„CONTEMPORARY APPROACH TO THE DEVELOPMENT OF SPATIAL COMPREHENSION THROUGH AUGMENTED REALITY CONTENT“

Erasmus+

EDUCATIONAL APPLICATIONS OF AUGMENTED REALITY

Prof. Manuel Contero
Universitat Politècnica de València, Spain

Ms. Dr.Sc.Ing. Zoja Veide
Ms. M.Sc. Veronika Stroževa
Riga Technical University, Latvia

SPACAR

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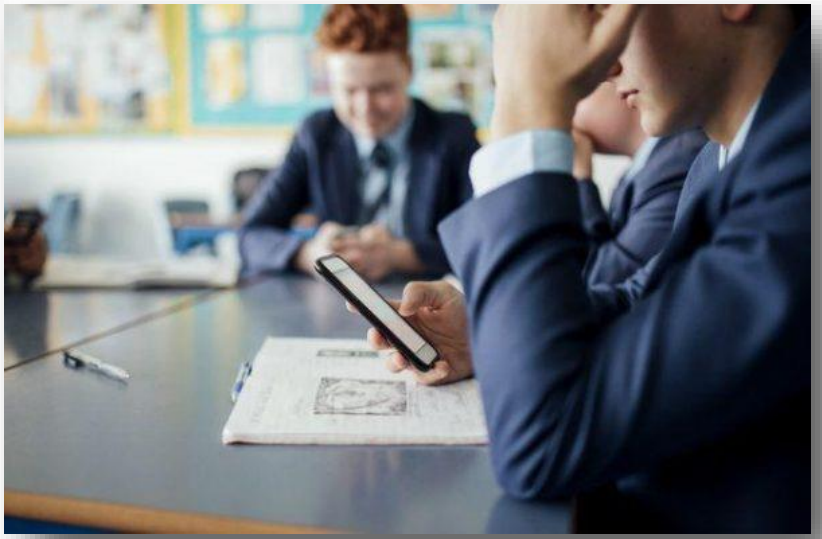
AR IN EDUCATION

- By 2025, two billion of the global population - Generation Alpha
- born between 2010 and 2025
- use smartphones, tablets and computers naturally

young people growing up among computers tablets smartphones and consoles

- Schools and colleges should create programs of study that require deep learning
- AR and VR content can make learning more efficient, faster, and much more fun



- They acquire knowledge by doing, screen-touching and experiencing
- Schools need to provide an environment that enhances this type of learning

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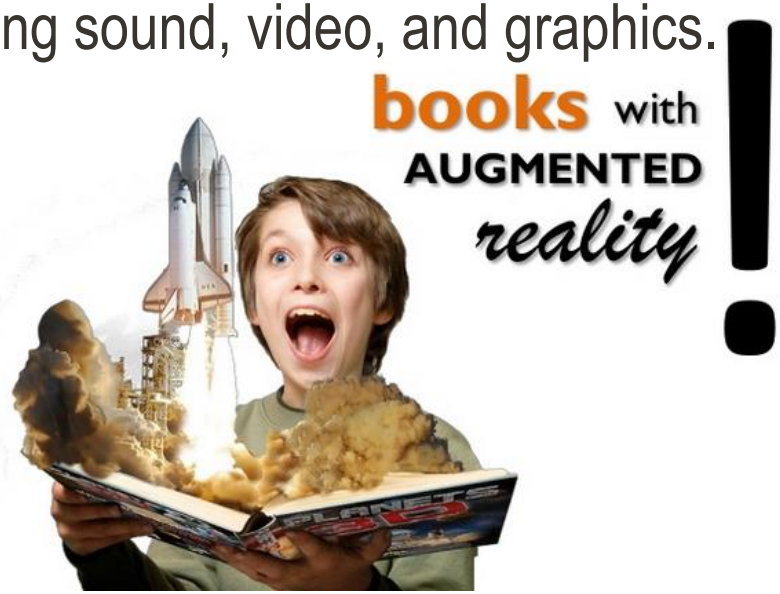
- AR is one of the best ways an educator can use to engage and motivate students
- Augmented Reality technology expands the physical world
- It augments our surrounding by adding sound, video, and graphics.



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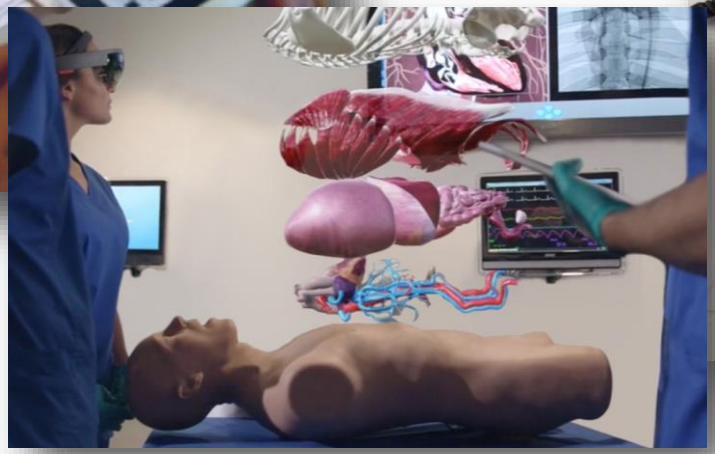
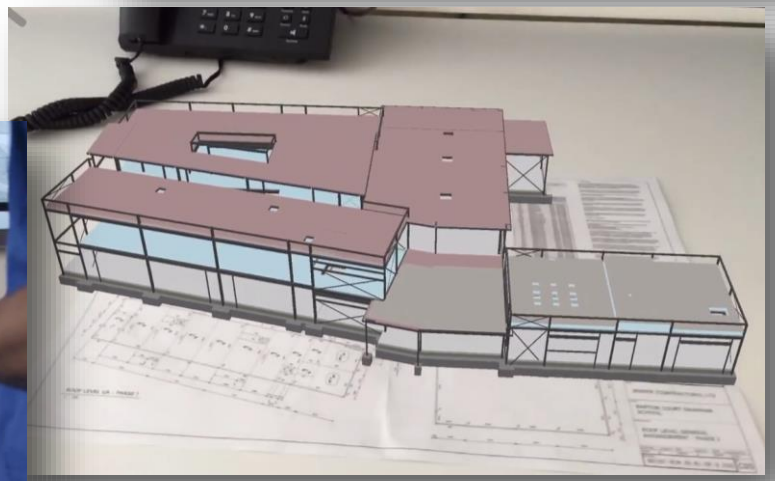
AR has been used in fields such as military; medicine; engineering design; robotic; manufacturing, maintenance and repair applications; consumer design; psychological treatments, etc.





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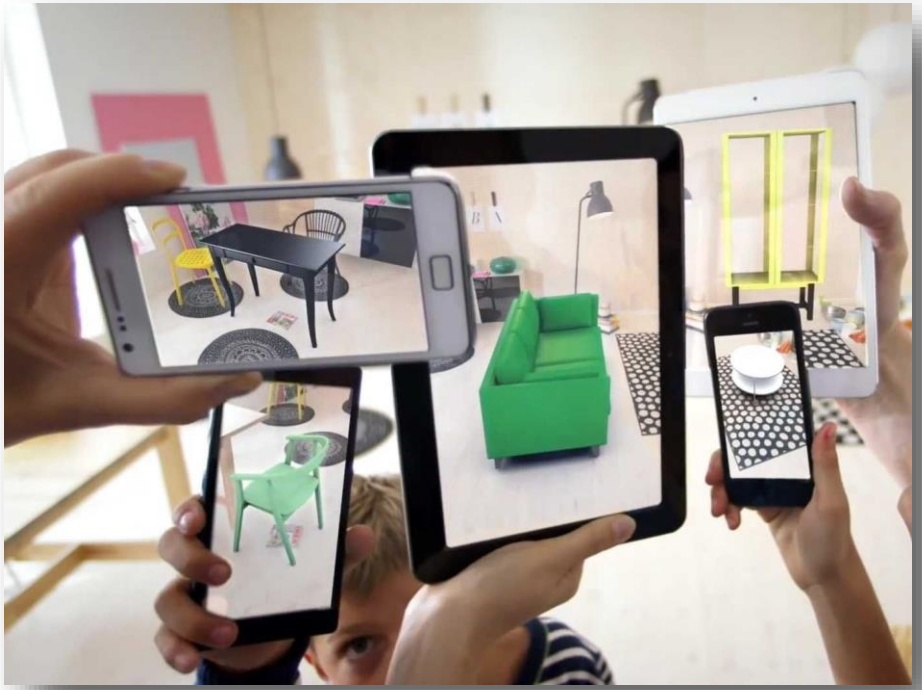
BENEFITS OF AR

Accessible learning materials
– anytime, anywhere.
AR has the potential to replace paper textbooks, physical models, posters, printed manuals.
It offers portable and less expensive learning materials.

BENEFITS OF AR

No special equipment is required. Unlike VR, augmented reality doesn't require any expensive hardware.
Because 73% of all teens currently own a smartphone, AR technologies are immediately available for use for most of the target audience.



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BENEFITS OF AR

Higher student engagement and interest.

Interactive, gamified AR learning can have a significant positive impact on students.

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BENEFITS OF AR

Improved collaboration capabilities.

Augmented reality apps offer vast opportunities to diversify and shake up boring classes. Interactive lessons, where all students are involved in the learning process at the same time, help improve teamwork skills.

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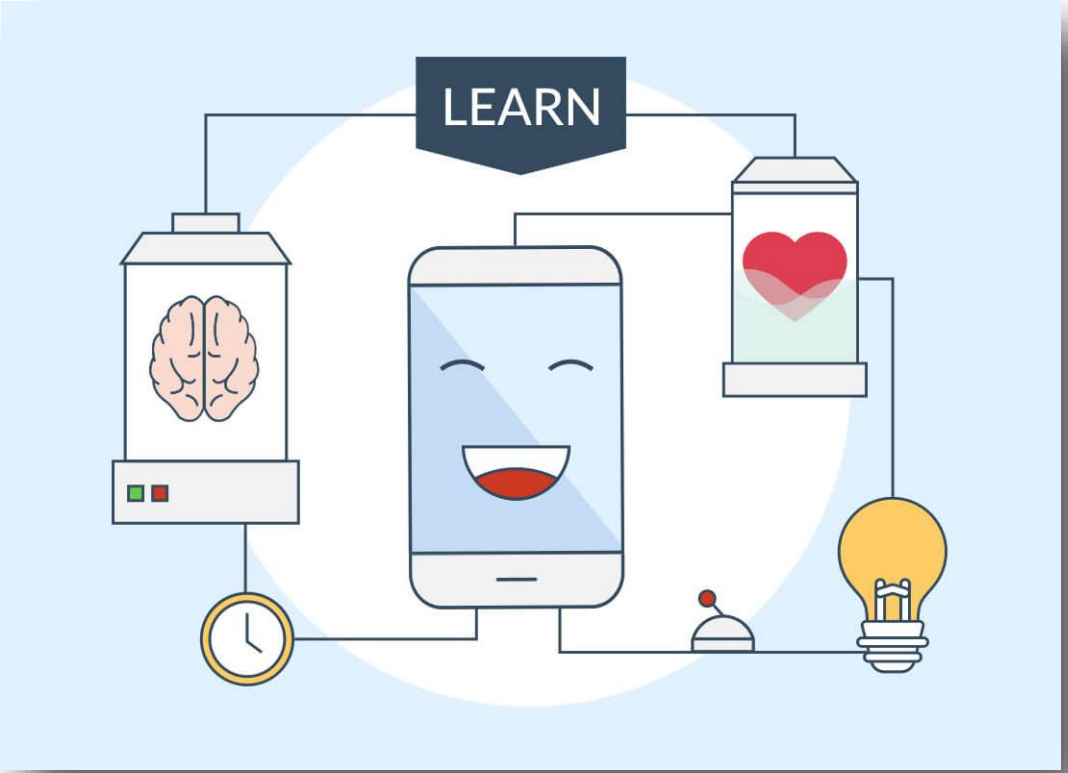
BENEFITS OF AR

A faster and more effective learning process.

AR in education helps students achieve better results through visualization and full immersion in the subject matter.



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BENEFITS OF AR

Practical learning.

Apart from schooling, professional training can also benefit greatly from the use of AR. E. g., accurate reproduction of in-field conditions can help master the practical skills required for a certain job.

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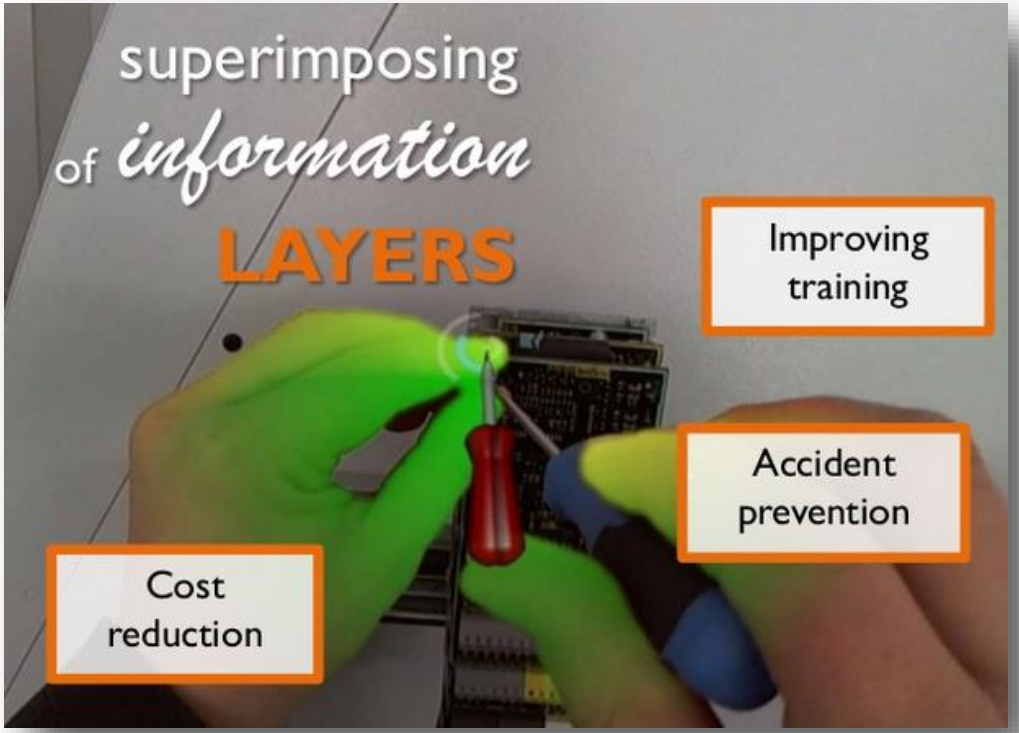
BENEFITS OF AR

Safe and efficient workplace training.

Imagine being able to practice in heart surgery or operating a space shuttle without putting other people in danger or risking millions of dollars in damage if something goes wrong. It is possible with AR.



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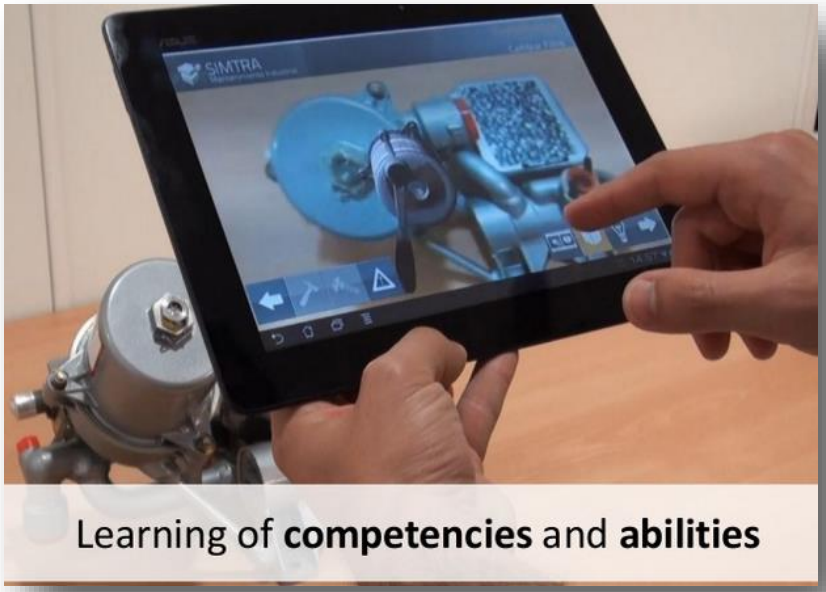
BENEFITS OF AR

Be it learning games for kindergarten or on-the-job training, AR isn't limited to only one use case or field of application.

Universally applicable to any level of education and training.



PITFALLS OF AR

A lack of necessary training.

For some teachers it is difficult to put new technologies into practice as they don't have necessary skills.

Dependence on hardware.

Using augmented reality requires a certain resource base. E. g., not all the students have smartphones capable of supporting AR applications.

Content portability issues.

The AR app needs to work equally well on all platforms and devices. However, it is practically impossible to provide the same quality of AR content on any device.

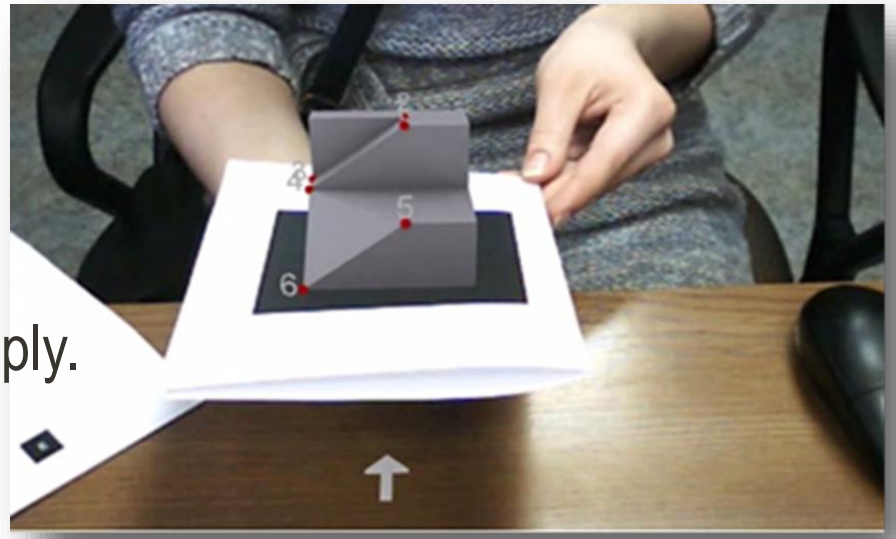
OUR EXPERIENCE IN APPLICATION OF AR

AR-DEHAES (Jorge Martín Gutiérrez, Manuel Contero González, Mariano Alcañiz Raya., Spain)

AR-DEHAES was used as an additional learning material for the course 'Descriptive Geometry and Engineering Graphics' in first-year studies.

The main aim was:

- to trigger students' interest to the studies.
- motivate students to study more deeply.
- to help them understand the course content better.
- to improve their spatial abilities.



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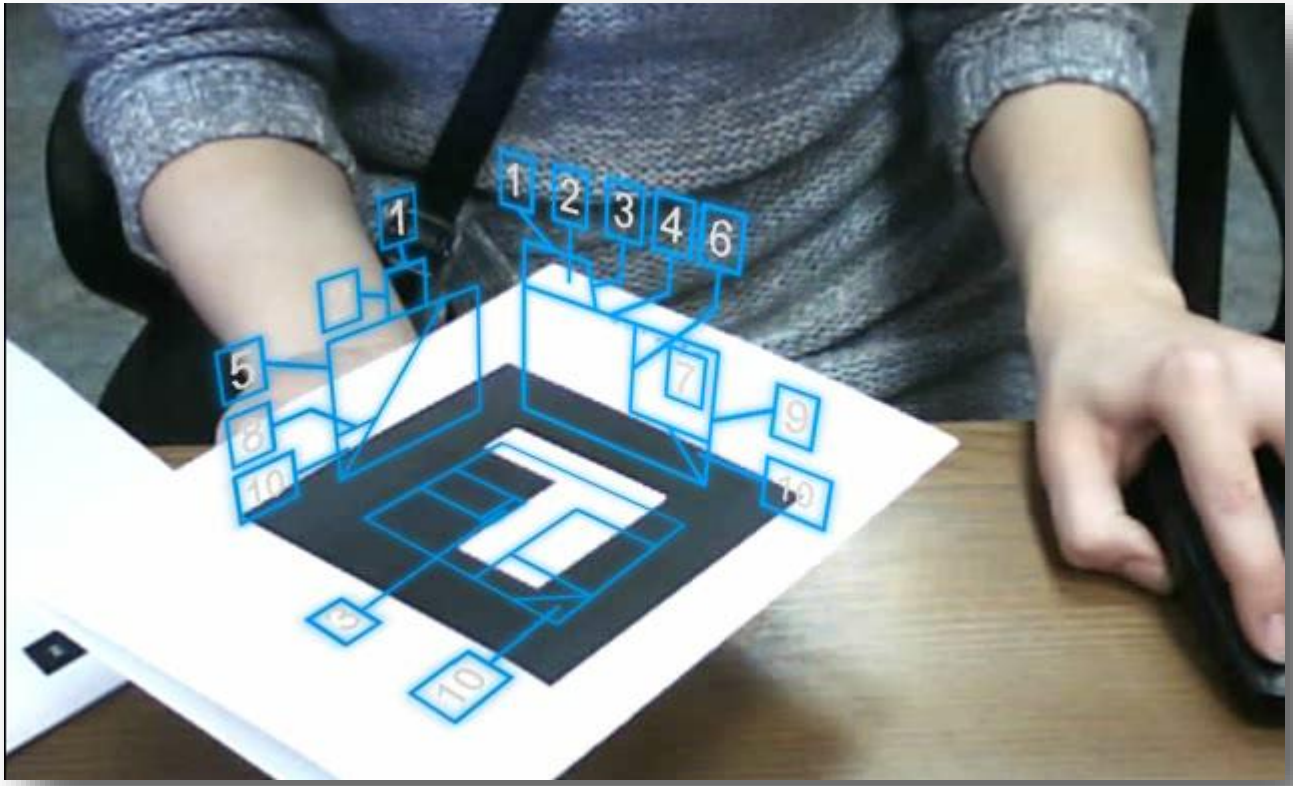
OUR EXPERIENCE IN APPLICATION OF AR

In the first academic semester, students worked with AR-DEHAES performing corresponding AR-BOOKS tasks.



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OUR EXPERIENCE IN APPLICATION OF AR

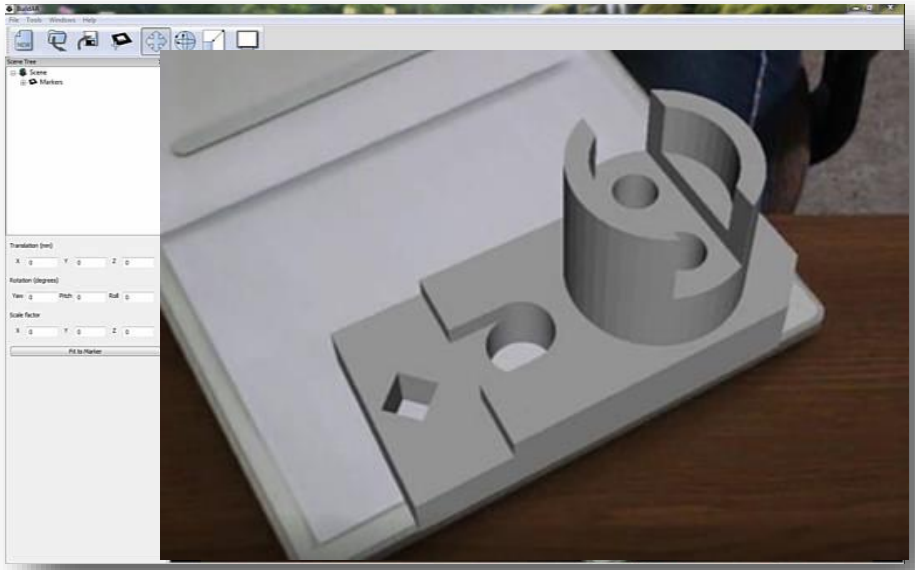
Students' spatial abilities were measured before and after studying the subject through Mental Rotation Test. The test was performed by two groups: engineering students who learned the subject with AR-training and the control group of engineering students who had regular course.

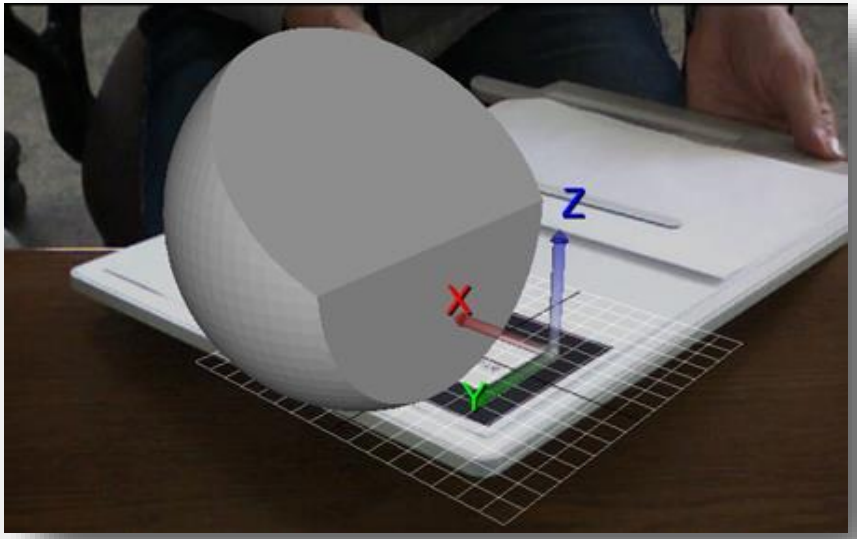
MEAN PRE- AND POST-TEST AND GAIN TEST SCORES (STANDARD DEVIATION) FOR EXPERIMENTAL AND CONTROL GROUPS.

	Pre-test	Post-test	Gain
Experimental group n=48	18.12 (5.91)	23.45 (4.05)	5.33 (4.31)
Control group n=24	17.42 (5.39)	21.83 (5.08)	4.41 (4.26)

OUR EXPERIENCE IN APPLICATION OF AR

3D objects from graphical tasks in the AR environment for ‘Descriptive Geometry and Engineering Graphics’ course.





Augmented Reality scenes were created using the **Envisage AR** software.

OUR EXPERIENCE IN APPLICATION OF AR

According to students' opinion, this approach is very useful in solving graphical exercises, such as multiview projections construction from 2D or 3D geometric objects.

The overall response of the students about the use of AR technology in the 'Descriptive Geometry and Engineering Graphics' course was very positive.

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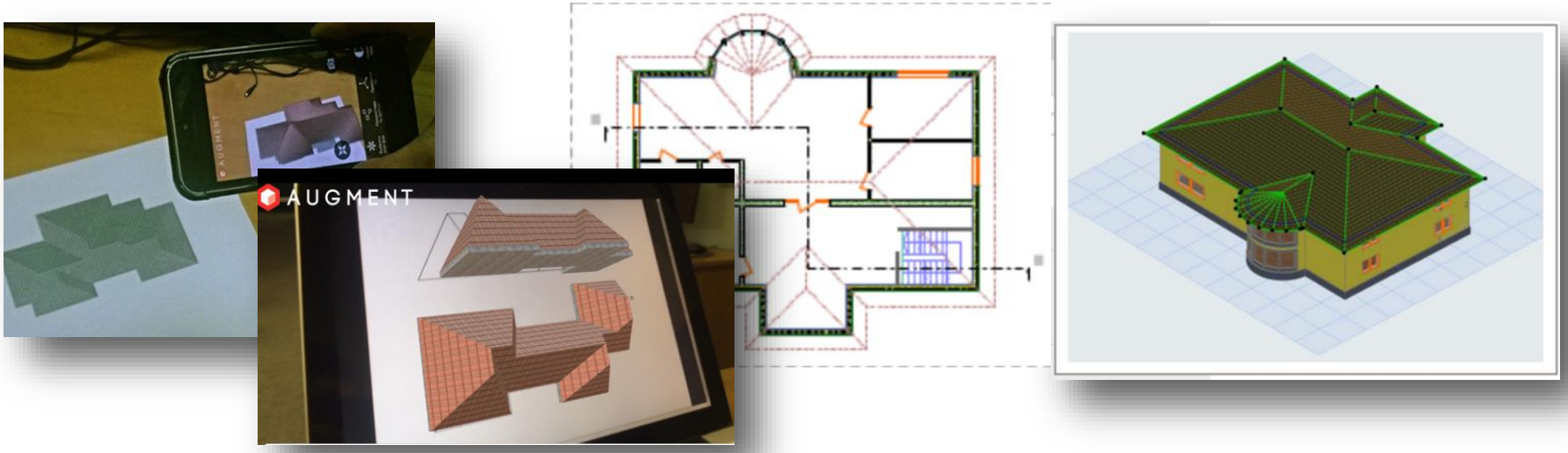
OUR EXPERIENCE IN APPLICATION OF AR

The AR technology for the course ‘Civil Engineering Computer Graphics’ includes:

- AR models for individual exercises on the theme ‘Roof Construction’.
- AR models for individual exercises on the theme ‘Building Model Creation’.



AR models were visualized using **Augment** – a platform that allows visualizing objects through tablets or smartphones.

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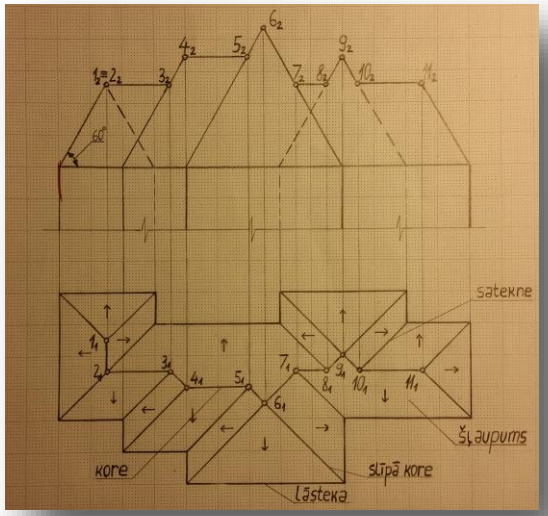
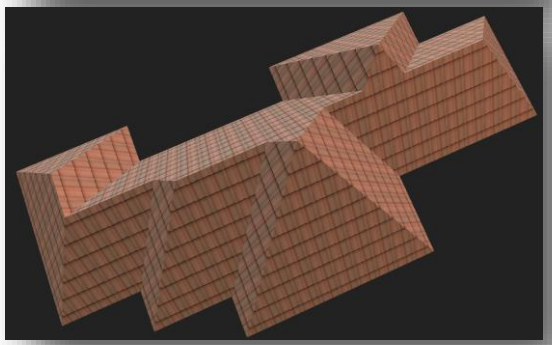
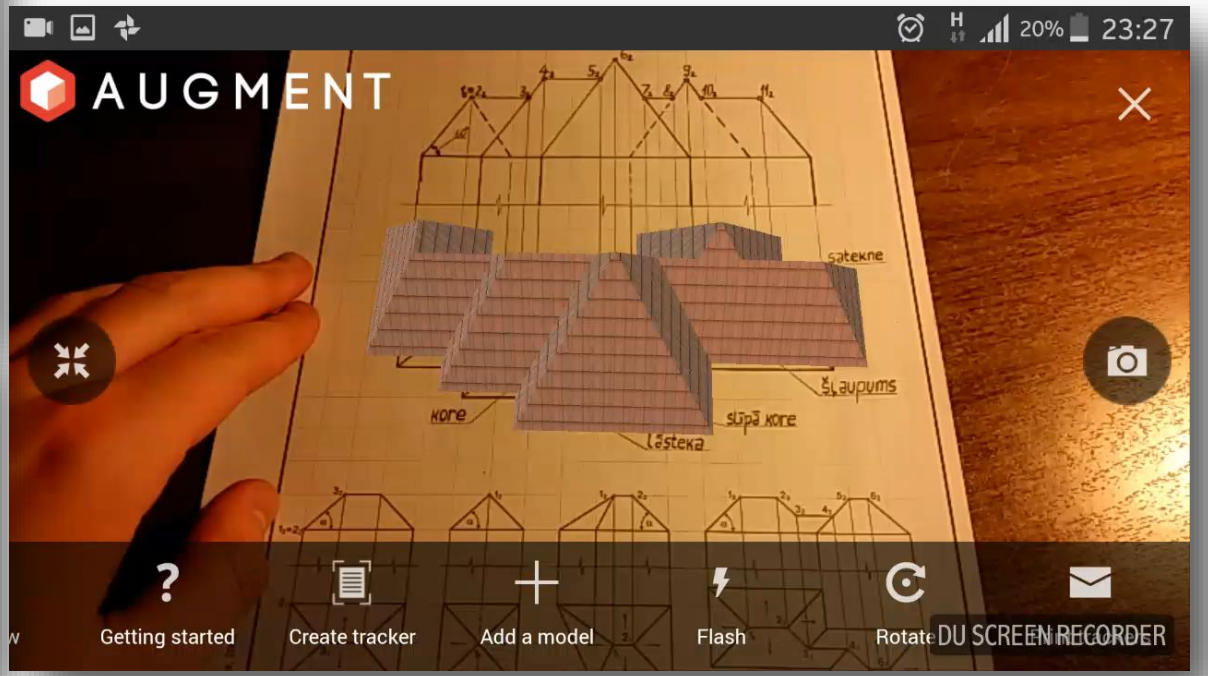
OUR EXPERIENCE IN APPLICATION OF AR

The example of an exercise on the theme ‘Roof Construction’







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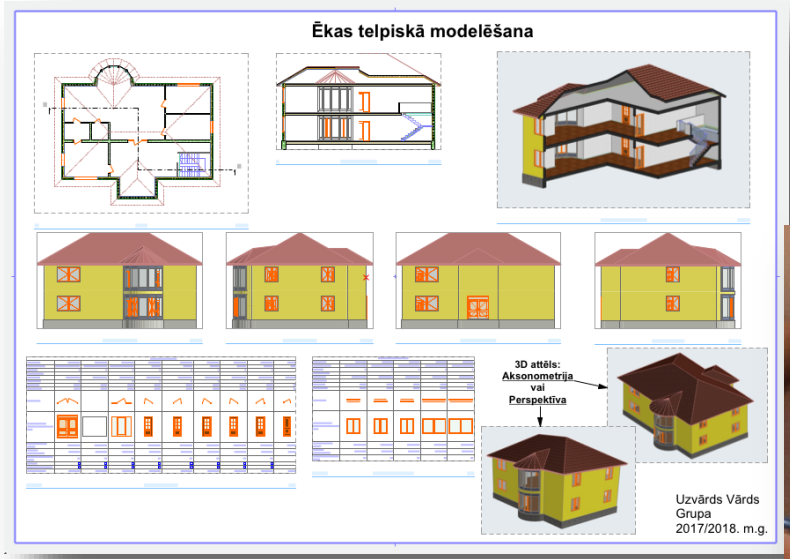
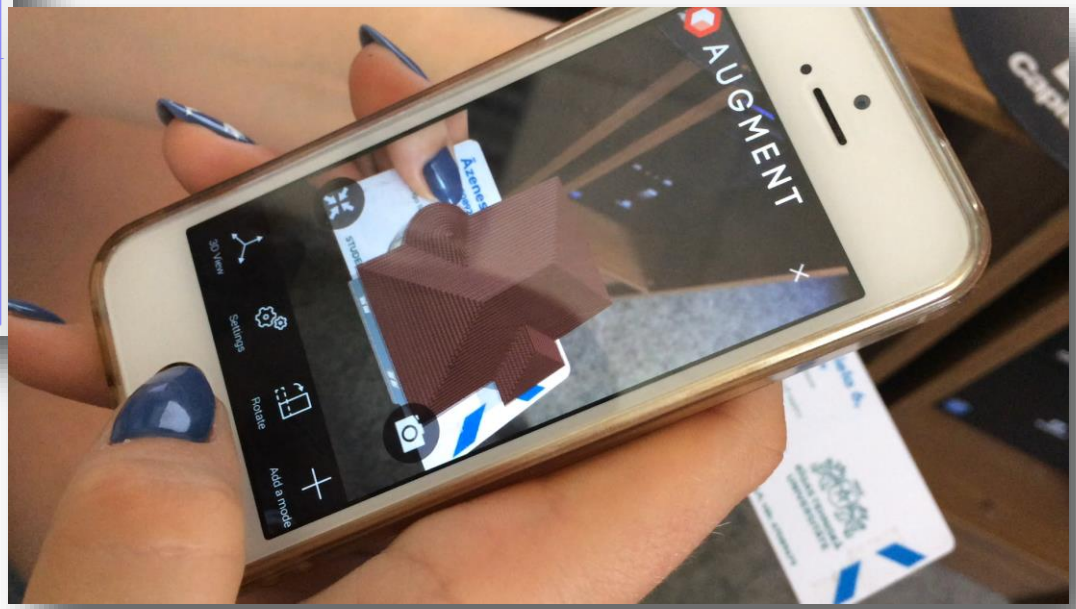
OUR EXPERIENCE IN APPLICATION OF AR



The example of an exercise on the theme 'Building Model Creation'



3D models were created by **ArchiCAD** software.

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CONCLUSIONS

The introduction of AR technology in learning process:

- makes themes of the subjects where students have difficulties more understandable.
- increases the effectiveness of students' independent work.
- improves the quality of training, enhances students' imagination and creativity, helps to transfer knowledge and skills acquired in the virtual environment to the real world.
- attracts people of today's generation and motivates them to learn.
- motivates teachers to change the kind of teaching and makes lessons more attractive and interesting.

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Thank You for Attention

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