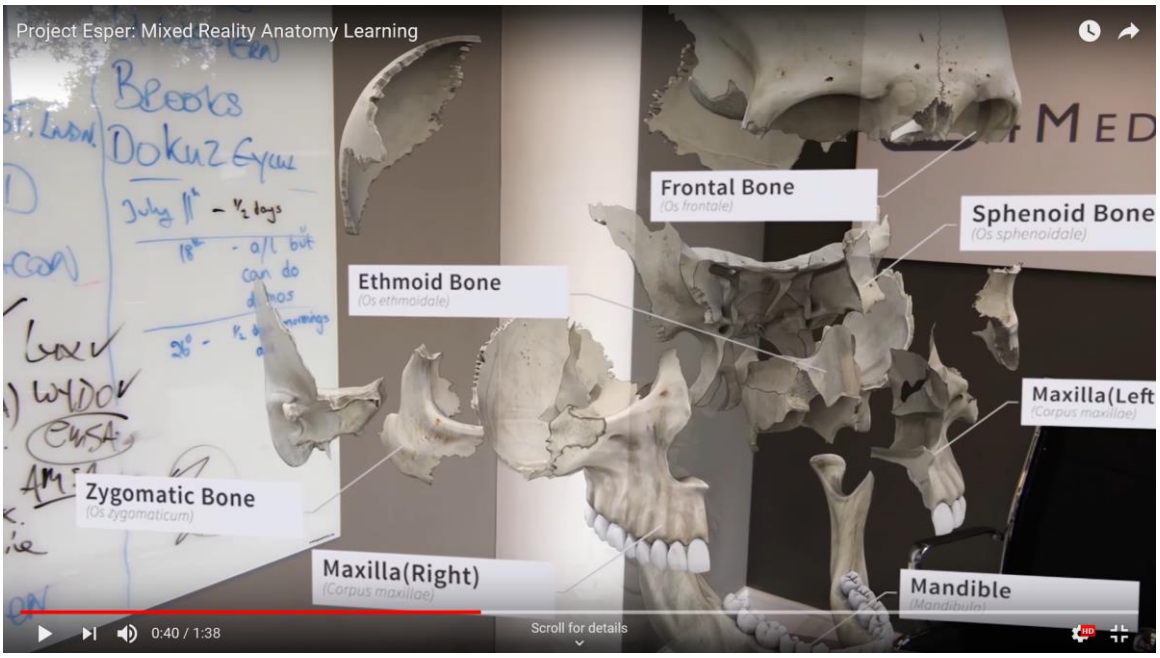
Length (secs): 1:38

Resolution: HD

Category: Education

Year of publication: 2016

Last access date: 21/12/2019



Description

This video demonstrates how to use Augmented Reality (AR) to learn body anatomy. The user can choose to display the male or female body. Then, s/he can select a part of the body to show it in 3D format and receive information related to the selected object. Moreover, this video provides an example of the bone structure of the human skull, the bones of the hand and the configuration of the spine.

Relevance to the project:

This video gives trainers and trainees a set of circumstances to know or perceive a situation of using AR in medicine.

Which DigComp 2.0 area will this video address

- ❑ **Information and data literacy**
- ❑ Communication and collaboration
- ❑ **Digital content creation**
- ❑ Safety
- ❑ Problem solving

Conclusions

The following conclusions are drawn from this video:

- AR allows learners to understand the anatomy of the human body in a simplistic, and correct way, at much lower costs.
- AR makes the teaching/learning process much more attractive and efficient.

Video No. 2

Title: **Augmented Reality in e-Learning, Teaching, Industries, Construction, Marketing, Games**

Source: https://www.youtube.com/watch?v=x-fAl4v79VY

Length (secs): 1:08

Resolution: HD

Category: Science & Technology

Year of publication: 2016

Last access date: 21/12/2019

Description

This video presents an Augmented Reality Demo App. The AR content is explaining the functionality of switched reluctance motor and usage of its components by using touch sensor. AR technology is demonstrated as a new way of teaching and learning which is used to provide additional information about the things we look at.

Relevance to the project:

This video is relevant to the project as:

- this kind of Apps can be easily used to teach adults in different fields
- using AR we can change the way we look at things and teach stuff

Which DigComp 2.0 area will this video address

- ❑ **Information and data literacy**
- ❑ Communication and collaboration
- ❑ Digital content creation
- ❑ Safety
- ❑ **Problem solving**

Conclusions

The following conclusions can be drawn by this video:

- AR has the potential to make education more appealing and interesting.
- AR gives a new dimension for learning and experiencing a technologically advanced education system.
- By using cutting-edge technologies, we can create an immersive 3D learning experience for all age categories.

Video No 3

Title: **How Augmented Reality will Change Education Completely |Florian Radke| TEDxGateway**

Source: https://www.youtube.com/watch?v=5AjxGqzqQ54

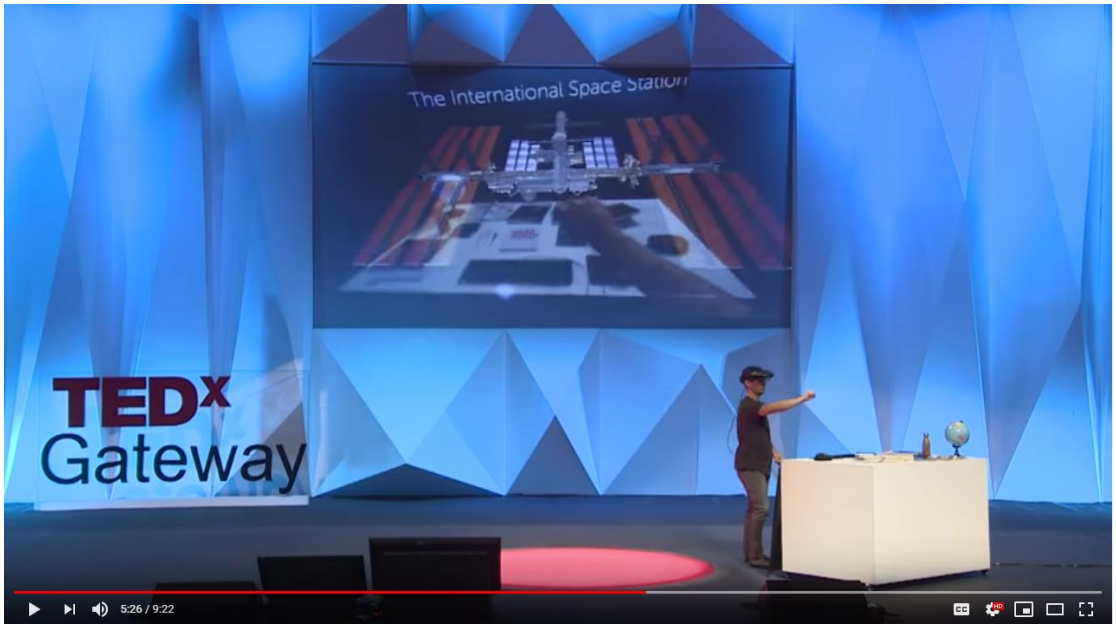
Length (mins): 9:22

Resolution: HD

Category: AR in Education, Communication and Production

Year of publication: 2017

Last access date: 21/12/2019



Description

This video demonstrates the use of Augmented Reality in the educational field, human connection and productivity. As we are already surrounded by data, the more we learn how to exploit and interact with it, the better and easier quality of life could be. AR is presented as a powerful tool that has the potential to create experiences that enhance our natural environments and facilitate greater learning and communication.

Relevance to the project:

It demonstrates the relevance Augmented reality has in the educational field, communication and productivity.

Which DigComp 2.0 area will this video address

- ❑ **Information and data literacy**
- ❑ **Communication and collaboration**
- ❑ Digital content creation
- ❑ Safety
- ❑ **Problem solving**

Conclusions

The following conclusions are drawn from this video:

- AR would have a positive impact in the educational field as well as communication and production field.
- AR has the potential to change the way adults will learn and work in the future.

Video No 4

Title: **How Augmented Reality Is Solving the Industrial Skills Gap**

Source: https://www.youtube.com/watch?v=NTAgMNqFUV8&fbclid=IwAR2ZTCkBcwnAOnI3ADwauU1uxkOyIJhf6SpBOH44OQ4m5RRvxWCy2tiXXJQ

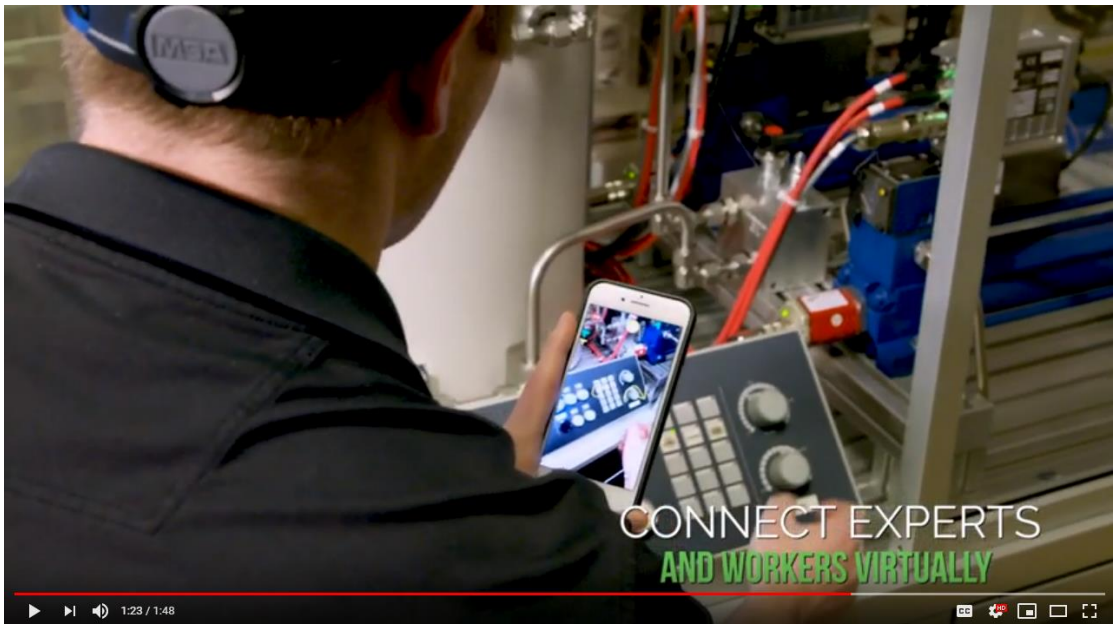
Length (secs): 1:48

Resolution: HD

Category: Science & Technology

Year of publication: 2019

Last access date: 21/12/2019



Description

The video demonstrates how AR can help to bridge the industrial skills gap through employee training. It is also highlighting that AR can support the need for adult upskilling and reskilling as job competition demands further training. Moreover, the video demonstrates workers perform a task by receiving instructions by an AR system which expands the users' view by adding a layer of digital information on the top of physical objects to help them learn new processes. Hence, workers acquire new competencies, while inexperienced ones can virtually connect with experts in a safe and effective environment.

Relevance to the project:

This video is relevant to the project as:

- it highlights the importance of digital skills in future workplace
- it demonstrates that AR can be an effective solution for training programs.

Which DigComp 2.0 area will this video address

- ❑ **Information and data literacy**
- ❑ **Communication and collaboration**
- ❑ Digital content creation
- ❑ Safety
- ❑ **Problem solving**

Conclusions

The following conclusions can be drawn by this video:

- In the modern workplace, digital skills are valued.
- AR can offer training and development to new and existing employees, reducing the skill gap.
- AR can provide each employee with a personalized training, reducing the need for human resources for on-site support.

Video No 5

Title: **Augmented Reality Solutions for Construction Inspection**

Source: https://www.youtube.com/watch?v=8lY4qaVvR8c

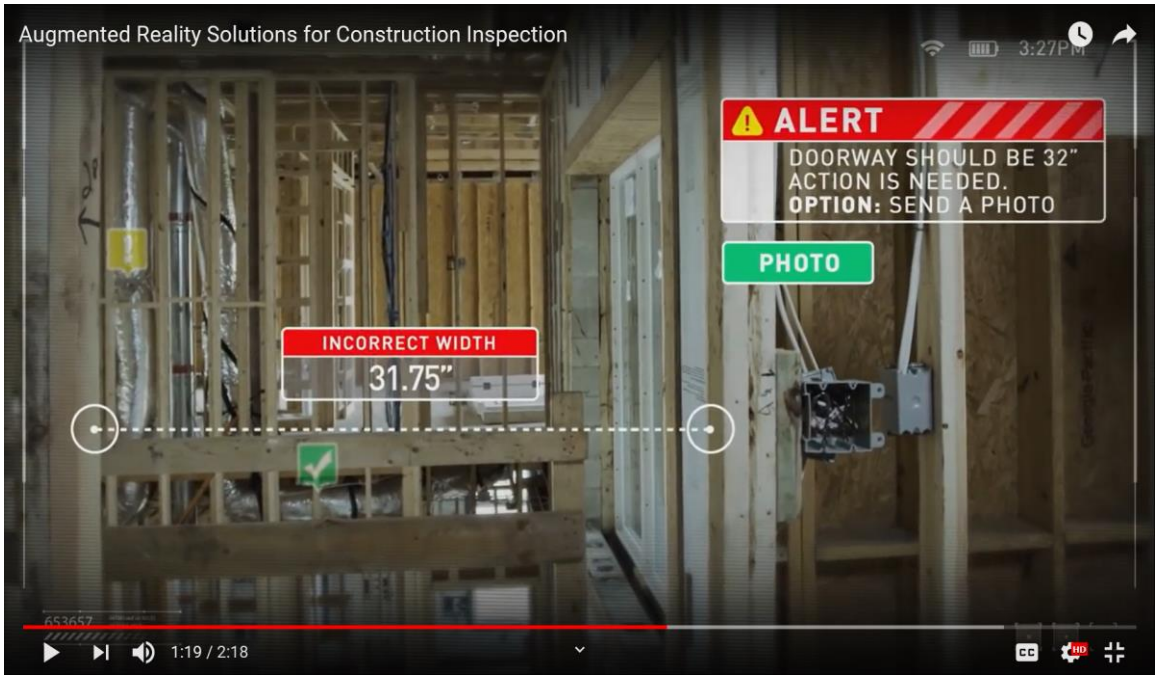
Length (secs): 2:18

Resolution: HD

Category: Science & Technology

Year of publication: 2017

Last access date: 21/12/2019



Description

This video demonstrates how to use an augmented reality (AR) application to improve the overall building inspection. Augmented reality technology enables real-time construction inspection by replacing the manual control process that requires more human resources. In addition, AR technology allows the transmission of pictures and real-time purchasing data to multiple devices or computers, thus saving time, reducing costs and improving safety with intuitive equipment and connected information.

Relevance to the project:

This video is relevant to the project as:

- shows that AR can be an effective solution for training programs in the field of building inspection;

- nowadays, it is compulsory for the operators to hold digital skills to have direct and quick access to necessary information via specially equipped mobile devices, such as tablets or smartphones.

Which DigComp 2.0 area will this video address

- ❑ **Information and data literacy**
- ❑ **Communication and collaboration**
- ❑ Digital content creation
- ❑ Safety
- ❑ **Problem solving**

Conclusions

The following conclusions are drawn from this video:

- AR in the inspection process holds great potentials for improvement control, by increasing efficiency, especially with the rise of industry 4.0.

- AR application supports employees to ensure a more sustainable knowledge transfer.

Video No 6

Title: **Remote Assistance through Augmented Reality**

Source: https://www.youtube.com/watch?time_continue=1&v=fMZaCVq5__g

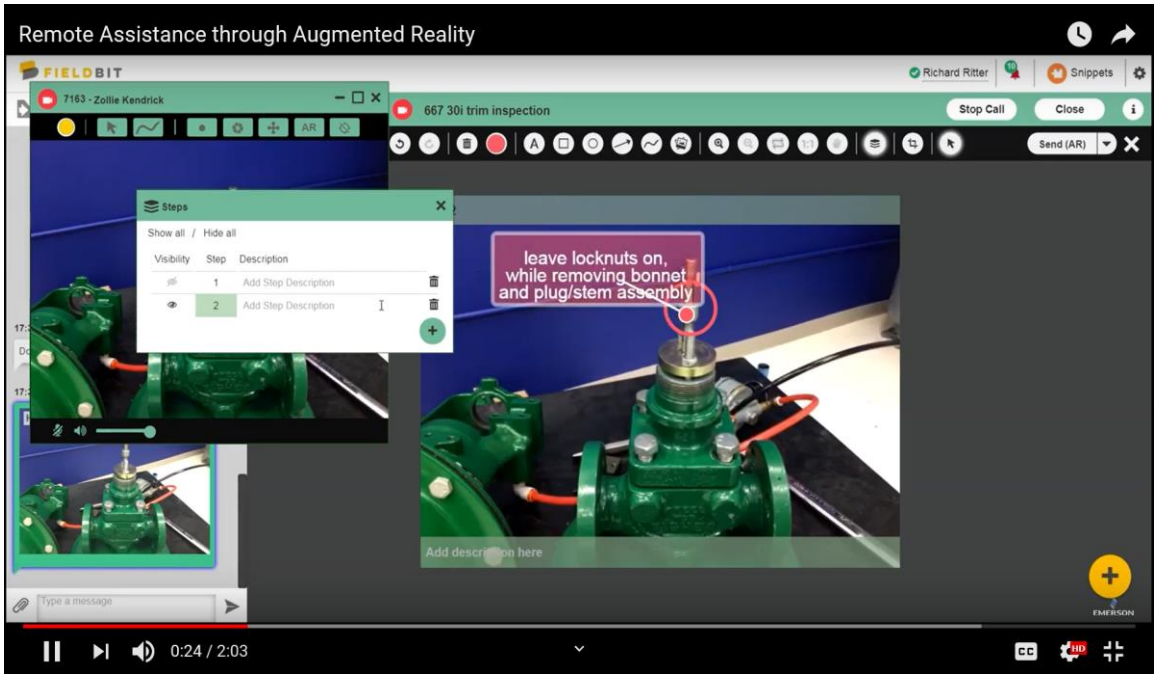
Length (secs): 2:03

Resolution: HD

Category: Science & Technology

Year of publication: 2019

Last access date: 21/12/2019



Description

This video demonstrates how adult learners can be trained to efficiently and effectively repair the equipment. Using AR technology, the experts can see that technicians see and can give them step by step text and audio information to guide through complicated repair. The provided information help technicians to solve the problems safely, efficiently and correctly.

Relevance to the project:

This video highlighted the importance of the ability to access remote control devices to help fix problems and access to information. Digital competences are absolutely necessary in the world of automation.

Which DigComp 2.0 area will this video address

- ❑ **Information and data literacy**
- ❑ **Communication and collaboration**
- ❑ Digital content creation
- ❑ **Safety**
- ❑ **Problem solving**

Conclusions

The following conclusions are drawn from this video:

- AR technology can be used to visually show the steps required to fix problems;
- the adult learners acquire the specific knowledge can be used for easy access in future similar situations.

Video No 7

Title: **Industry 4.0: Augmented reality system for production**

Source: https://www.youtube.com/watch?v=0m67O1Em7dY&feature=share&fbclid=IwAR2w-8IoHYFefoQsutn9f0NmUXowKr3VGjBcfrOOuuBpvGDKk3EKoTltHDU

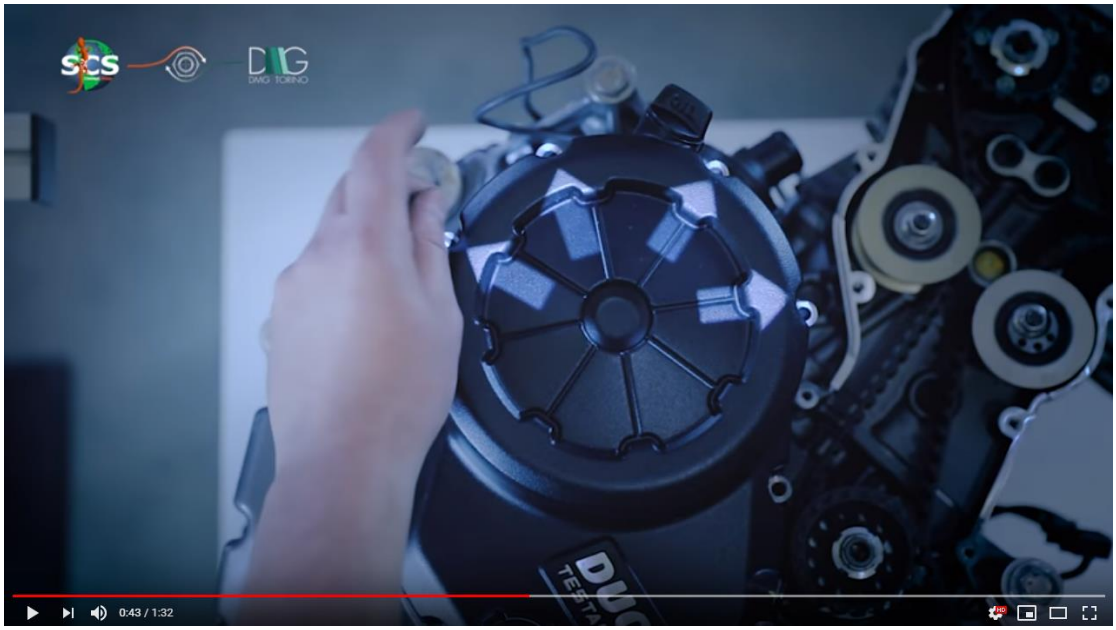
Length (secs): 1:32

Resolution: HD

Category: Science & Technology

Year of publication: 2017

Last access date: 21/12/2019



Description

The video demonstrates an Augmented Reality System for manufacturing processes. A Visual Production Guide assists the operator during the assembly processes. The system displays the necessary step-by-step instructions to the operator. Results are acquired automatically. Also, errors are detected automatically. Every time the operator makes a mistake, there is a warning sound. A confirmation sound occurs when the operator performs the task correctly. Furthermore, an appropriate software selects automatically the right piece of assembly and indicates the correct position in which the operator has to place it.

Relevance to the project:

This video provides adult learners, trainers and partners an opportunity to become aware of the educational use of AR in an actual workplace procedure.

Which DigComp 2.0 area will this video address

- ❑ **Information and data literacy**
- ❑ **Communication and collaboration**
- ❑ Digital content creation
- ❑ Safety
- ❑ **Problem solving**

Conclusions

The following conclusions can be drawn by this video:

- AR can help adult learners complete a process by following step-by-step interactive instructions in a safe environment.

- AR allows adult learners understand in an easy manner the working process through virtual trial and error training.

- AR assists in bridging the knowledge gap created by advancing technology.

Video No 8

Title: More than Reality

Source: YouTube https://www.youtube.com/watch?v=9aPo6-imjTs

Length (secs): 3:17

Resolution: HD

Category: Science & Technology

Year of publication: 2018

Last access date: 21/12/2019

Description

The video shows how Augmented Reality can support operation, maintenance as well as training in the energy industry. It focuses on the benefits of DAQRI Smart Helmet, which through AR, offers an innovative Operation and Maintenance training program, using virtual work instructions, prepared training sequences and “remote assistance” directly from a trainer. It also focuses on the usefulness of DAQRI Smart Helmet as an intelligent solution in operation and maintenance. All these innovative features make it possible to achieve the best efficiency in the energy industry.

Relevance to the project:

This video is relevant to the project as:

- it highlights the importance of digitalization and innovation in the energy industry workplace
- it explains clearly value of AR in training adult workers
- proves how efficient AR can be in complex working environments

Which DigComp 2.0 area will this video address

- ❑ **Information and data literacy**
- ❑ **Communication and collaboration**
- ❑ Digital content creation
- ❑ **Safety**
- ❑ **Problem solving**

Conclusions

The following conclusions are drawn from this video:

- AR can offer more effective on-site training to employees through different innovative techniques, which make it possible to get the best efficiency in the energy industry.
- AR makes work training almost risk-free.

Video No 9

Title: **Augmented Reality Training for BMW assembly line workers**

Source: https://www.youtube.com/watch?v=V0WrCf8PbEk

Length (secs): 4:18

Resolution: HD

Category: Science & Technology

Year of publication: 2019

Last access date: 21/12/2019

Description

This video focuses on the design as well as implementation of an Augmented Reality training environment by Capgemini. It highlights the simplicity of the method, which allows learners to save time. It also draws attention to the benefits of the training app, which due to its different innovative features (multiple highly and easily configurable scenarios, the use of holograms, audiovisual content, etc.), provides a better learning experience. Moreover, it explains how the app enables trainers to see workers' training process in real time and provide comments and support, while at the same time, learners are able to provide feedback after each session through the evaluation model, enhancing the effectivity of the learning process. Finally, it highlights the usefulness of the app in the production process and in the training of maintenance and repair work.

Relevance to the project:

This video is of great relevance for the project because it enables learners, trainers as well as partners to see the benefits of using AR technology for effective learning processes.

Which DigComp 2.0 area will this video address

- ❑ **Information and data literacy**
- ❑ **Communication and collaboration**
- ❑ Digital content creation
- ❑ Safety
- ❑ Problem solving

Conclusions

The most important conclusion that can be drawn from this video is that Augmented Reality, due to its innovative features, makes learning processes much more effective, as it makes learning easier, time-saving and entertaining.

Video No. 10

Title: **Bosch Augmented Reality for the automotive workshop**

Source: https://www.youtube.com/watch?v=gefW8EC-ZCc

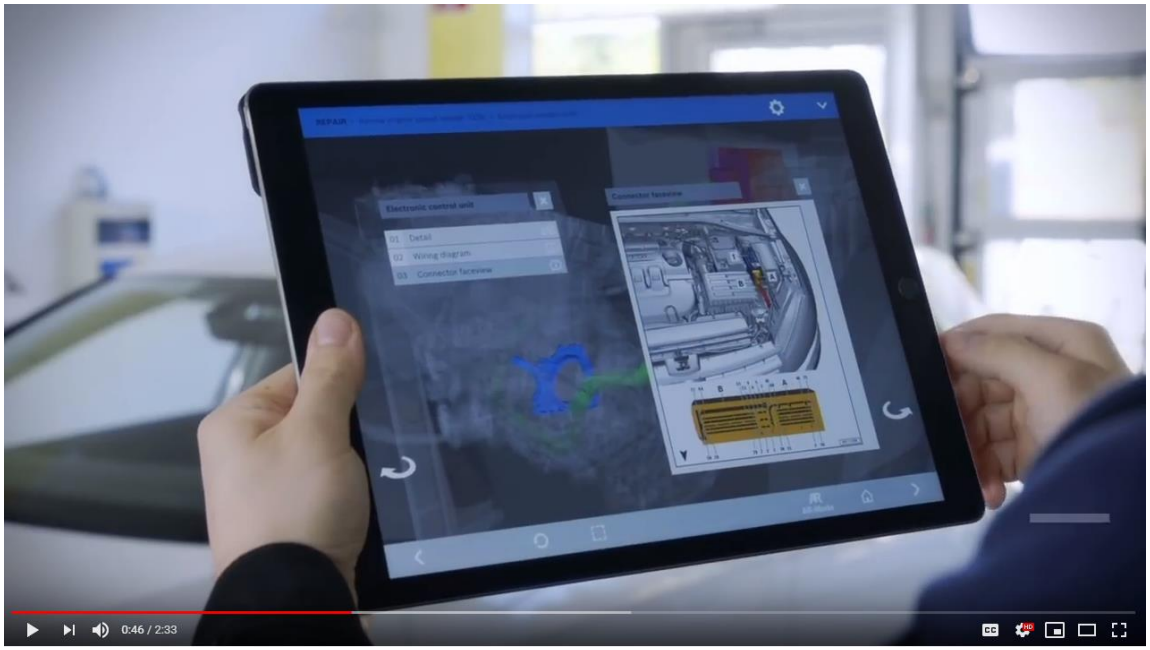
Length (secs): 2:33

Resolution: HD

Category: Science & Technology

Year of publication: 2017

Last access date: 21/12/2019



Description

In this video, a new AR technology by Bosh and its uses – all relevant repair information at a glance - are presented. The Common Augmented Reality Platform (CAP) is a modular system for development and publication of AR content. This intelligent technology which presents all relevant information directly in your field of view primarily aims to make workshops more efficient.

Relevance to the project:

This video is relevant to the project as:

- it highlights the importance of digital skills in workplace
- it demonstrates that AR can be an effective tool for employers by saving time and cutting costs

- the complexity of different products and information is often challenging for workshops and their staff
- multi-user experience with sustainable learning effect reduces training costs

Which DigComp 2.0 area will this video address

- ❑ **Information and data literacy**
- ❑ Communication and collaboration
- ❑ Digital content creation
- ❑ Safety
- ❑ **Problem solving**

Conclusions

The following conclusions can be drawn by this video:

- In the modern workplace, digital skills are necessary
- AR speeds up work tasks and reduces the need for human resources
- AR enables more efficient work
- Different procedures can be accomplished simply and easily by using AR
- Using AR in education reduces training costs
- By using AR you can avoid mistakes

Main conclusions

The study of the videos has resulted in a better understanding of AR technology and its contribution in both education/training and workplaces.

The main findings are presented below:

- In the modern workplace, digital skills are particularly valuable, as they enable adults to have direct and quick access to necessary information.
- AR has the potential to impact the educational field positively by making the teaching/learning process much more attractive, efficient, engaging, time-saving and entertaining.
- AR has the potential to be an effective solution for training programs in an actual workplace and in a wide range of professional fields.
- AR can offer training and development to new and existing employees, reducing the skill gap.
- AR also assists in bridging the knowledge gap created by technology advancement.
- AR can provide each employee with a personalized training, reducing the need for human resources for on-site support.
- AR can help adult learners complete a process by following step-by-step interactive instructions in a safe environment.
- AR can train employees in a safe working environment.
- AR can be an effective tool for employers by saving time and cutting costs.
- AR application supports employees to ensure a more sustainable knowledge transfer.

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Activity 3: Focus Group Meetings

Focus Groups meetings

1. Specific objective

DESK consortium partners want to assess attitudes, beliefs and behaviors among adult trainers in partner countries, over the last years in order to develop a documented report concerning the potential of utilizing AR technology in the field of adult education.

For this purpose, 7 focus groups activities have been conducted in the following EU countries: Greece, Romania, Malta, Poland, Italy, Spain and Czech Republic.

List of Focus Groups Activities

Activity	Location	Date
Focus Group 1	Karditsa, Greece	1/10/2019
Focus Group 2	Bucharest, Romania	3/10/2019
Focus Group 3	Iklin, Malta	30/9/2019
Focus Group 4	Pila, Poland	30/9/2019
Focus Group 5	Potenza, Italy	3/10/2019
Focus Group 6	Bilbao, Spain	27/9/2019
Focus Group 7	Praha, Czech Republic	4/10/2019

2. Questionnaire

The questionnaire created aims to reflect the potential of utilizing AR technology in the field of adult education, which is the main objective of the project.

The questionnaire design was based on the Technology Acceptance Model - TAM (Davis, 1985) which is suitable for studies in information systems environments and was designed to predict the acceptance and use of Information and Communication Technologies (ICTs).

Based on this model, users' motivations related to the acceptance and use of an information system can be mainly interpreted by three determinants: "Perceived Ease Of Use", "Perceived Usefulness" and "Attitude towards Use" of a new technology system. In this model "Perceived Usefulness" is defined as the degree to which a person believes that using a particular technology (system or service) will improve his/her performance (Davis, 1985). "Perceived Ease Of Use" is defined as the degree to which a person believes that the use of a particular technology (system or service) will be easy, free from physical or mental fatigue (Davis, 1985). "Attitude towards Use" of a system is defined

as the general assessment or feeling of favorable or unfavorable disposition of a person towards that particular system (Fishbein & Ajzen, 1975).

The TAM has been a tool for a lot of researches and has been expanded with the addition of new determinants leading to new extended forms (Maruping, Bala, Venkatesh & Brown, 2017; Kaba & Toure, 2014; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000).

For the purpose of this project's specific activity, a semi-structured questionnaire based on the TAM used as a research tool to draw conclusions through focus group discussions. The questionnaire consists of 6 questions. Each question investigates one of the following determinants:

1. Perceived Ease Of Use
2. Perceived Usefulness
3. Pedagogical Value of AR-based Learning
4. Attitude towards Use
5. Social Influence
6. Obstacles

3. Methodology

All partners agreed to follow the same procedure for the implementation of the Focus Group in each country. Then, they set the selection criteria to identify the participants.

Participants' selection criteria

As a focus group is a qualitative aspect of research, participants were selected taking into account who can best answer the research questions and strengthen understanding of using AR in education. The following criteria were established:

- Occupation: Adult trainers, if possible, from different fields
- Education level: at least Level 6 diploma
- Number of participants per focus group: 6-7
- Preconditions: Existing attitudes, beliefs, behaviors in the context of the use of AR in Adult Education
- Other: preferable compiling people who do not know one another

How participants were selected

- A list of possible participants was creating based on the established criteria.
- The most appropriate were chosen.
- Invitations were sent (by email or phone) after ensuring contact information.

Moderators' selection criteria

In order to select the appropriate moderator, partners set the following criteria:

- Occupation: Adult trainer
- Education level: at least Level 6 diploma
- Knowledge: Having an adequate understanding of the subject in question
- Personality: Being a respectful and good communicator.

Assistant Moderators' selection criteria

The Assistant Moderator is needed to have at least similar characteristics with the participants and also background knowledge about AR in education, if possible.

He/she would be in charge for keeping notes, recording the interactions and handling environmental conditions.

Participant Consent

Each participant read and signed an informed consent statement (Annex III) at the beginning of the focus group discussion. Issues concerning the protection of personal data was included in the form. One copy was given to participants and the second one was kept by the partner organization.

Moderator Guide

After carefully considering the questions that the participants would be asked, a Moderator Guide was developed (Annex I).

Procedure

In each partner country a focus group activity was conducted. The participants gathered together and discussed openly the topic in question. Full details of the focus groups are provided in Annex IV.

At the beginning of the meeting, a summary of the DESK project with the general and specific objectives was presented to the focus group participants and a discussion about it followed. After which, the group was engaged in a Questions and Answers (Q&A) session. The goal of the Q&A

session was to understand their point of view on AR, their opinion on AR in educational field and reflect on the impact AR would have in education.

The data collected were analyzed based on the theoretical background of TAM. Each moderator with the assistant moderator reviewed the notes, analyzed and summarized the conclusion of the focus group in a report.

The leader of this IO (the coordinator) read all the focus group reports and create the final report.

Focus Group Discussions

Focus Group in Greece

Conclusions

The following results emerged during the discussion:

1. **Do you consider it was easy for you to learn how to use AR technology to reach the educational goals you had set? Moreover, do you believe it would be easy for adult trainers to learn how to use AR technology to reach their educational goals?**
   The majority of respondents consider that AR technology is generally easy to use. They also consider that their interaction with this technology was perfectly understandable, they created their desired educational content without difficulty, they were intellectually stimulated and they stated that the process did not require an extensive amount of effort.

   Regarding their evaluation for the interaction of AR technology with adult trainers in general, they consider that AR systems' interfaces are user friendly but require prior experience in basic digital skills.

   Participants believe that in order for AR to be used in adult education, it has to be easy for adult trainers to learn it and use it. In addition, they agreed that if a system is not practical enough for everyday use then it may be abandoned soon.

2. **Do you generally believe that AR technology would be useful to teach different subjects to adults?**
   Respondents believe that AR technology can create, through interactive graphical environment, virtual learning scenarios within which the user can immerse and enhance his / her learning capacities. They consider it allows the creation of a controlled environment within which the users learn through action, trial and error, as interesting activities are incorporated, encouraging the application of knowledge. Eventually, learning through acting is achieved in a big percentage. Furthermore, such approaches of active and experiential learning are considered to lead to the better understanding of the subject taught as well as

enhancement of the long-term memory of experience. Moreover, they contribute to sustain gnostic information and the user acquires personal interest for the subject taught. Moreover, respondents consider that adults' trainers can be more effective, efficient and productive in their job, using the technology of AR as they can use it to teach many cognitive fields, for a wide spectrum of learning environments and at various levels of education.

3. Which are considered to be the educational benefits gained from the use of AR technology in adult education?

Pedagogical benefits gained:

- Development of experiential learning
- Enrichment and reorganization of learning environments
- Familiarization with practices qualifying trainees for their future working positions
- Bridging the gap between theory and practice
- Development of the trainees' interest, motivation and satisfaction during the learning process
- Personalized learning (control of the flow and processing of information, without the need to have the trainer continuously intervening)
- Utilization of situated learning: the trainee can solve a problem using tools and means of his working environment
- Development of skills to solve problems
- Provision of immediate feedback
- Retention of experience for a longer period of time, compared to other, more traditional methods
- Creating real learning situations with real stimuli
- Familiarization with new technologies and the multimedia characteristics of modern technologies
- Mental and emotional satisfaction of those involved
- Creation of the circumstances for active, critical and imaginative thinking
- Modeling methods and processes that create an authentic framework for the participant / trainee who is allowed to create knowledge, skills and attitudes used by creatively thinking professionals
- Acquisition of knowledge to deal with real needs and problems
- Contribution to a deeper understanding and learning of concepts and issues dealt with by the trainers
- Approach to new knowledge in an innovative way, combined with existing experiences and knowledge.

4. How would you consider the attitude of adult trainers and trainees towards using AR technology in adult education?

Respondents consider that the use of AR in adult education could help to experience teaching in a pleasant, essential and positive way, creating stimulations to actively engage trainees. They also consider that it can contribute to the creation of self-confidence in trainees during their training (e.g. effective exploration of new ideas, satisfactory participation in activities

etc.), while this experience is seen as relatively easy for the skills, age and knowledge of the trainees.

5. **How do you consider that your colleagues and/or other experts in adult education view the idea of using AR technology in adult education?**

Respondents consider that adult trainers' beliefs on learning opportunities presented by the use of AR in adult training are intensely affected by opinions and advice of important others (like experts in adult education and / or AR). They also consider that their opinion on the possible creation of learning opportunities by using AR technology in adult training, is affected by their own experience on using AR technology. Therefore, they believe that a useful practice would be for adult trainers to be provided opportunities for professional development and training to acquire hands-on experience with AR technology and redefine their beliefs on the potential positive effects it has on adult education.

Respondents also believe that dissemination of good practices and innovative applications of AR technology in adult education, will affect positively the beliefs of adults' trainers, and will contribute to create an atmosphere that encourages and promotes a culture of acceptance of AR in adult education.

To ensure that introduction and use of AR technology in adult education is easy, respondents believe that trainers need a) proper information and training on how to use AR in adult education, b) technical training to use AR and to incorporate it to teaching and c) communication tools to enable communication among trainers so as to exchange good practices.

They also consider that, in order to make it easier for adults' trainers to apply AR technology into different subjects' teaching, it is appropriate to have a website, specially developed to contain information and sources about the application of AR technology in adult education.

6. **Which, in your opinion, are the main obstacles in the use of AR technology in adult education?**

Following the discussion, basic factors preventing adult trainers from incorporating AR technology in adult education have been documented as being:

- Time availability to design and develop sessions where AR technology can be applied.
- Availability of efficient educational material and digital educational resources for the different subjects taught by adults' trainers.
- Skills / qualifications of adults' trainers to incorporate AR technology in the educational process.
- Inadequate opportunities for professional training relevant to the utilization of AR technology in teaching.
- Lack of interest from adult trainers to utilize AR technology in adult education.

- Negative attitude towards technology in general by adult trainers and other professionals who are involved in adult education, who express their concern on the positive outcomes of the use of such technologies.
- Possible lack of interest of adult trainers concerning the use of technology-based teaching method.
- Possible lack of understanding of affordances for teaching by adult trainers.
- Possible different aspects on the benefits of the application of AR technology among a) the least and most experienced adult trainers, and b) people of different gender.

7. Other feedback

It was suggested to create an m-Learning course.

Focus Group in Romania

Conclusions

The following conclusions emerged during the discussion:

1. Do you consider it was easy for you to learn how to use AR technology to reach the educational goals you had set? Moreover, do you believe it would be easy for adult trainers to learn how to use AR technology to reach their educational goals?

The majority of respondents consider:

- AR technology is generally easy to use
- no advanced digital skills are required
- AR systems' interfaces are user friendly
- it is easy to use and not very difficult to learn
- stimulates the teaching process
- it could stimulate the didactic activity, and at the same time become interactive

2. Do you generally believe that AR technology would be useful to teach different subjects to adults?

All participants stated that:

- AR applications are very versatile.
- AR can be applied in many areas and all education levels
- AR technology can create virtual learning scenarios, a controlled environment within which users learn through action, trial and error, as interesting activities are incorporated, encouraging the application of knowledge

- AR technology can complement the traditional teaching activity, thus expanding the learning spectrum.

3. Which are considered to be the educational benefits gained from the use of AR technology in adult education?

- Accessible learning materials – anytime, anywhere. Augmented reality has the potential to replace paper textbooks, physical models, posters, printed manuals. It offers portable and less expensive learning materials. As a result, education becomes more accessible and mobile.
- No special equipment is required. Unlike VR, augmented reality doesn't require any expensive hardware.
- Learner engagement and interest. Interactive, gamified AR learning can have a significant positive impact on learners.
- Improved collaboration capabilities. Augmented reality apps offer vast opportunities to diversify and shake up boring classes.
- Interactive lessons, where all learners are involved in the learning process at the same time, help improve teamwork skills.
- A faster and more effective learning process. AR in education helps learners achieve better results through visualization and full immersion in the subject matter.
- Development of skills to solve problems
- Provision of immediate feedback
- Practical learning. Apart from schooling, professional training can also benefit greatly from the use of AR. For example, accurate reproduction of in-field conditions can help master the practical skills required for a certain job.
- Safe and efficient workplace training.
- Because of its possibilities for advanced spatial visualization and interaction, AR provides a superior learning environment.
- Universally applicable to any level of education and training.

4. How would you consider the attitude of adult trainers and trainees towards using AR technology in adult education?

Respondents consider that the use of AR in adult education could help to experience teaching in a pleasant, essential and positive way.

5. How do you consider that your colleagues and/or other experts in adult education view the idea of using AR technology in adult education?

In a contemporary and demanding training context, the educator-teacher should combine an array of attributes such as leader, organizer, designer, inspirer, facilitator, researcher, counselor, innovator, presenter or evaluator.

From this perspective, the traditional didactic activity is very well complemented by AR Technology. Thus, in the immediate future, the applications of AR will be unending from the daily routine of a trainer.

At first they may be a little reluctant (due to the fear of the unknown), but seeing the usefulness of AR technology, it will overcome these fears. Respondents also believe that dissemination of good practices and innovative applications of AR technology in adult education, will affect positively the beliefs of adult trainers, and will contribute to create an atmosphere that encourages and promotes a culture of acceptance of AR in adult education.

6. **Which, in your opinion, are the main obstacles in the use of AR technology in adult education?**

Some obstacles remain in making AR experiences part of the average classroom. One is the lack of content- creation tools. Many educational content developers, such as teachers, do not have the highly developed programming and 3D modeling skills currently required to design AR experiences. Unless tools become usable without such skills, AR interfaces most likely will not catch on in the mainstream curriculum. In addition, as more AR systems become mobile, new opportunities for creating highly engaging and interactive educational experiences will emerge. Future research must address the unique opportunities and challenges of mobile systems and how they can enrich classroom teaching, as well as offer novel authoring solutions for students and educators. In many ways, AR technology is where 2D interactive multimedia was in the 1980s. In the decades since, mul-Mobile AR systems are especially useful for learning activities that get students actively engaged both inside and outside the classroom.

Likewise, we expect AR technology to mature enough that students in 2030 will be routinely building AR educational content, thereby tightly connecting the classroom experience to the world around them

Some participants signaled out the lack of resources that were destined in the centers for the use of this technology: “Not enough resources are dedicated to the production of materials with AR” and ”The investment of the governments to pay for materials and elements in AR in the education system, thus promoting traditional education”.

Some obstacles mentioned could be considered operational, such as: finding the materials in English (“Sometimes the educational material is in English, very important” and “the resources are in another language”); non-existence of materials for all subjects (“sometimes there are no resources for the topics that the teacher needs to work”, “there are no materials in the area of educational marketing” or ”lack of materials adapted to students with special educational needs”), the diversity of technology (“The diversity of applications and apps for its use sometimes makes it difficult to install several on different devices” or “The incorporation of a standard for AR that speaks with current LM“”), the economic aspects (“The cost of equipment”), and the lack of support staff for teachers (“The lack of personnel prepared to support the use of AR in teaching is very important”).

Other identified obstacles can be framed in the educational type, as can be seen from the following comments: “In general the conservatism of the directors”, “A more certain

methodological change vision, that incorporates learning objects linked to the AR", or that "It must be integrated into the learning design as a new technological contribution that is complementary".
One last identified issue is Possible lack of understanding of affordances for teaching by adult trainers.

7. **Other feedback**
-

Focus Group in Malta

Questions

The following conclusions emerged during the discussion:

1. **Do you consider it was easy for you to learn how to use AR technology to reach the educational goals you had set? Moreover, do you believe it would be easy for adult trainers to learn how to use AR technology to reach their educational goals?**
In using AR technology for educational purpose, the only challenge is to find a good platform which allows you to create AR content at a reasonable price. In creating the AR content itself, it is quite easy and not so time consuming. From what trainers experienced with their learners, the response was quite good and the learners found it easy to adapt and to interact with the AR platform. Of course, trainers and trainees needs to have a minimum level of digital skills.

2. **Do you generally believe that AR technology would be useful to teach different subjects to adults?**
As AR is accessible through mobile phone app or tablet app, it is more reachable to adult learners as they can use the app both at home, whilst traveling and even at work. It is also easy to use as they do not require a physical tutor whilst going through the material on the AR app. Moreover, AR can be applied to all education levels including primary, secondary, higher education, adult/VET levels and in several areas (e.g. science, mathematics, etc.).

3. **Which are considered to be the educational benefits gained from the use of AR technology in adult education?**
This technology has the following benefits in education:
    1. Optimization of traditional tools and methods for reuse in more efficient manner
    2. Maximum efficiency and productivity with minimum effort

3. An interactive way of learning.
4. Stimulation of curiosity
5. Cost efficient and inexpensive implementation
6. Unlimited educational application

4. How would you consider the attitude of adult trainers and trainees towards using AR technology in adult education?

Both the trainers and trainees have welcomed AR in their curriculum very well and have adapted quite fast. With the benefits discussed above, it was proved to be more efficient than traditional methods. Students can collaborate with the learning environment using either a physical interface (i.e. marker cards) or hardware devices (i.e. keyboard, mouse, 3D mouse) and software user interfaces (i.e. graphical user interfaces).

5. How do you consider that your colleagues and/or other experts in adult education view the idea of using AR technology in adult education?

AR is a topic of discussion in the educational field. The younger and tech savvy educators are very much in favor of the technology and look forward, if not already done, to include such technology in their methods of teaching. Those more conservative are not as welcoming as the prior group however, they are still curious on how the students would perform in their examination with this method of learning.

However, teachers/trainers in the focus group remarked that although they see potential, they feel that there are not enough educational opportunities for the trainers to be prepared and able to create such content. Moreover, they consider that dissemination of good practices of AR technology, will affect positively the attitude of trainers regarding the use of AR in education.

6. Which, in your opinion, are the main obstacles in the use of AR technology in adult education?

- Lack of teacher training
- Lack of educational experience
- Lack of conceptual foundation
- Lack of educational research
- Institutional difficulty/lack of institutional support

7. Other feedback

It was suggested to make the AR app more for mobile phones rather than tablets as it is more accessible for the trainers to use.

Focus Group in Poland

Questions

The following conclusions emerged during the discussion:

1. **Do you consider it was easy for you to learn how to use AR technology to reach the educational goals you had set? Moreover, do you believe it would be easy for adult trainers to learn how to use AR technology to reach their educational goals?**
   Getting into AR is rather easy if tool is designed with usability in mind. Not only it allows teacher/trainer to pick up method quickly, but also shortens time needed by learners to get into method itself. If a teacher/trainer has basic digital skills, creating additional content is rather easy task, although time consuming.

2. **Do you generally believe that AR technology would be useful to teach different subjects to adults?**
   Respondents consider AR technology as a useful educational tool. Moreover, they mentioned that it makes education much safer. It allows teachers/trainers to perform either dangerous tasks or not possible experiments (poorly equipped schools, which cannot afford certain materials otherwise).

3. **Which are considered to be the educational benefits gained from the use of AR technology in adult education?**
   AR can:
   - capture learners' attention
   - provide better understanding of a subject
   - increase learners' participation and motivation
   - make lesson more interesting
   - increase curiosity
   - provide a safe learning environment
   - promote experimental learning and hands-on experience
   - be applied at all educational levels

4. **How would you consider the attitude of adult trainers and trainees towards using AR technology in adult education?**
   Mixed. Some look forward into it, as a new method of learning. Mostly younger teachers/trainers. More experienced teachers/trainers are afraid of removing them from the learning process in general.

5. **How do you consider that your colleagues and/or other experts in adult education view the idea of using AR technology in adult education?**

Respondents believe that the use of AR in education is at an early stage. They emphasized the need to provide trainers with the opportunity to learn this technique and gain practical experience on how AR can be used to enhance the learning process. As an example, they mention when the Internet was introduced for the first time in education.

6. **Which, in your opinion, are the main obstacles in the use of AR technology in adult education?**
   Teachers/trainers who are lacking digital skills. Teachers/trainers who are still behind with modern technology are not going to cooperate happily, as they are going to struggle with tech itself.

7. **Other feedback**
   -

Focus Group in Italy

Conclusions

The following conclusions emerged during the discussion:

1. **Do you consider it was easy for you to learn how to use AR technology to reach the educational goals you had set? Moreover, do you believe it would be easy for adult trainers to learn how to use AR technology to reach their educational goals?**
   Most respondents consider that AR technology is easy to be used by both adult trainers and learners. However, they emphasized the need for adults to be digitally literate. They mentioned that someone needs a minimum level of basic digital skills to take advantage of this technology. Older trainers didn't use smartphones or such advanced technologies during their studies. But now the times have changed. It is important for trainers to get closer to new technologies. In general, AR technology is simple to use but all depends on people's willingness to learn.

2. **Do you generally believe that AR technology would be useful to teach different subjects to adults?**
   Most respondents consider that a trainer can enrich the learning process through AR and subjects taught can be more interesting and attractive. By using a mobile phone, an image can be turned into a video and a drawing in an explosive animated 3D model. They mentioned that it is a tool that can facilitate learning. In addition, some of the respondents referred that the problem is not the technology, but the script. Technology is available but the contents have to be developed in a meaningful way so that to be useful. They also believe that AR can be applied in all education fields and levels.

3. **Which are considered to be the educational benefits gained from the use of AR technology in adult education?**

Pedagogical benefits gained:

- AR increases curiosity, transferring knowledge, but also increasing the attention curve. Through the use of AR technology, learners are active participants.
- Nowadays technology is part of education. AR can give learners the opportunity to gain knowledge through a modern method. AR enable trainees to be engaged in learning through interaction with the educational material. On the long run, this improves understanding and increases both attention and focus in the learning process.
- Trainees are engaged in the learning process as the use of AR in education increases their motivation and interest. Furthermore, AR can help to bridge the gap between theory and practice.
- As the majority of adults and young people own a smartphone, they can have access to learning material anywhere and anytime. Maybe, AR is a tool that can help learners of all ages to enhance their learning in an attractive way.
- AR technology can increase learners' involvement and motivation. Learning can be more interesting and effective.

4. **How would you consider the attitude of adult trainers and trainees towards using AR technology in adult education?**

Most respondents consider that there are a lot of benefits by using AR in adult education but the problem is always the resistance due to the IT gap of some generations. Most adults are not used to using these tools and they do not want to learn or even invest in learning. Another factor that make difficult the use of AR in education process is that it is required a minimum level of English proficiency. As the use of AR in education is in its infancy, education institutes need to invest in training and equip the trainers with skills in order to use those tools so that the learning process to be more attractive.

5. **How do you consider that your colleagues and/or other experts in adult education view the idea of using AR technology in adult education?**

As it has been mentioned, AR technology is in its infancy. Firstly, trainers need to understand the benefits of this educational tool. Unfortunately, there is lack of training opportunities for them to learn how to use this technology and also how to incorporate it in their sessions.

6. **Which, in your opinion, are the main obstacles in the use of AR technology in adult education?**

The following obstacles have been mentioned:

- lack of training opportunities both in pedagogical and technological knowledge regarding AR
- the few educational experiences found
- lack of sources and educational material to be used
- lack of collaboration with experts in the field
- lack of digital skills
- lack of time for training
- the rapid evolution of technology

7. **Other feedback**
AR can be applied in many subject areas and it can also help learners of all ages. Moreover, AR allows learning to take place anywhere and anytime.

Focus Group in Spain

Conclusions

The following conclusions emerged during the discussion:

1. **Do you consider it was easy for you to learn how to use AR technology to reach the educational goals you had set? Moreover, do you believe it would be easy for adult trainers to learn how to use AR technology to reach their educational goals?**
All attendees agree on the interesting contributions AR technology brings to educational world. They point out that there are different degrees of complexity. Present institutions state that they started using simple resources so that it was not difficult for them to introduce AR technology in the classroom.

   Attendees assert that the use of AR for educational purposes is taking place mainly among trainers keen on new methodologies, who decide to introduce them in classroom, because they are already familiarized with other innovative methodologies. We could say that "they have lost their fear" with regards to using new innovative supports.

   All attendees agree that it would be easy for trainers to learn about the use as well as the potential of AR, as long as they receive an adequate training that could introduce them into the specificities of the new tool.

2. **Do you generally believe that AR technology would be useful to teach different subjects to adults?**
Attendees respond affirmatively to the question, asserting that AR technology has great potential. They claim that considering the training needs as well as learning difficulties of adult learners, trainers could take advantage of AR for increasing motivation in classrooms.

It must be considered that training designed under the technology of Augmented Reality can contain text, images, animations, videos, audios and so on, which considerably expands the available resources for trainers to design higher quality as well as more attractive content for learners of all ages.

3. **Which are considered to be the educational benefits gained from the use of AR technology in adult education?**

Different benefits have been listed among the attendees:

- Greater attractiveness of the offered content.
- Greater accessibility
- Easy way to expose educational content
- Availability to access places that otherwise would require physical displacement
- Immediacy
- Safety in practice
- Trial and error learning
- Costs reduction.

4. **How would you consider the attitude of adult trainers and trainees towards using AR technology in adult education?**

In general, trainers are open to using new technologies and methodologies, provided that they bring value to content and that they integrate with training needs as well as the design of the training. Technology itself does not make sense to trainers, who nowadays have easily accessible different resources at a methodological level. The group agrees on the need of concrete actions to make trainers aware of the advantages of this new methodology, as well as on the need of training, which is almost non-existent in the market.

5. **How do you consider that your colleagues and/or other experts in adult education view the idea of using AR technology in adult education?**

It is reiterated that there is great ignorance regarding the advantages of Augmented Reality as a methodology. They believe it is valid, but they point out that it is necessary to raise awareness so that reluctant trainers are able to realize that AR is more accessible than what they thought. The main reason for trainers avoiding using it is the lack of knowledge about how to apply it on classroom. It is more widespread in matters related to technical skills.

They assert again that not all contents are adaptable to this methodology. For this reason, they claim that it is of the utmost importance to consider the contents, context and groups in which it is used.

6. **Which, in your opinion, are the main obstacles in the use of AR technology in adult education?**

Different obstacles have been listed:

-The lack of professionalization in adult training leads to few resources / Planning of training programs in which new methodologies such as AR are well integrated

-The lack of training offered for trainers on new methodologies such as AR prevents/hinders its practical application and introduction into specific training programs.

-Adult trainers generally have few pedagogical resources.

-Changing contexts of both students and learning environments require to make review in the contents and methodologies used in adult training.

7. **Other feedback**

Infrastructure, current organization, objectives, educational offer as well as the demand of learners in matters of adult training has been multiplied. Adult training does not only seek literacy, it also seeks new educational opportunities.

Adult education is the place of reference where learning must meet with curiosity, emotion, and people in a real way. In this context AR is more reasonable than ever.

Training must be complemented with strategies for the construction of a living environment, in which apart from learning, learners can provide knowledge also. In this context, AR can play an important role.

Focus Group in Czech Republic

Conclusions

The following conclusions emerged during the discussion:

1. **Do you consider it was easy for you to learn how to use AR technology to reach the educational goals you had set? Moreover, do you believe it would be easy for adult trainers to learn how to use AR technology to reach their educational goals?**

From all participants of the focus group point of view – yes. However, most of them studied IT at high-school or University. That is why they mentioned that for the older generation of adult trainers, it could be a problem to learn how to use AR technology.

On the other hand, the applications for mobile phones nowadays are usually developed in a very simple and user-comprehensive way, so in general, they don't think that AR would represent a difficult type of new digital skill, once the person using it has some basic knowledge about using mobile apps and smartphones. Furthermore, they agreed that it can seem not to be easy at first sight, but later we can see, that it´s easier than as it seems.

Using AR technology in education is beneficial and can help to reach adult trainers' educational goals. However, it also depends on the qualities of the trainer and the ways he is using AR in education. Combination of an experienced superior teacher and AR effects would overall be the best motivation for adult trainees.
Overall, when trainers try to understand it as much as it´s possible, it can be easy for them to learn it and use it for reaching their educational goals through a very efficient and attractive way.

2. **Do you generally believe that AR technology would be useful to teach different subjects to adults?**

AR is a multimedia tool with a lot of possibilities. However, we cannot forget that the most important thing in education is its content.
All five respondents believe that AR technology can be useful to teach different subjects to adults as well as to youngsters/children. In their opinion, there is no big difference in using such tools between adults and youngsters/children. Also, the big IT systems are primarily developed for adults, not for youngsters, so the argument like "all digital tools are more accessible for the youngest" is quite false.
With the AR technology, we are talking about an attractive tool aiming at getting things more tangible (somehow) and/or more explanatory. There is no need for deep knowledge of the technology or advanced digital skills, only for basic and very general skills in this area. We can see this as an opportunity for adults to catch up with some of the gaps they could have with new technologies. There are already low-educated warehousemen using AR/VR and mobile apps in their daily work, for example.
It enriches teaching in different ways which should be filled with not only quality information but also with practical examples. Generally, they believe in the usefulness and beneficial effect of AR technology in this context as it enriches teaching which should be filled with not only quality information but also with practical examples in many different ways.

3. **Which are considered to be the educational benefits gained from the use of AR technology in adult education?**

- AR technologies make teaching more attractive – learning topics can be brought closer to participants in a new and interesting way
- An efficient, demonstrative, playful way of education with a multimedia character which engages several of our senses and leads to a deeper perception of the moment, of the educational process
- Possibility of demonstration of the taught theme
- More possibilities for how to show pictures and present the taught topic
- Relatively affordable and available technology
- When using AR one can inexpensively simulate the situation that exists on the other side of the world – that means that AR can be used around the world without having to go there

- AR can be labelled as a non-invasive technology – because of the AR you can explore a different type of things and at the same time you don't have to cut it up, throw it away and need a new one next time or spend on restoration

4. **How would you consider the attitude of adult trainers and trainees towards using AR technology in adult education?**

It depends on the type of person. Nowadays, most of the adult's trainers are quite conservative (for using new media including AR technology), but at the same time, some are always enterprising, active, hardworking and initiative in discovering new useful technologies. Moreover, using AR technology in education is still quite new that means that it still has the potential to be a fun and attractive tool to anyone who does not avoid new things a priori.
To motivate and impress adult trainees the trainers should be wisely choosing taught topics and be patient to let trainees get used to it, like it and see its benefits.

5. **How do you consider that your colleagues and/or other experts in adult education view the idea of using AR technology in adult education?**

As it was said in 4th answer it depends on the type of a person. From respondents' personal experience professionals who already have a good experience with AR technology are supporting it but others without experience are more caution. Adult's trainers can be quite conservative in using AR technology. But when they see and understand the usefulness and helpfulness, they like to use it.
On the other hand, currently, these principles are often accepted as a normal part of teaching. Younger trainers could be more active in using AR in adult education – right from start. Because a new generation like and use new media more commonly.

6. **Which, in your opinion, are the main obstacles in the use of AR technology in adult education?**

- Financial costs and possibilities
- Insufficient edification
- Older adult educators who are not open learning new things and using new technologies in their classes
- Skepticism to new things
- Technical support of institutions
- Insufficient experience in using AR technologies

7. **Other feedback**

-

General Conclusions

Despite the increasing use of Augmented Reality in many areas of the modern era, the educational applications are still new and immature. However, trainers in the focus group noted that:

i. AR systems' interfaces are user friendly but require prior experience in basic digital skills. In this view, DESK curriculum can help adults catch up with basic digital skills.
ii. AR can be useful in education at various levels including primary, secondary, tertiary and also Adult/VET.
iii. AR technologies have the potential to both enrich learning environments by structuring new knowledge in innovative ways and also provide a deeper understanding of subjects through interactive learning.
iv. AR applications can also enhance learners' motivation and collaboration, while keeping their interest undistracted.
v. Trainers/teachers notice that there are few opportunities for professional training in AR educational technology. That's why the newly designed curriculum will cover this need.

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ANNEX I

MODERATOR GUIDE

Welcome and thank you for taking part in this focus group. This focus group is conducted in the framework of the Erasmus+ project "An Adult Digital Education Skills Kit to Foster Employability (DESK)". Your experience and your opinion are important for us.
(A brief summary of the project will be presented.)

Introduction:
This focus group discussion is conducted to assess your attitudes, beliefs, behaviors concerning the potential of utilizing AR technology in the field of adult education.

The duration of the discussion is between 1 hour and 1 hour and 30 minutes.

I would like to assure you that the conclusions resulting from our discussion will contain no information that could be used to link someone to specific statements.

Please feel free to express your thoughts and beliefs on the subject in question. Also, I would like to ask you not to interrupt the other members of the group before they express their opinions.

The moderator introduces himself and so do the participants. The moderator shares the demographics details questionnaire (Annex II) and waits for the participants to fill them in. He also shares the informed consent statement (Annex III) and waits for the participants to read and sign it. *(The assistant moderator collects them.)*

Does anyone have any question?

Do I have your permission to record our discussion? *(If not, the assistant moderator will keep notes.)*

Discussion

As far as I know most of you have some experience in the utility of the technology of AR (through your participation in educational training programs), while the rest of you have used AR in training sessions out of personal motivation. This is the reason I believe your opinion could give us valuable information, concerning the opportunities and obstacles we face to put this technology in use in educational practices.

Questions

1. Do you consider it was easy for you to learn how to use AR technology to reach the educational goals you had set? Moreover, do you believe it would be easy for adult trainers to learn how to use AR technology to reach their educational goals?

   More explanatory questions:

   - Could adult trainers' interaction with AR technology be understandable and clear for them?
   - Would it be easy for adult trainers to perform educational content with the use of AR technology?
   - Would adult trainers' interaction with AR require a significant intellectual effort?

2. Do you generally believe that AR technology would be useful to teach different subjects to adults?

   More explanatory questions:

   - Do you consider that the use of AR technology would enable adult trainers complete their training sessions quicker?
   - Would the use of AR technology improve adult trainers' performance during their training sessions?
   - Would the use of AR technology lead to a better understanding of the subject by the adult learners?
   - Would the use of AR technology increase adult trainers' productivity during their training sessions?
   - Would the use of AR technology improve the quality of adult trainers' teaching?

- Would the use of AR technology allow adult trainers to have more control over their teaching work?
- Would the use of AR technology enable adult trainers carry out a larger volume of educational work, in comparison with different?

3. Which are considered to be the educational benefits gained from the use of AR technology in adult education?
4. How would you consider the attitude of adult trainers and trainees towards using AR technology in adult education?
5. How do you consider that your colleagues and/or other experts in adult education view the idea of using AR technology in adult education?
6. Which, in your opinion, are the main obstacles in the use of AR technology in adult education?
7. Other feedback

Conclusion

Thank you for your time. I hope you found the discussion interesting. I would like to assure you once again that your opinions will remain anonymous.

ANNEX II

DEMOGRAPHIC DETAILS QUESTIONNAIRE

Please answer the following questions.

1. Gender: ….. Male ….. Female

2. Age: .....

3. Educational Level: .....

4. Occupation: .....

5. Teaching subject area: .....

6. Years of experience in Adult Education: .....

7. Experience in AR: .....

.....

.....

Thank you for your time.

ANNEX III

Informed Consent Statement

Moderator:

Phone:

This focus group activity investigates the opinions on how AR can be used in Adult Education. I will take part in a discussion answering some structured questions. This activity will take about 60 minutes.

The answers I give are confidential. Only the researcher has the right to have them. When the results are reported, my answers will not be connected with me as an individual. I will not share other participants' names or answers to anyone outside the focus group. I am entitled not to answer any questions or not to do any tasks I choose not to. I have the right to abstain from the discussion any time I want to, without facing any penalties. As soon as the research is completed, I should be made aware of the results as soon as they are made known.

I choose to take part in this activity on my own, without being forced by external factors.

I am an adult, and understand my rights as a participant of the research as explained above. I participate as a volunteer.

Name: _____

Signature: _____ Date: _____

ANNEX IV

Focus Groups Details

Focus Group in Greece

Date of Focus Group Meeting: 1/10/2019

Moderator and assistant moderator:

The moderator was Mr. Charalampos Barmparousis. He is/holds:

- Sociologist (Panteion University of Social and Political Sciences)
- a Master's Degree in "Sociology of Education" (University of Ioannina)
- PhD Candidate (University of Ioannina)
- a certified Adult Trainer (> 12 years in-service teaching experience in Adult Education)
- co-author of the book titled «Social and Political Education with the Use of New Technologies» (Nikolaou & Barmparousis, 2017)
- Director of a Secondary Education School in Karditsa

Mr. Barmparousis has dealt with the pedagogical use of AR technology in his book entitled «Social and Political Education with the Use of New Technologies» which is a textbook for some Greek University Departments.

The assistant Moderator was Mrs. Maria Malliora. She holds/is:

- an Electrical & Computer Engineer's Degree (Aristotle University of Thessaloniki, AUTh)
- a Master's Degree in Adult Education (Hellenic Open University, HOU)
- a certified Adult Trainer (> 19 years in-service teaching experience in Adult Education)
- experienced in AR since 2016 after her participation in the Erasmus+ Project with code 2015-1-EL01-KA104-013699.

Participants' Profile:

Gender: 6 Adult Trainers (5 men and 1 women)

Age: 40-55 years old

Educational Level:

- Bachelor's Degree : 4
- Master's Degree : 2
- Doctoral Diploma, Ph.D : 0

Occupation: All participants are Adult Trainers. 5 of them are also school teachers.

Teaching subject area: ICT: 2, physic: 2, literature: 2

Years of experience in Adult Education: 5 out of 6 attendees have more than 10 years in-service teaching experience in Adult Education, 1 out of 6 attendees have less than 5 years.

Experience in AR: 2 of them were trained in AR through the Erasmus+ Project with code 2015-1-EL01-KA104-013699, 2 of them were trained in AR through the Erasmus+ Project with code 2018-1-EL01-KA102-047291 and 2 of them learnt to use AR by their own.

Venue: E-school's premises

Length of focus group discussion: 1 hour and 20 sec

Data collection: Notes were kept by the assistant Moderator.

Below some photos of the focus group.

Focus Group in Romania

Date of Focus Group Meeting: 3/10/2019

Moderator and assistant moderator:

The moderator was **Prof. AMZA Catalin Gheorghe .** He is/holds:

- Professor at University Politehnica of Bucharest, Faculty of Industrial Engineering and Robotics
- Holds an Engineering Degree in Computer Science from University Politehnica o Bucharest
- Holds a Master's Degree in Human Computer Systems from De Montfort University, United Kingdom
- Holds a PhD Degree in Computer Science from De Montfort University, United Kingdom
- A certified Adult trainer
- Experienced in AR since 2006; 3 books in the AR filed; 5 scientific papers in the AR field
- Project manager for three research projects in the AR field

The assistant Moderator was Prof. CHICIOREANU Teodora: She is/holds:

- an Electrical & Computer Engineer's Degree (University POLITEHNICA of Bucharest)
- a Master's Degree in Adult Education (University of Bucharest)
- a PhD Degree in Mobile Learning (University of Bucharest)
- a certified Adult Trainer (> 20 years in-service teaching experience in Adult Education)
- experienced in AR since 2012

Her area of expertise lies within pedagogical educational aspects, e-learning technologies, web technologies and novel and innovative technologies such as Augmented Reality.

Both moderators have published scientific papers and books in the field of AR

Participants' Profile:

Gender: 9 Adult Trainers (4 men and 5 women)

Age: 28-42 years old

Educational Level:

- Bachelor's Degree : 7
- Master's Degree : 2
- Doctoral Diploma, Ph.D : 0

Occupation: All participants are Adult Trainers.

- 4 school teachers
- 1 director in state school (programmer)
- 1 director in state kindergarten (programmer)
- 1 Erasmus project evaluator
- 2 programmers

Teaching subject area:

- ICT: 4
- math: 2
- economics: 2
- physic: 1

Years of experience in Adult Education:

- 6 persons have 10 years in-service teaching experience in Adult Education
- 3 persons have experience in training

Experience in AR: all of them learnt to use AR on their own.

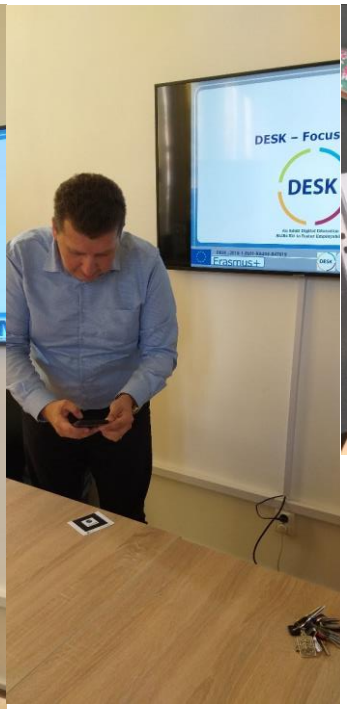
Venue: University POLITEHNICA of Bucharest, building BN, room 230

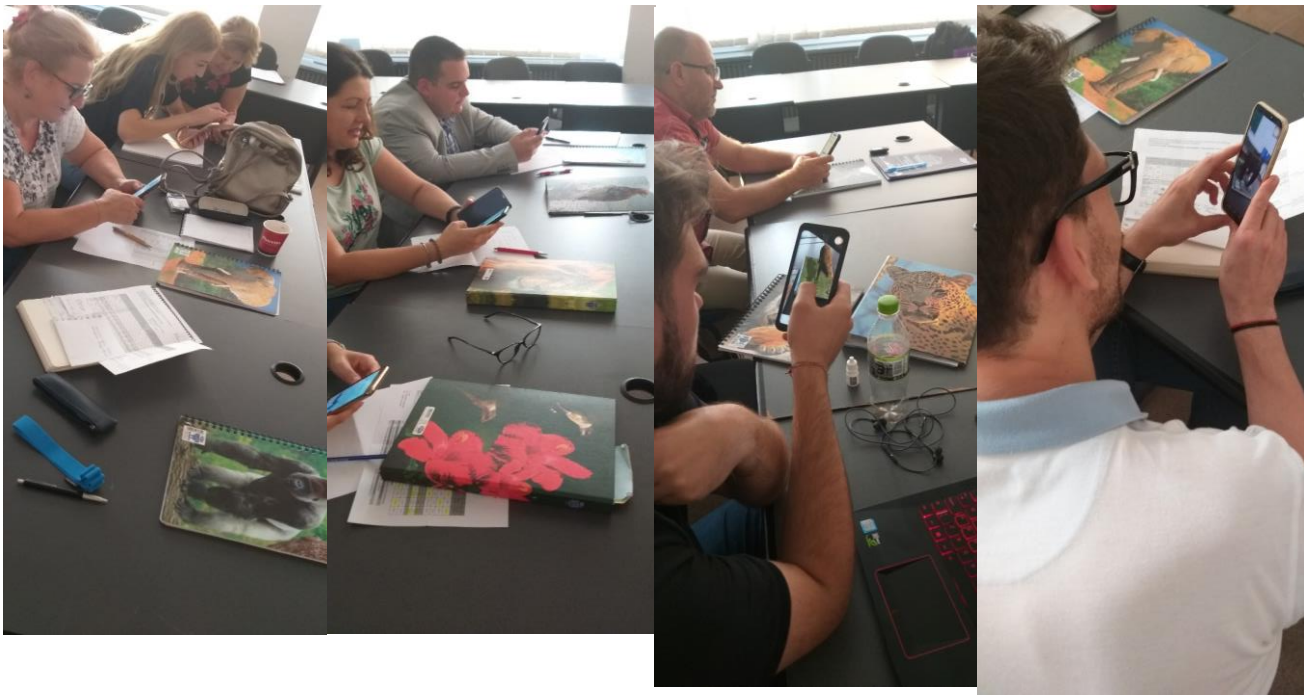
Length of focus group discussion: 1 hour

Data collection: Notes and photos were kept by the assistant Moderator.

Below some photos of the focus group.


DESK – Focus Grup
DESK


DESK – Focus
DESK
Erasmus+



Focus Group in Malta

Date of Focus Group Meeting: 30/09/2019

Location: Malta

Moderator's Name: Eric Flask

Assistant moderator's Name: Stephanie Borg Cappello

Participants' Profile:

The focus group consisted of 7 people, 4 males and 3 females, whereby ages varied between 30-55 years. From the group 71% (5/7) held a Bachelor's Degree whilst the remaining 29% (2/7) held a Master's Degree.

Participants come from the educational background, whereby they are either primary school educators, secondary school educators and tertiary school lecturers. The subjects taught by these educators were either ICT, Marketing, Programming or Communications.

86% (6/7) of the attendees had more than 10 years' experience in education whilst 14% (1/7) had between 5 to 10 years.

72% (5/7) of the educators were self-taught in AR, 14% (1/7) received training in AR from a course whilst the remaining 14% (1/7) never received any training at all (from this 14%, very little knowledge of AR was known).

Below some photos of the focus group.

Focus Group in Poland

Date of Focus Group Meeting: 30/09/2019

Location: Stanisław Staszic University of Applied Sciences in Pila, Poland

Moderator's Name: Michal Hartlinski

Assistant moderator's Name: Maciej Gawrysiak

Participants' Profile:

Gender: 5 adult trainers (5 men)
Age: 35-62 years old
Educational Level: Master's Degree x4, Ph. D x1
Occupation: All participants are academic teachers
Teaching subject area: Economics x1, Physics x3, Education x1
Years of experience in Adult Education: 8+
Venue: Stanisław Staszic University of Applied Sciences in Pila premises
Lengh of focus group discussion: 60 minutes
Data Collection: Notes were made by Michal Hartlinski

Below a photo of the focus group team.

Focus Group in Italy

Date of Focus Group Meeting: 03/10/2019

Moderator and assistant moderator:
The moderator was Mr. Leonardo Filiani. He is/holds:

- a business consultant
- over 300 hours as a trainer
- is a Team staff at Euro-net and works on many KA2 Projects
- no experience in AR

The assistant Moderator was Mrs. Maria Rosaria Polosa. She holds/is:

- a Degree in Modern Foreign Languages and Literatures
- a Master's Degree in Tourism Economics and Management at Ciset
- (International Center of Study in Tourism Economics)
- is a Team staff at Euro-net and works on many KA2 Projects
- no experience in AR

Participants' Profile:

Gender: 5 Adult (4 men and 1 woman)

Age: 35-55 years old

Educational Level:

- Bachelor's Degree: 4
- Master's Degree: 1

Occupation: The group of participants is heterogeneous: 2 of them are Tech Professionals (programming and design), 1 is a Set Designer, 1 is a Consultant and 1 is a Communication Expert and Trainer.

Teaching subject area: Communication, Innovative Technologies, Web and Graphic design, Social Media and Business

Years of experience in Adult Education: 4 out of 5 attendees have 5 to 10 years in experience in Adult Education – 1 has not experience at all

Experience in AR: 3 out of 5 attendees are self-taught in AR, 1 was trained in AR at a training course held by a private company in Potenza, 1 doesn't have any experience with AR but is an expert in Innovation and Communication and works as trainer for high school students and adults.

Venue: Participants sat around a table in GoDesk premises (a co-working space in Potenza)

Length of focus group discussion: 1 hour and 10 mins

Data collection: Notes and photos were kept by the assistant Moderator.

Below some photos of the focus group.

Focus Group in Spain

Date of Focus Group Meeting: 27/9/2019

Venue: Bilbao

10:00-11:30

Moderator's profile

The focus group has been moderated by Leire Monterrubio (Media Creativa 2020), Sociologist who has been working in social research for more than 20 years. Moreover, she has specific training regarding the implementation of qualitative techniques.

Participants Profile:

- Head of Educational Innovation
- Head of Training x 3
- Adult trainer x 2
- Freelance trainer
- Manager

Used method

Regarding the recruitment process, the group has been completed with 8 people, 4 men and 4 women, representing gender balance in relation to attendees.

All participants have proven experience regarding the subject we are going to deal with, being either the Head of Training or trainers with great experience in the use of AR technology.

Focus Group in Czech Republic

Date of Focus Group Meeting: 4/10/2019

Moderator and assistant moderator:

The moderator was PhDr. Jan Hauser

- Master's Degree in *International Area Studies* (Charles University)
- PhD Candidate
- Adult Trainer at Charles University
- Certified expert of European Commission (TAIEX)

The assistant Moderator was Mgr. Martin Rejmíš

- Master's Degree in *International Area Studies* (Charles University)
- Experienced Adult Trainer – social innovations, active employment policy, innovations in tourism

Participants' Profile:

Gender: 5 Adult Trainers (2 men and 3 women)

Age: 30 – 40 years old

Educational Level: Master's Degree: 5

Occupation: All participants are Adult Trainers. 3 of them are working as educators in the department of education within Prague City Gallery. 2 of them are IT experts and trainers.

Teaching subject area: Art education, AR/VR gamification, IT systems

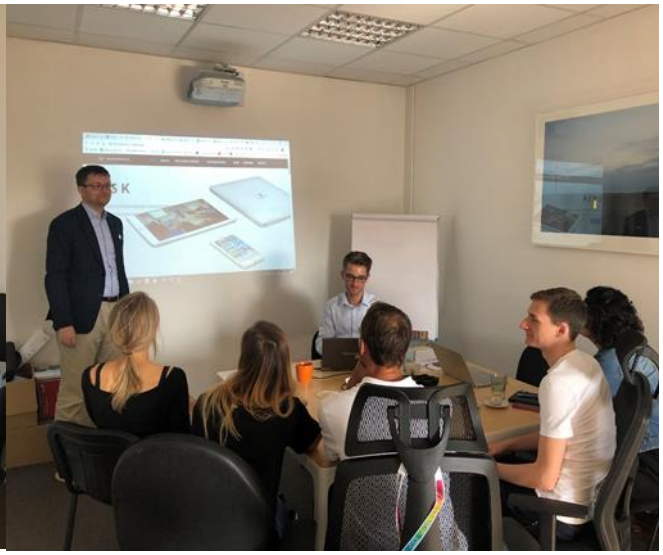
Years of experience in Adult Education: on average more than 5 years of teaching experience in Adult Education

Experience in AR: advanced

Venue: Hradčanská office center, Milady Horákové 116/109B, 160 00, Prague (CZE)

Length of focus group discussion: 1 hour

Data collection: Notes were kept by the assistant Moderator.



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An Adult Digital Education Skills Kit to Foster Employability

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