Education and Culture DG
Lifelong Learning Programme

LARGE PROJECT

Learning Augmented Reality Global Environment

LIFE LONG LEARNING PROGRAMME – KEY ACTIVITY 3 ICT

[DURATION: November 2011 – October 2013]

STAKEHOLDERS' CONSULTATIONS SUMMARY

[WORK PACKAGE 3: Stakeholder consultations / Deliverable 2]

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LOCAL WORKSHOPS RESULTS AT ALL EDUCATIONAL LEVELS

1. Dates and places of the workshops

Country	City	Date
Bulgaria	**Blagoevgrad**	28th – 29th March 2012
	Lukovit	30th – 31st March 2012
	Velingrad	06th – 07th April 2012
Italia	**Empoli**	13th – 14th March 2012
	Empoli	15th – 16th March 2012
	Empoli	28th – 29th March 2012
Lithuania	**Vilnius**	3th of March 2012
	Trakai	22nd – 23th March 2012
	Trakai	24th March 2012
Estonia	**Tallinn**	8th March 2012
	Tallinn	14th March 2012
	Tartu	30th March 2012
	Laulasmaa	4 - 5th May 2012
Romania	**Bucarest**	8th – 9th March 2012
	Bucarest	8th – 9th March 2012
	Bucarest	14th – 15th of March 2012

2. Geographical coverage of the workshops

2.1. Bulgaria

In the first workshop participated 6 economic planning regions out of 6 in the country, 13 districts out of 28 in the country, 28 municipalities out of 264 in the country.

In the second workshop Bulgaria involved 5 economic planning regions out of 6 in the country, 9 districts out of 28 in the country, 9 municipalities out of 264 in the country.

The persons that participated at the third workshop were coming from 6 economic planning regions out of 6 in the country, 13 districts out of 28 in the country, 28 municipalities out of 264 in the country.

2.2. Italy

All the three Workshops organized in Italy covered mainly the Empolese Valdelsa district and the Toscana region with important cities such as Florence, Pisa and Livorno.

The attendees were schools (Busoni-Vanghetti School, Enrico Fermi High School, Leonardo da Vinci Institute for Superior Education, Il Pontormo High School), universities (Università di Firenze, Università di Pisa, Università di Siena), and Vocational Education and Adult Training Agencies (Agenzia per lo Sviluppo Empolese Valdelsa, CE.S.CO.T., Scuola Professionale di Estetica Armony).

2.3. Lithuania

In the first workshop the participants were schools from Vilnius, Kaunas, Utena, Kupiškis.

The second workshop involved VET and adult education providers from Vilnius, Kaunas, Utena, Alytus.

The third workshop's attendees were universities, the participants were from Vilnius Gediminas Technical University, Vilnius University, Kaunas Technological University, Šiauliai University, Klaipėda University, Kaunas Vytautas Magnus University, Kaunas A. Stulginskis University, Alytus University, Vilnius university of applied engineering sciences, Vilnius Mykolas Riomeris university

2.4. Estonia

In the first two workshops and in the last one, the attendees were from all over Estonia but primarily the Northern region of the country where the population is most dense and in which the capital Tallinn is situated. No specific data was collected in relation to the geographical origins of attendees.

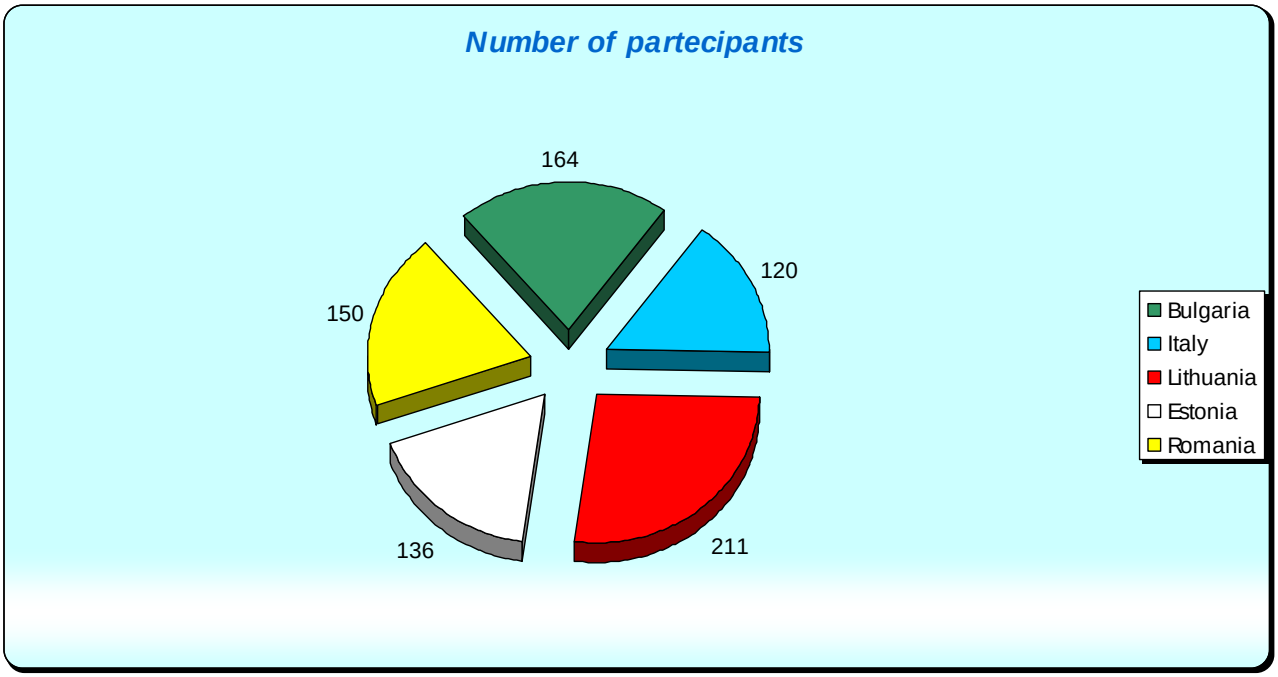
The attendees at the third workshop were mainly from the Southern region of Estonia. The workshop was held in Tartu, the second city which is situated in the south of the country.

2.5. Romania

The three workshops organized in Romania covered the districts of the municipality of Bucharest.

3. Number of participants and their distribution by target groups

3.1. Number of participants



At the Local Workshops organized in the 5 partner countries of the project LARGE took part a **total of 781 persons.**

In **Bulgaria** the most representative age-group were the people between 41-50 years old, followed by people with the age between 31-40 and 51-60. More than a half of the attendees were women.

In **Italy** 33,33% of the attendees were students under 18 years old, 25% were young people aged 19-25 and 30 % were teachers over 35. Another interesting observation is that 61,7% were male.

In **Lithuania** the average age of the attendees 36,9 years old and 62% were women.

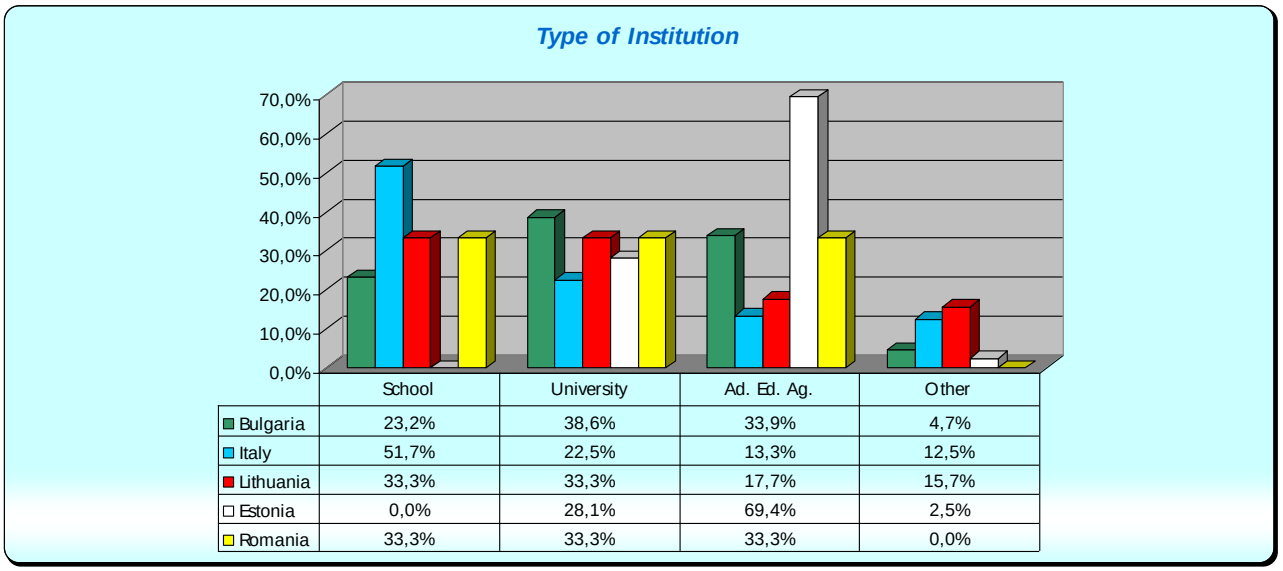
In **Estonia** the most representative age-group that reached in all 4 workshops more than 90% was the one between 20-29 years old and more than 60% of the attendees were male.

In **Romania** 76% of the people who participated in the University Workshop were between 21-23 years old and 75% of them were female. At the pre-university level, 70% were students between 11 and 14 years old while only 12% were adults between 30-40 years old. Half of the attendees in the VET and Adult Education Workshop were between 30 and 50 years old.

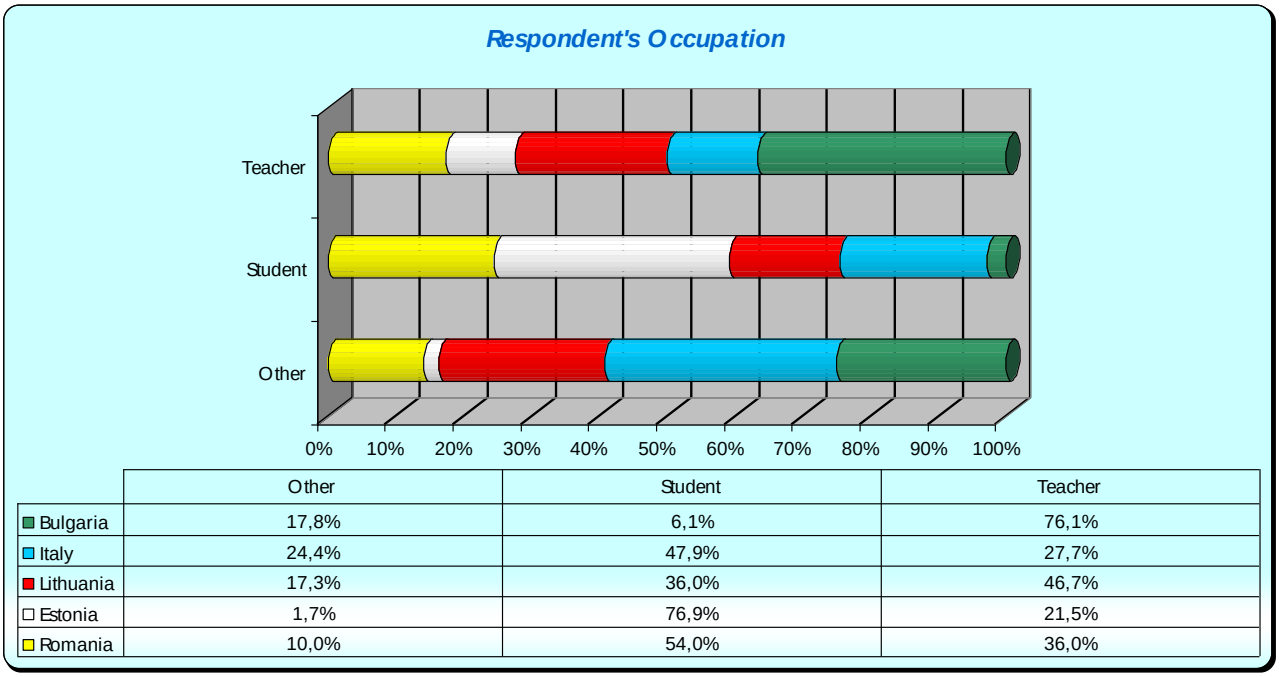
3.2. Distribution by target groups

As shown in the graphic below, regarding the target groups of the attendees in the workshops organized all over Europe by the 5 partner countries in the LARGE project, we can see that in Bulgaria the highest percentage was reached by the university target group (38,6%), in Italy 51,7% of the attendees in all

workshops were coming from the schools target group, in Estonia they reached in a percentage of 69,4% the VET target group, while in Lithuania and Romania the distribution was more balanced.



	School	University	Ad. Ed. Ag.	Other
Bulgaria	23,2%	38,6%	33,9%	4,7%
Italy	51,7%	22,5%	13,3%	12,5%
Lithuania	33,3%	33,3%	17,7%	15,7%
Estonia	0,0%	28,1%	69,4%	2,5%
Romania	33,3%	33,3%	33,3%	0,0%



	Other	Student	Teacher
Bulgaria	17,8%	6,1%	76,1%
Italy	24,4%	47,9%	27,7%
Lithuania	17,3%	36,0%	46,7%
Estonia	1,7%	76,9%	21,5%
Romania	10,0%	54,0%	36,0%

Regarding the occupation of the attendees in the Local Workshops, the 5 countries had quite different results: 76,1% of the attendees in Bulgaria were teachers and only 6,1% students; in Italy the students (47,9%) were the most representative number, followed by the teachers with 27,7%; the situation changes in Lithuania where we have again more teachers (46,7%) then students (36%); in Estonia like in Italy, 76,9% students against 21,5% teachers; in Romania 54% of the attendees were students, and 36% teachers.

In **Bulgaria** the pre-university level education workshop was attended by teachers and students as well as by representatives of municipalities and the Regional Inspectorate of Education (RIE) in Blagoevgrad, 67,2 of the attendees were pupils.
At the Vocational Education and Training workshop the attendees were mainly teachers in institutions offering continuing education and training for adults as well as managers of such organizations.
The representatives of the institutions offering continuous education and training for adults form the main share in the distribution of participants in the workshop (87,76%), but some representatives of vocational training departments of the universities and one secondary school also took part in it.
The greater majority of the participants in the third workshop were teachers in higher schools in the country, and a little bit over one quarter of the participants were currently occupied predominantly with the organization of the educational process in the universities in which they teach.

In **Italy** the participants in the Workshop for the universities were mainly university students and university teachers, but there were also some Adult Education trainers and adults in training courses. In the Workshop organized for the schools 71% were pupils and 24 were teachers. The attendees in the Vocational Education and Training workshop were 36% young people attending training courses in a VET Agency.
Representatives of the municipalities and other public institutions also attended the workshops and are 12,5% of the total number of participants.

In **Lithuania** the participants in the three workshops were divided in the following way: 33,33% came from schools and the same percentage from universities, 17,7% were coming from the Vocational Education and Training and 15,7% other non specified fields in the education environment.

In **Estonia** the university level workshop attendees were primarily university students and teachers from the Tallinn University of Technology. The observation regarding the people who took part in the VET workshop is that they were adult learners engaged in a project management course provided by the Tallinn University of Technology. Other target groups were formed by students from a technical college in Tartu and by university teachers and university (PhD) students.

In Romania at the pre-university level the workshop involved35 pupils and 15 teachers from 6 schools and 1 kindergarten. The university level workshop was attended by 46 students and 4 teachers from 2 universities

and the third workshop, addressed to the VET and Adult Education field involved 15 trainees and 35 teachers and trainers from 7 institutions for VET and Adult Education.

4. Comments on the presentation of the objectives of the LARGE project and the possible benefits regarding the optimization of the educational and training processes at national and European level

4.1. Bulgaria

In the Bulgarian schools, the low level of personal motivation and the unattractive teaching were highlighted by the participants in the workshops as important existing obstacles to enhance the effectiveness of the educational process, while the goals and products of LARGE were defined as an adequate and necessary tool for a possible overcoming of these problems.

Enhancing the attractiveness of teaching the educational content was noted as one of the basic advantages of the project, together with the conditions created to increase the interest and motivation of students as well as the universal applicability of the technology to all educational and training levels and forms. According to the participants in the discussion, these positive effects can be multiplied through the active role of RIE, not only as a controlling authority, but also as a creator of AR lessons and local libraries of various AR applications as well as an evaluator of the created by means of the application and as a result of the project lessons and themes. The participants in the discussion proposed organizing school competitions where students can present their 3 D applications.

Regarding the universities, the teachers approved the ideas and goals of the project and consented that applying the technology in the sphere of education is not only fully possible, but it is also a necessary

precondition for enhancing the quality of the educational and teaching process in the conditions of the constantly developing information technologies and their mass usage.

The participants in the discussion welcomed the possibility of the technology to present three-dimensional models started by an image. In this connection, they proposed the inclusion of such images directly in the textbooks, which, according to them, is an effective way for a comparatively fast popularization of the technology. According to the participants, the increase of students' motivation and the attractiveness of the educational content as well as the stimulation of the creative potential of the teachers are only part of the positive effects that AR will have in all educational spheres.

For the Vocational Education and Training, according to the participants in the workshop the ideas and goals of the LARGE project are correctly set and well aimed, having in mind the relatively slower introduction of innovative technologies in the educational systems and their needs in general.

The participants in the discussion agreed with the wide application and the great effectiveness of the technology in the sphere of Vocational Education and Training (VET) and the education for adults. According to all the participants, the creation and use of educational 3 D materials will be exceptionally useful in all practical trainings, which will, without doubt, enhance the effectiveness of the educational process.

They also approved the establishment of a library of 3 D applications, but part of them expressed their concern that the institutions offering continuing education and education and training for adults function on a competing principle, which will be an obstacle for the realization of cooperation and free exchange of 3 D models among them.

Still, a great part of the participants saw in this market functioning principle the possibility to increase, through the use of the AR technology, the competitiveness of the institutions in which they work.

4.2. Italy

The still limited introduction of technology in schools comes in part from structural issues but it is also linked to a lack of decision makers update. This lack is not just upgrade knowledge about IT solutions applied to learning path and new methodology, sometimes is much more a cultural resistance.

In Italy we have several projects that aim to introduce new technologies in the educational environment.

One of these is the Project **CI @ ssi 2.0,** also present in Spain and United Kingdom, that wants to verify how, through the constant and widespread use of technology in everyday teaching practice, the learning environment can be transformed.

Another project, **The Digital School Project** was founded to develop and enhance educational innovation through the use of information technology.

To this end, the Italian Ministry for Instruction, Research and University has prepared a plan to equip state schools with a kit consisting of technological Whiteboards Interactive Multimedia with integrated projector and personal computer.

Introducing LARGE in this context we obtained a good feedback from the participants in all three workshops, and quite all of them agreed that introducing new technologies for teaching can only make a better educational system.

None of the school teachers that participated in our workshops were using Augmented Reality for teaching, but they would be very interested to use it. The concern of all the teachers involved in the workshops in Italy was that the tool for creating AR contents would be difficult to use, it would be time-consuming and that would be negative for the future of LARGE.
Only 10% of the school teachers think that AR will not increase students motivation for studying, that means the remaining 90% do believe that new technologies can improve their work.
The attitude of the VET teachers regarding the use of AR for teaching seems to be less enthusiastic about this technology, for example only 70 % of them would be interested in using the interactive modelling for teaching. The situation is identical from the students' point of view . Anyway, only 30% of them don't think that AR could make the lessons more attractive, while 70% say that they would feel confident about using AR during their classes.

4.3. Lithuania

For the schools, Augmented Reality has a lot of advantages in the education processes. This technology helps to encourage different thinking perspectives and teamwork. It helps each child to understand objects. For primary-school children, it can be the easiest way to teach and tell stories about the world, history, nature and etc.

Augmented Reality can be very useful for Vocational Education and Training. It could help to ease integrated students in labour market, increase competitive abilities, learning productivity, teamwork and encourage different thinking perspectives. This technology is new for VET students and teachers.

As for the universities, Augmented Reality has a lot of advantages in the learning processes. This technology helps to increase productivity, encourage different thinking perspectives, teamwork, and discovery based learning.

4.4. Estonia

The aims and intended deliverables of the LARGE project were presented in the workshops. The feedback received from attendees indicated general support for these aims and that there are potential benefits from the application of augmented reality in education and training.

A detailed consideration of the products of the LARGE project was not possible as the LARGE project is at a very early stage of its implementation and has not yet produced any specific products which could be demonstrated to the workshop.

It was felt that augmented reality is becoming more important and that the potential benefits from its application in education and training could include more effective teaching of complex material and providing new perspectives though significant development is still needed before it can be widely used.

4.5. Romania

All respondents confirmed the need of introducing computer-based active learning in the teaching/learning process at all levels of education in Romania and considered that interactive learning is more effective than the traditional methods of education because it provides the student with an enhanced learning experience and a more comprehensive understanding of the lesson at hand.

The respondents considered that Augmented Reality can offer to the field of education a greater level of understanding and, for pupils, an improved retention of knowledge based on increased motivation and interest. A significant number of respondents felt increase confidence and confidence about the future use of AR in education for all given subjects but especially for school subjects such as History, Foreign Languages, Science, Biology.

5. Comments in relation to the presentation of the results from the National Users' Requirements Analysis about the use and implementation of IT based solutions in the education and training areas

5.1. Bulgaria

The participants in the workshop for pre-university level, consented to the conclusions of the analysis and supported them with facts from their professional experience. All agreed that displaying web content and using PowerPoint presentations are the most popular IT based solutions, used in the educational process in our country. The representatives of the school education consider that using computer applications in the educational process should be widened and enriched.

The larger part of the participants in the discussion agreed that computer technologies are used in schools, but underlined that the intensity of presenting educational materials with the help of these methods is still at a low level. The students participating in the discussion agreed with their teachers and in addition stated that "computer technologies make education more entertaining and interesting to them".

The presentation of the results for the universities regarding the use of computer technologies in education caused no surprise to the participants; they all agreed with the results and with the fact that the availability of computer technologies in the educational system creates favorable environment for the introduction and use of AR. The attitudes of the participants in the discussion coincided with the attitudes of the teachers in the system of higher education who were respondents in the national-wide analysis of users' requirements. The participants in the discussion consented that currently AR is not used for the purposes of education in our country and stated that they would use the technology in their work.

The Vocational Education and Training participants in the discussion agreed with the results of the national-wide analysis of user requirements. As a whole, they shared their observations that during the last 5-10 years there is a trend of increasing the use of the information technologies in education and training. The introduction of the AR technology in the sphere of education was defined as the next step in this direction. According to the participants, the abilities of the technology to present real objects in their entirety of separate elements of them nay allow the students to follow in detail the process of manufacturing of a given product. The participants in the discussion consented that the use of such technology in education and training will increase the opportunities of the learners for more successful participation on the labour market.

5.2. Italy

At pre-university level, the use of educational software by the schools is still quite limited. During the last years most of the Italian schools have been provided with Interactive boards, unfortunately those are still used only by 10% of the teachers because they are not very familiar with the way they work.

The attendees in the School Workshop agreed with the results of the National Survey about the of Power Point presentations (31% of the teachers use it)) and web contents (31% of the teachers use it), against 28% who play audio or video content during their lessons and only 10% teach using Interactive boards .

At university level, the university professors use quite the same technologies for teaching as their colleagues from lower education levels, the difference is that they use Learning Management Systems and Interactive Whiteboards in a more significant percentage.

The trainers in Vocational Education and Training seem to be less enthusiastic about Augmented Reality, for example only 70 % of them would be interested in using the interactive modelling for teaching. The situation is identical from the students' point of view. Anyway, only 30% of them don't think that AR could make the lessons more attractive, while 70% say that they would feel confident about using AR during their classes.

5.3. Lithuania

Augmented Reality is not widely used in education processes. This new technology has great interest for teachers and children. There are a lot of teachers and students who want to try it in their learning/teaching process. They want to identify benefits of this technology on their own.

VET students want to know if there are any requirements to use it at home (computer capacity, etc.) and they want to identify benefits of this technology on their own.

For the Universities the Augmented Reality is not as popular as other teaching methods. Despite the fact that IT is very much used in education process, this new technology is quite unknown. On the other hand, there are a lot of teachers and students who want to try it in their learning/teaching process.

5.4. Estonia

The summarized results from the analysis of national users' requirements were presented to the workshop. Attendees to the workshop did not express any surprise or comment further on these, so we considered that they were in general agreement with these findings.

5.5. Romania

The participants considered the results of the National users' requirements analysis as representative for the reality of the educational system in Romania and for the needs of diversifying the educational methods and the introduction of new technologies.

All of workshop' participants agreed that the minimum technical requirements - Adobe Flash Player and PDF Reader – requirements that are easy to achieve.

6. Summary of the participant's feedback regarding the strengths and weaknesses of the interactivity as an educational method and the identified needs for improvement of the effectiveness and quality of teaching by the use of innovative IT solutions

6.1. Bulgaria

All participants in the workshop agreed that the interactive elements in education are undisputedly bringing benefits to the students and the quality of the educational process. The participants in the discussion consented that in this way the interest of the students is stimulated, better comprehension and retention of the learned material as well as higher quality of teaching is achieved, etc. The innovative IT solutions, which the LARGE project offers in this respect, evoked the positive estimations of the participants in the discussion. The representatives of the vocational schools stressed once again that this is the way of optimizing the traditional education and "a way to bring students out of the classrooms". The stimulation of the creative potential of teachers was also defined as a means for enhancing the effectiveness and quality of teaching.

All participants in the workshop agreed that the interactive educational methods are well known in the system of higher education as tools for enhancing the quality of teaching on the one hand and for a more effective assimilation of the study material, on the other hand. Regardless of this, the participants in the discussion shared that the intensity of using interactive methods is comparatively low, as a whole, for our country. According to them, the innovative technologies in education should include interactive elements, by means of which to provoke students and teachers and to stimulate the positive interaction between them as well as to be compliant with the modern educational requirements for quality education and training. In this connection, the participants agreed that AR possesses all the necessary qualities in order to meet the trends in all spheres of education and training.

According to the participants in the workshop, the interactive educational methods namely carry the biggest potential for optimization of the process of teaching in all educational spheres. They agreed that using AR will allow all teachers to present the learning material in a more attractive and comprehensible way to the learners.

On the other hand, they stated that this will allow the students to understand and retain the knowledge more easily. The participants in the discussion stressed once again the ability of the AR technology to present the manufacturing of a product – its assembling step by step, or showing its separate elements. According to the participants bringing education closer to reality, without the need of a specially equipped hall or equipment, will enhance the effectiveness of teaching in the sphere of VET and the education for adults.

6.2. Italy

In the schools the attitude of both teachers and students was positive, even though especially the teachers were worried about their capacity of working with such modern technology. It is very important to say that the students from elementary and secondary schools are the ones that gave 100% positive feedback when asked if 3D images were attractive for learning and if learning with computers helped understanding better what their were learning.

The university teachers expressed their doubts regarding the use of augmented reality for teaching, even if they admitted the importance of using interactive educational methods or IT solutions.

One teacher pointed out that the traditional way of teaching is much more effective, because students need a very strict approach in order to have good results.

Anyway, the participants, both teachers and students, agreed that augmented reality as an educational technology could play a prevalent role in education, with applications pertinent in subject areas such as geography, chemistry and history, but at university level it would be probably used more for technical universities.

We witness that the interest to augmented reality is increasing in the field of education and this is partly due to the fact that camera-equipped and software-downloadable mobile phones are surging in recent years. In education and training, AR has the potential to make ubiquitous learning a reality, allowing learners to gain immediate access to a wide range of location-specific information from various sources.

6.3. Lithuania

Majority of participants identified these strengths of the interactivity: active thinking, visualization, the ability to apply it individually. Teachers think that training courses should be organized.

Majority of VET group identified these strengths of the interactivity: efficiency, active thinking, and integrating students in labour market more ease. Some worried that there may be some problems with hardware and ability to use it in home.

Majority of students and teachers identified these strengths of the interactivity: efficiency, active thinking, the ability to apply it individually, discovery based learning. Some worried that there may be some problems with hardware. Teachers think that training courses should be organized.

6.4. Estonia

Attendees were generally supportive of greater use of interactivity in education and training and expressed the desire to integrate more innovative IT solutions into their own education and training. They also made specific suggestions as to how this might be achieved in terms of education content.
Specifically, and reflecting the construction-related nature of the educational courses which most attendees were engaged with, it was suggested in group discussions that a building or room on the university campus could be set up to be augmented with virtual content in order to show, for example:

- The detailed building technologies used in its construction
- The construction process by which it was built
- Building performance parameters.

The workshop attendees considered that this would enhance the effectiveness and attractiveness of their educational course content.
The participants also considered that the main strengths lay in the possibilities to enhance the effectiveness and attractiveness of their educational course content.

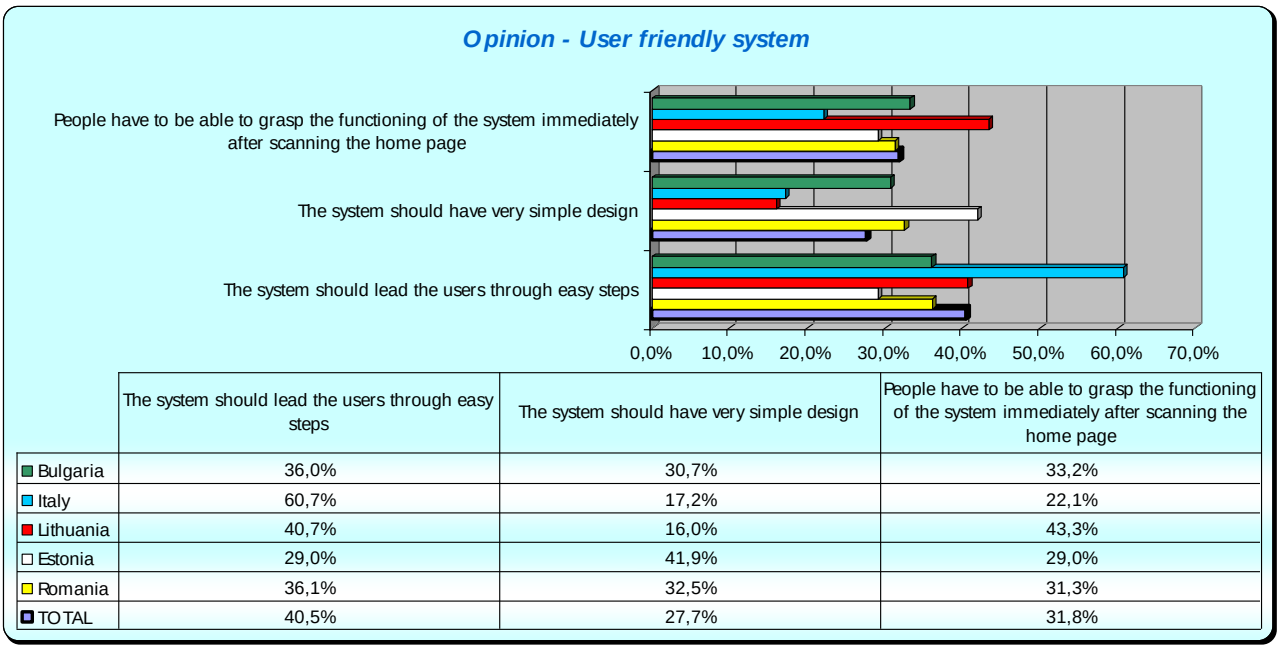
Weaknesses were identified as limited access to suitable hardware (as innovative technologies tend to be hardware capability intensive), that the technology and platforms are as yet not fully developed and this makes it relatively complicated and difficult to apply augmented reality in the learning process currently.

6.5. Romania

The participants considered the following strengths of the interactivity as an educational method: it will engage, stimulate and motivate students to explore class materials from different angles; it will help teach subjects

where students could not feasibly gain real-world first-hand experience (e.g. astronomy and geography) and it will enhance collaboration between students and instructors and even among students. The respondents mentioned also the weaknesses or the limitations of the interactivity as an educational method: its implementation could take a long time because of the lack of technical endowments and because of financial reasons; this type of teaching cannot be used in an exclusive way as it can bring disadvantages (taking students away from the books which become boring to them) while a balanced used (both traditional and interactive using AR) seems the optimum solution; the impossibility of teachers to change/modify/adjust the content of the material according to the necessities of the lesson or to the needs/characteristics of the students.

7. Summary of the feedbacks and recommendations related to requirements of the potential users regarding the design, functionality and the content of the LARGE products for ensuring of its comprehensive feasibility in the education and training process



	The system should lead the users through easy steps	The system should have very simple design	People have to be able to grasp the functioning of the system immediately after scanning the home page
Bulgaria	36,0%	30,7%	33,2%
Italy	60,7%	17,2%	22,1%
Lithuania	40,7%	16,0%	43,3%
Estonia	29,0%	41,9%	29,0%
Romania	36,1%	32,5%	31,3%
TOTAL	40,5%	27,7%	31,8%

7.1. Bulgaria

The participants in the discussion consider that the two platforms and the software for creation of AR applications should be easy to use and not require special IT skills. In support of this they underlined that primary schools students might experience serious difficulties using this technology because of lack of computer skills in early childhood age. The creation of an interface similar to MS Office would facilitate the users due to the known appearance and functions. Teachers think that a forum should be established to the web based platform, where they themselves can share their experience and give further proposals for

elaboration and development of both the platforms and the created AR applications. The participants in the discussion stressed upon the significance of establishing a library to the web based platform, which would allow easy downloading of the necessary applications and uploading of applications with the aim of widening the AR models database. The creation of exemplary lessons and comprehensive instructions for modeling were also highlighted as requirements of the users.

The participants proposed the 3 D models to be created in a simplified way, for example, by taking pictures of a given object from different sides by a camera or camcorder and the use of a program which combines the separate 2 D images in a 3 D model. For this purpose, the teachers, who are more acquainted with the modern technologies, recommended the use of Shockwave player. As per the participants in the workshop, achieving greater compatibility among the different software products will also allow a more effective and easy 3 D objects modeling. According to the participants in the discussion compatibility between the two platforms and the already existing 3 D models should also be achieved. The process of creating 3 D models with the program, resulting out of the project, should allow the development of a scenario to visualize the object. The development of detailed instructions for the creation of 3 D applications was stated as an important condition for the use of the system by teachers and students, who do not posses specialized IT skills. With respect to the web based platform, the participants in the workshop noted that it should allow the logging in of many users to it, without being overloaded.

The participants in the discussion stated that the ease of use of the two platforms and, most of all, of the program for creation of AR applications is of decisive importance for the sustainable realization of the goals of the LARGE project. They supported the idea of creating detailed instructions for modeling of 3 D applications and also stated that this should not require special IT skills. They also proposed that the system allows upgrading and elaborating the already created 3 D materials, which will help any teacher to present specific details of a given model, which are necessary for the purpose of his or her teaching. As an example the participants stated, that in the sphere of shipbuilding a simplified 3 D ship model may be further developed presenting its specific indices of twisting and firmness, while, for the purposes of tourism, the same model, but further developed in another direction, may show details in the cabins, decks, baggage premises, etc. The participants approved the idea of creating a library of 3 D applications and stressed the necessity of establishing a rating system by means of which to evaluate the uploaded models using given criteria. The participants in the discussion also noted that the uploaded 3 D models in the library should be distributed in categories according to their educational purpose and also proposed that any application should contain a short description, which, according to them, will facilitate the use of the library.

7.2. Italy

It is obvious that the LARGE system and the Content Creation Tool have to be as simple as possible in terms of design and functionality, quite all the participants were concerned about the complexity of creating AR contents and teachers were afraid that it could be too time-consuming for them since they are already overloaded with work.

81% of the attendees thought that the requirements for using the system are easy to achieve, the remaining 19% had no idea if this would be easy or not.

This particular situation occurs because in Italy we can still find persons with a very low computer literacy and this is something we'll have to overcome in order to have a successful outcome of LARGE.

7.3. Lithuania

Children think that augmented reality should be used for storytelling and visualization. There could be chapter for each lesson. It would be easier to orient students and teachers.

VET group did not have any recommendations for feasibility in the education and training process. They were surprised of these technology opportunities.

Users think that there should be chapters by modules in which all information (with augmented reality technology) would be saved. It would be easier to orient students and teachers.

7.4. Estonia

The workshop found that simplicity of use was an important characteristic in terms of the design of the LARGE products. It was noted that most of the content shown in the demonstrations was of low definition and that there were image registration problems (including slow response times, non-identification and misidentification of markers) and that these problems seriously affected its meaningful educational impact in many cases. It was therefore considered important that the LARGE platform would be capable of handling detailed content in real time for it to be useful in the educational applications envisaged by the attendees.

The stated level of computer literacy and hardware requirements for LARGE were not considered to present any problem to the attendees of this workshop.

7.5. Romania

Respondents' opinion regarding a user-friendly system is that the system should lead the users through easy steps and it should have a very simple design.

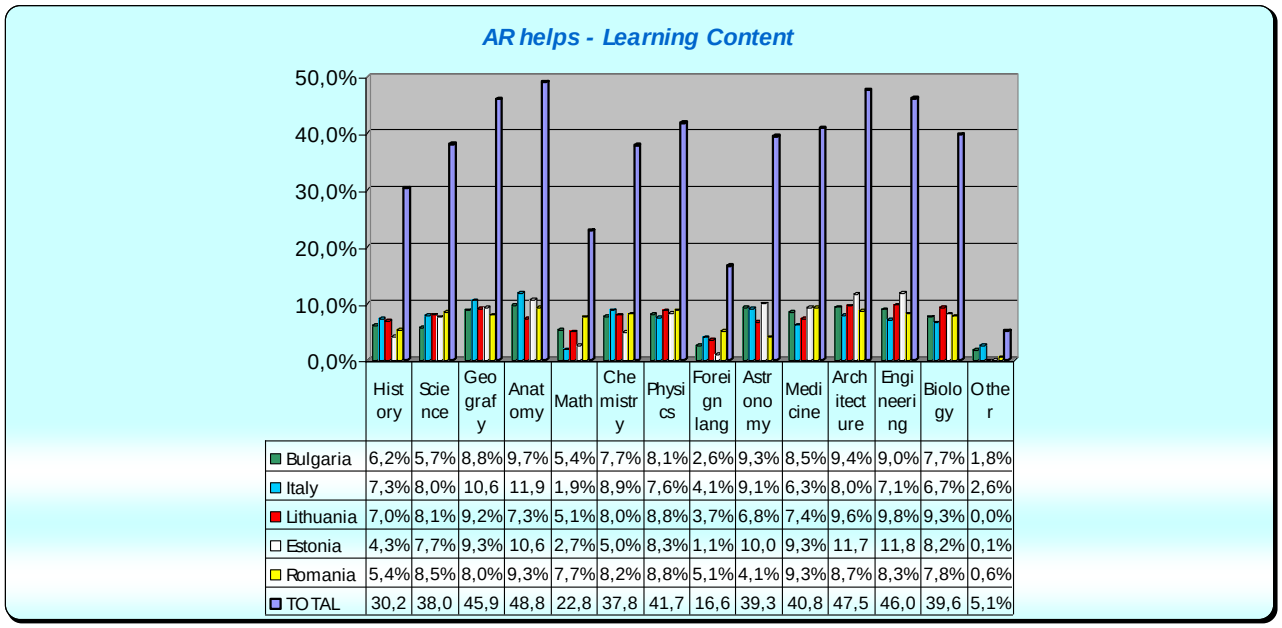
8. Presentation and analysis of the results based on the completed by the workshop participants' questionnaire about the use of Augmented Reality in education and training

Around the world, the cutting edge of AR research and development is being driven more by business-related interests than by groups focused on augmenting education. A majority of AR technologies are being developed with no actual educational agenda.

8.1. Educational/learning content could be easier understood with the help of AR

While there has been much experimentation with augmented reality, particularly by the American military and private commercial industries, augmented reality is still relatively early in its development as an educational technology.

Augmented reality provides a powerful constructivist experience for exploration and discovery of the connected nature of information in the physical world (Jonassen, 2006). It also aligns with situated learning in that it permits experimentation and exploration to take place in the same context in which the activity occurs (Horizon Report, 2011). The Horizon Report, a research report published annually by the education think tank Educause that charts the landscape of emerging technologies for teaching, learning and creative inquiry, has forecast in their 2010 and 2011 reports that augmented reality as an educational technology could play a prevalent role in education, with applications pertinent in subject areas such as geography, chemistry, and history.



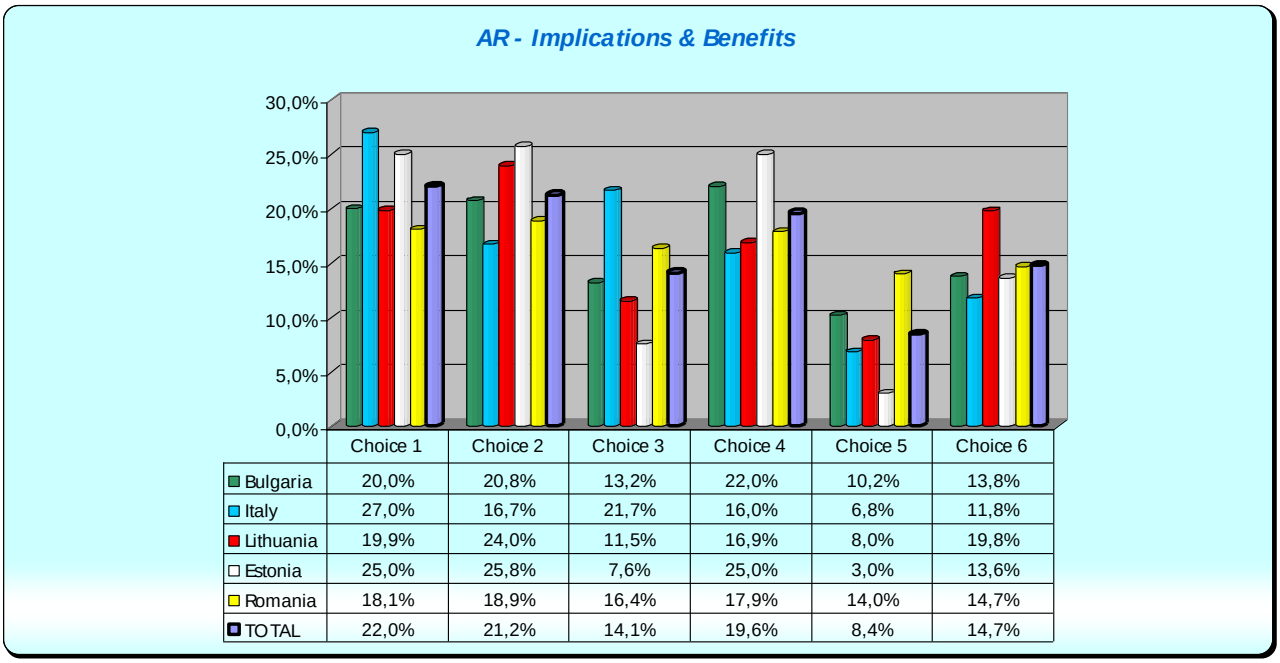
	History	Science	Geography	Anatomy	Math	Chemistry	Physics	Foreign lang	Astronomy	Medicine	Architecture	Engineering	Biology	Other
Bulgaria	6,2%	5,7%	8,8%	9,7%	5,4%	7,7%	8,1%	2,6%	9,3%	8,5%	9,4%	9,0%	7,7%	1,8%
Italy	7,3%	8,0%	10,6	11,9	1,9%	8,9%	7,6%	4,1%	9,1%	6,3%	8,0%	7,1%	6,7%	2,6%
Lithuania	7,0%	8,1%	9,2%	7,3%	5,1%	8,0%	8,8%	3,7%	6,8%	7,4%	9,6%	9,8%	9,3%	0,0%
Estonia	4,3%	7,7%	9,3%	10,6	2,7%	5,0%	8,3%	1,1%	10,0	9,3%	11,7	11,8	8,2%	0,1%
Romania	5,4%	8,5%	8,0%	9,3%	7,7%	8,2%	8,8%	5,1%	4,1%	9,3%	8,7%	8,3%	7,8%	0,6%
TOTAL	30,2	38,0	45,9	48,8	22,8	37,8	41,7	16,6	39,3	40,8	47,5	46,0	39,6	5,1%

From the total number of respondents to the LARGE Survey, 48,8% chose Anatomy as the subject where augmented reality as an educational technology could be of major help, followed by Architecture, Engineering, Geography, Physics and Medicine.

8.2. Researchers believe that AR has vast potential implications and numerous benefits for the augmentation of teaching and learning environments.

Choice 1: AR will engage, stimulate and motivate students to explore class materials from different angles: in Italy this choice was considered by 27% of the respondents as the most significant one, and it is also the choice that on the total results in the 5 countries reached the highest percentage 22%.

Choice 2: AR will help teach subjects where students could not feasibly gain real-world first-hand experience (e.g. astronomy and geography): both Estonia (25,8%) and Lithuania (24%) of the attendees in the workshops chose this as very relevant opportunity related to augmented reality. And it was the second most important choice with 21,2% on the overall analysis.



	Choice 1	Choice 2	Choice 3	Choice 4	Choice 5	Choice 6
Bulgaria	20,0%	20,8%	13,2%	22,0%	10,2%	13,8%
Italy	27,0%	16,7%	21,7%	16,0%	6,8%	11,8%
Lithuania	19,9%	24,0%	11,5%	16,9%	8,0%	19,8%
Estonia	25,0%	25,8%	7,6%	25,0%	3,0%	13,6%
Romania	18,1%	18,9%	16,4%	17,9%	14,0%	14,7%
TOTAL	22,0%	21,2%	14,1%	19,6%	8,4%	14,7%

Choice 3: AR will enhance collaboration between students and instructors and among students: it's again Italy the country where the respondents (21,7%) gave a significant importance to this choice.

Choice 4: AR will foster student creativity and imagination: Estonia with 25% and Bulgaria with 22% of the respondents that answered the transnational survey, considered this opportunity as important.

Choice 5: AR will help students take control of their learning at their own pace and on their on path: was considered by all respondents in all countries the least interesting opportunity that could be offered by the use of augmented reality in education.

Choice 6: AR will create an authentic learning environment suitable to various learning styles: in Lithuania this was considered 19,8% validated this choice as interesting.

8.3. During the workshops organized in the five countries involved in the LARGE project, there were showed examples of possible AR educational applications.

It is likely that the **AR books** will be a major stepping stone helping the public bridgethe gap between the digital and physical world. AR technology has great potential to offer students 3D presentations and interactive experiences. In addition, AR books can be used at the primary level and this is why in Italy the most significant percentage (31,8%) of the respondents chose this application.

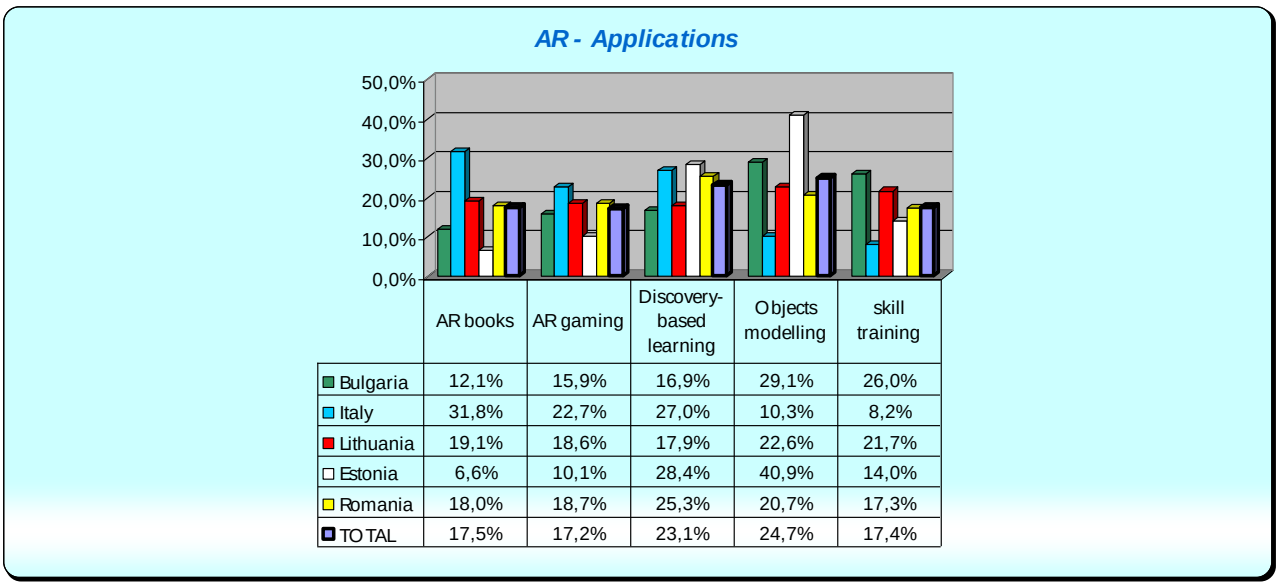
Often educators utilize games to assist students in easily grasping class concepts. With the help of AR technology, games that are based in the real world and augmented with networked data can give educators

powerful new ways to show relationships and connections. **AR gaming**, on the overall analysis, had 17,2% of the answers, in the same area as AR books (17,5%), and skill training (17,4%).

AR applications that convey information about real-world place open the door for **discovery-based learning**. 28,4% of the respondents in Estonia chose this application against only 16,9% in Bulgaria.

Augmented reality can also be used to **model objects**, allowing learners to envision how a given item would look in different settings. Models can be generated rapidly, manipulated, and rotated. It is very interesting to point out that this application that had the highest percentage of the respondents in all countries (24,7%).

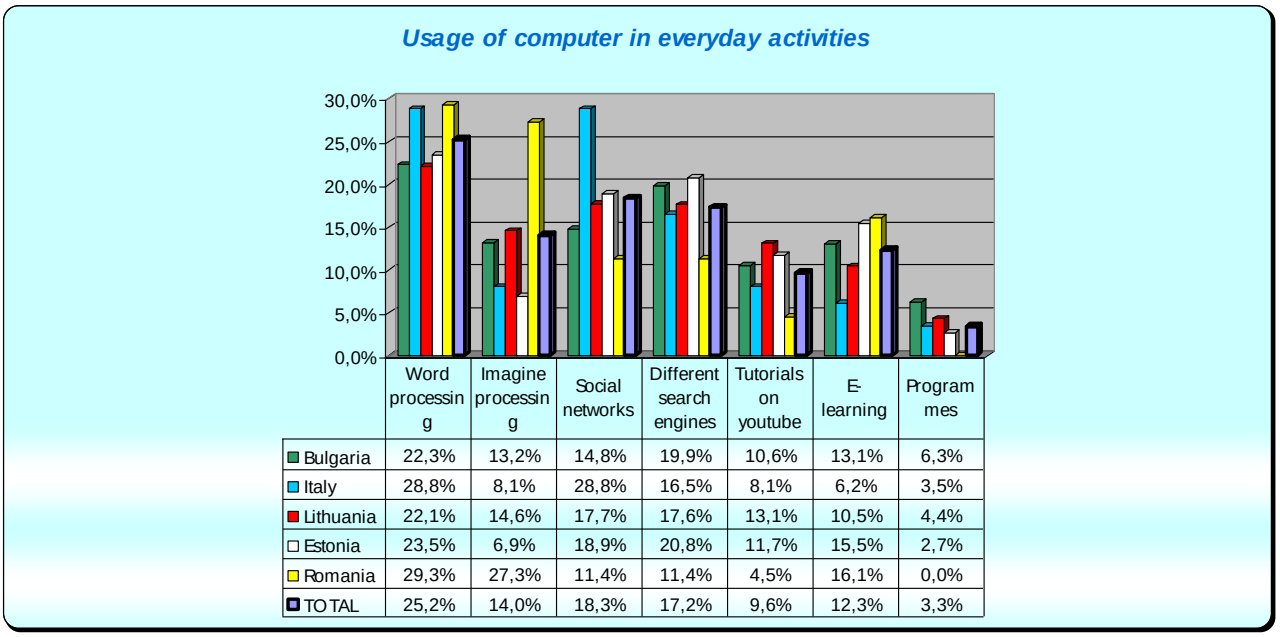
Augmented reality has strong potential to provide powerful contextual, in-situ learning experience and exploration while simultaneously promoting the discovery of the connected nature of information in the real world.



	AR books	AR gaming	Discovery-based learning	Objects modelling	skill training
Bulgaria	12,1%	15,9%	16,9%	29,1%	26,0%
Italy	31,8%	22,7%	27,0%	10,3%	8,2%
Lithuania	19,1%	18,6%	17,9%	22,6%	21,7%
Estonia	6,6%	10,1%	28,4%	40,9%	14,0%
Romania	18,0%	18,7%	25,3%	20,7%	17,3%
TOTAL	17,5%	17,2%	23,1%	24,7%	17,4%

8.4. Computer literacy is defined as the knowledge and ability to use computers and related technology efficiently

Computer literacy, the ability to use computers to perform a variety of tasks, is becoming fundamental to the learning process. The "information age" perhaps best describes the twentieth century; the next century has been described as the "information processing" age. Wide varieties of computer skills are useful and, in some cases required, as an essential part of college learning and employment for most individuals.



	Word processing	Imagine processing	Social networks	Different search engines	Tutorials on youtube	E-learning	Programmes
Bulgaria	22,3%	13,2%	14,8%	19,9%	10,6%	13,1%	6,3%
Italy	28,8%	8,1%	28,8%	16,5%	8,1%	6,2%	3,5%
Lithuania	22,1%	14,6%	17,7%	17,6%	13,1%	10,5%	4,4%
Estonia	23,5%	6,9%	18,9%	20,8%	11,7%	15,5%	2,7%
Romania	29,3%	27,3%	11,4%	11,4%	4,5%	16,1%	0,0%
TOTAL	25,2%	14,0%	18,3%	17,2%	9,6%	12,3%	3,3%

9. General Conclusions

The world of augmented reality is continuously changing, and active projects in this area increase exponentially. The augmented reality is also a social phenomenon, and we believe that soon it will change the way we see the world and the way in which we interact with it.

The last decade has seen Information and Communication Technologies dramatically transforming the world, enabling innovation and productivity increases, connecting people and communities, and improving standards of living and opportunities across the globe.

While changing the way individuals live, interact, study, and work, ICT has also proven to be a key precondition for enhanced competitiveness and economic modernization. For information and communication technologies to be used effectively, technology needs to be matched to the local context and to be sensitive to people's needs. This is one of the objectives of the project LARGE.

In the Global Information Technology Report 2012 the five countries involved in the LARGE project rank as follows: Estonia 24 out of 142 countries, Lithuania 31, Italy 48, Romania 67, and Bulgaria 70.

Because educational phenomena are quite complex and multi-faceted, the right questions are not about whether or not to use technology at all, but about which technology solutions can best suit the evolving learning requirements that each individual teacher has to manage in the classroom. Equipment may shine and speak for itself, but unless it is properly used no educational effects will be ever seen.

Besides economic factors, one of the key problems of e-learning programs is that the huge majority of teachers receive very little training in how to use advanced educational technologies in Learning Environments. That is why in order to assure the long term success of the partnership involved in the LARGE Project has to work in close cooperation with other projects like for example Teaching to Teach with Technology, which has the goal s to develop an innovative teacher trainer program to promote the use of advanced learning technology by university teaching staff, school teachers and trainers in industry.

9.1. Bulgaria

The greater majority of the participants see a significant possibility to optimize the educational process in Bulgaria as a result of the implementation of the project LARGE.

The participants consented to the presented results regarding the use of IT applications in education and shared their observation for the progressive increase of their use, defining the introduction of AR as the next step in this trend.

The introduction of modern interactive methods of education and training was defined as a factor that will enhance the quality of teaching in the system of VET and the education for adults as well as will increase the opportunities of the learners for more successful participation on the labour market. The ability of AR to make education more realistic stood out as the main means toward achieving this goal.

The participants in the discussion made interesting proposals and shared their expectations regarding the functionality of the system. They brought interesting proposals regarding the creation of 3 D models and their further development and gave examples of the potential use of the technology in the process of teaching.

Through the filled in questionnaire valuable information was gathered regarding the use of the AR technology in the sphere of education and training. This information reveals the favorable conditions for the implementation of the LARGE project and shows both the trust of the participants in the advantages of the AR technology compared with the traditional methods of teaching and the need of the educational institutions to introduce new interactive technologies and tools, which will optimize the educational process.

All participants considered the participation in this workshop as interesting and useful because they could find out about a new technology that can change education.

AR is perceived by the majority of participants as a useful interactive technology that should be implemented in the system of education in the future. The attitudes of the participants in the workshop are positive and optimistic regarding the LARGE project, which is revealed by the positive feedback and the results of the two

inquiries that were carried out. The greater majority of the participants see a significant possibility to optimize the educational process in Bulgaria as a result of the implementation of the project.

No surprise, the participants in the workshop consented to the results regarding the use of IT applications in education, revealed through the Bulgaria national-wide analysis for establishing consumer attitudes.

The participants in the workshop are of the opinion that the interactive methods of education and teaching have a number of advantages compared with the traditional education and pointed that their active use will enhance the quality of teaching in our country.

During the discussion interesting proposals and comments were made regarding the functionality and the design of the system, while the program for creation of applications stirred great interest among them.

It was established from the carried out enquiry regarding the use of the Augmented Reality technology that a number of prerequisites for the success of the LARGE project are in place, part of which are the undisputed advantages of the interactive educational methods and the need of the educational system of such ones as well as possibility to bring the educational content closer to the students and make it more attractive to them.

The feedback received from the participants regarding the carried out workshop is positive. It reveals, in general, their satisfaction regarding the conducted workshop, the presented information and its relevance, usefulness and applicability. Most of the participants in the workshop also expressed their wish to join in the pilot testing of the system.

The attitudes of the participants in the workshop are positive and optimistic regarding the LARGE project, which is revealed by the positive feedback and the results of the questionnaires. The greater majority of the participants see a significant possibility to optimize the educational process in Bulgaria as a result of the implementation of the project.

What concerns the results regarding the use of IT applications in education revealed through the conducted national-wide analysis for establishing consumer attitudes, it became clear that the participants in the workshop not only accepted the presented results, but also supported them with examples from their practice.

The participants unanimously agreed about the advantages of the interactive methods of education and teaching and pointed at the necessity to implement them with the aim of enhancing the quality of teaching in our country.

During the discussion interesting proposals were made regarding the functionality and the design of the two platforms and the program for creation of applications, and the wish of the participants to establish a forum to the web based platform reveals their strong motivation to develop a sustainable channel for feedback by means of which to become part of the future development of the platforms after their establishing. The

participant also expressed their satisfaction by the fact that their opinion as future users of the platforms and the programs was asked for already in the process of their establishing.

As a result of the filled in questionnaire, it became clear that an extremely positive environment exists for the use of AR for the purposes of education. Part of the conditions of this environment originate from both the advantages of AR against the traditional methods of teaching and the need of the educational institutions for new interactive technologies and tools which are to optimize the educational process, bringing the educational content closer to the students and making it more attractive to them.

The feedback received from the participants reveals their high degree of satisfaction regarding the conducted workshop, the presented information and its relevance, usefulness and applicability. More than half of the participants expressed their wish to join in the development of the first applications and lessons in our country as well as in the pilot testing of the technology in the educational institutions.

9.2. Italy

Functional and technological accessibility is not usually the main factor in deciding whether to adopt a certain educational technology into practice. Taking a deep approach to learning and student-centered teaching, along with outcomes-centered curriculum design, and all kinds of other institutional considerations, are sure to be more relevant than technological capability in deciding how AR might make its way into educational settings. On the other hand, AR does hold out the prospect of providing rich contextual learning experiences with present-day technologies.

For example, augmented learning-exploration and discovery games may be devised to enhance student field trips to museums or historical sites, assuming that they are outfitted with mobile devices. Simplified versions of AR training models also could serve in classroom and individual activity –based explorations of the connected nature of information in the real world.

The general feedback of the attendees in all the workshops organized in Italy was positive regarding the use of new technologies in education and the respondents were either very confident or confident about the future of education. Anyway, we have to be realistic and admit that it will not be an easy process and maybe we'll only see some results in a few years from now on.

9.3. Lithuania

Augmented Reality has a lot of advantages to the educational sector. It not only helps to explain the learning contents more efficiently, but also helps to increase students'/teachers' learning/teaching motivation. All in all,

Augmented Reality makes an opportunity for students and teachers to take control of their own learning, and interact with the real and virtual environments.

Students/trainees can manipulate objects that are not real, and learn tasks and skills. So this type of training provides opportunities for more authentic learning and appeal to multiple learning styles.

9.4. Estonia

The workshop attendees were in general agreement that augmented reality potentially offers education and training benefits and specific recommendations were made with regard to piloting augmented reality content to enhance the learning experiences of university students on construction-related courses.

Taking account of the findings from the users' requirements surveys and these workshops, it is now necessary to develop the technical deliverables of the LARGE project to the extent that stakeholders can be given a clear and unambiguous demonstration of the functionality of the LARGE platform so that they can determine the extent to which they can use it in their teaching and learning.

9.5. Romania

AR is perceived by the majority of participants as a useful interactive technology that should be implemented in the system of education in the future. The Romanian system of education still focuses on traditional methods and it is in the process of decentralizing and modernizing. Augmented Reality (AR) as a variation of Virtual Environments or Virtual Reality is perceived "a useful tool in understanding the mechanisms, components and their function within the systems" but it is needed to take into account the recommendation "to develop predictive software, forecasting the dynamics of components and systems that integrate them." (University Professor in Ecology)