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Augmented Reality applied to training on key competences

WP5. AR.KEY System Development

D6. Ar.Key App

FUNDACIÓN LABORAL DE LA CONSTRUCCIÓN
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- Centro Edile Andrea Palladio (Italy)
- Ente Nazionale per la Formazione e L´Addestramento Professionale Nell´Edilizia (Italy)

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1. Introduction

1.1. Description of the App

This App is a training system for non-qualified workers from construction industry, in order to improve their mathematical competence and basic competences in science and technology, keys to successfully follow up their training and hence their professional career.

The system is organized in training modules based on Augmented Reality (AR), which is a live, direct or indirect, view of a physical, real-world environment whose elements are augmented by computer-generated sensory input such as sound, video, graphics or GPS data. As a result, the technology functions by enhancing one's current perception of reality.

The APP is available for Android and IOS devices and can be found in both Google Play and Apple Store. It is also available in the following languages, Spanish, English, German, Romanian, Italian and Portuguese.

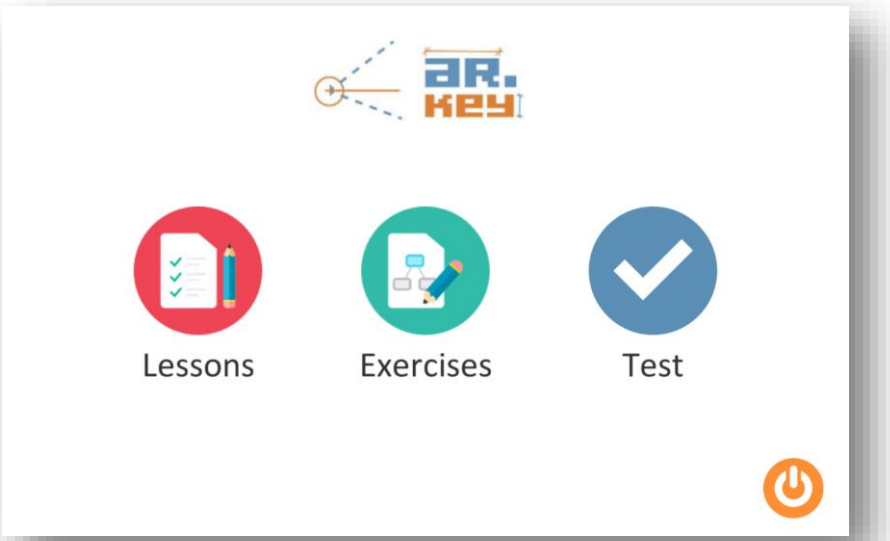
ANDROID: http://bit.ly/ARKEY_ANDROID_APK
IOS: http://bit.ly/ARKEY_IOS_APP

In the following link, it can be seen an example of the Augmented Reality application use:

https://drive.google.com/file/d/0BxDTCaPOFoRDcDR5NlRBMVhIaEk/view?usp=sharing

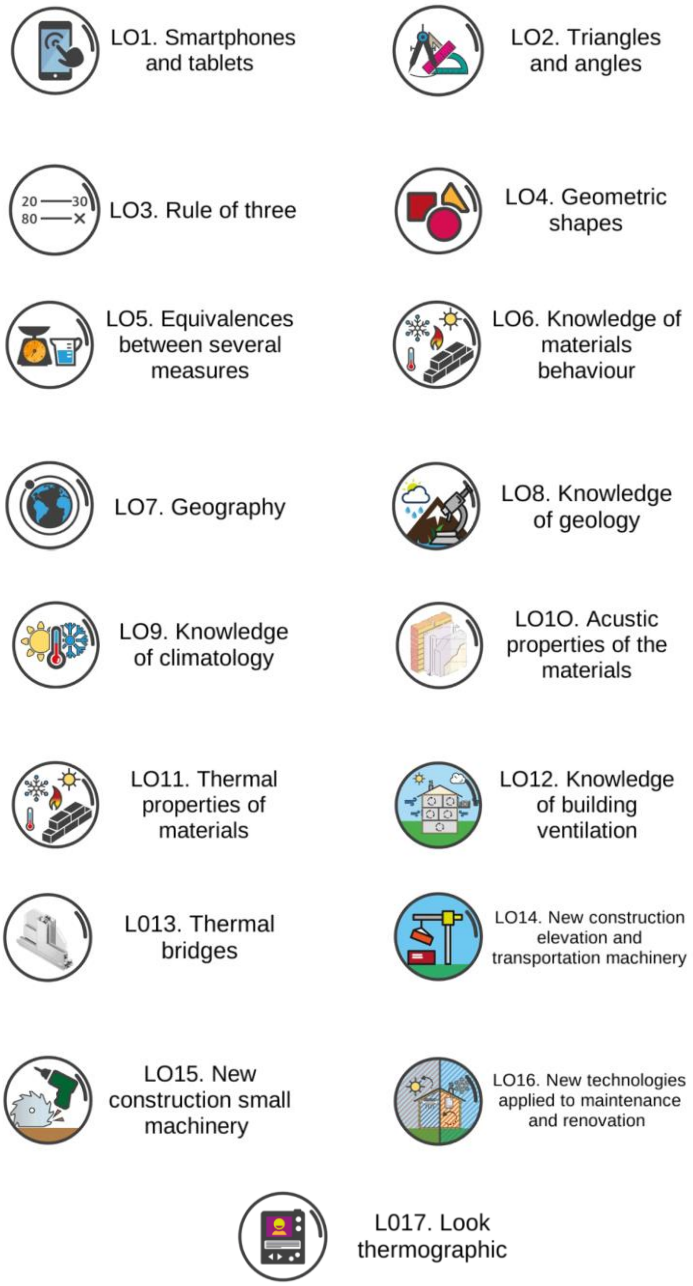
The application is formed by 3 differentiated modules:

- Module 1. Lessons
- Module 2. Exercises
- Module 3. Test



1.2. Module 1. Lessons

The App is formed by 17 learning outcomes divided in Common Skills, Mathematic skills, science skills and technological skills.



1.2. Module 2. Exercises

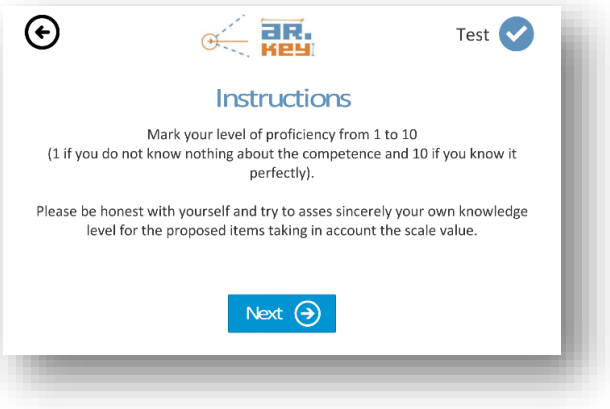
Each learning outcomes counts with an extensive number of exercise for helping to understand in a practical way each of the lessons previously learned.

It is noteworthy to mention that the student / trainee will be able to practice the same exercise the times he/she consider due that it is configured for changing the data each time.

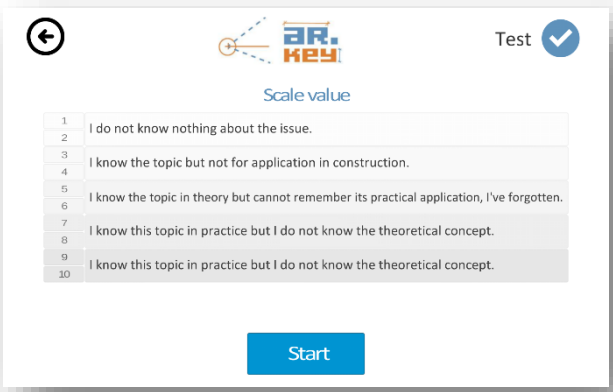
All the exercises are type "drag and drop", interactive navigation, animations and simulations.

1.3. Module 3. Test

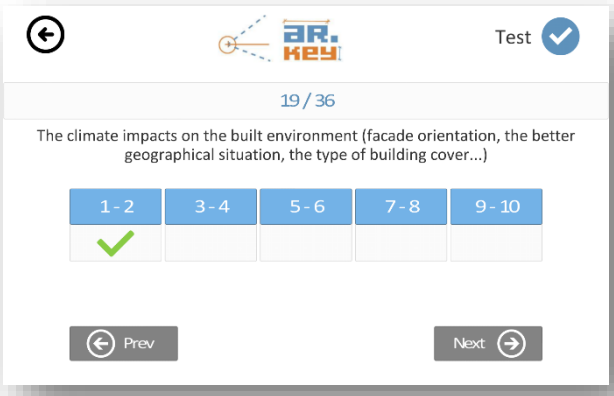
Before to start with the App, the student/trainee should complete the following test for assessing their own knowledge level for the proposed items.



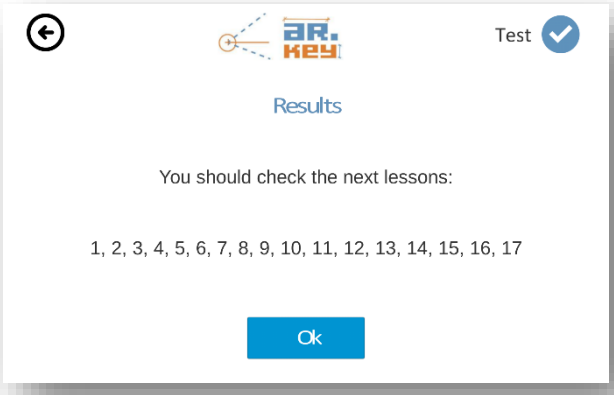
First screen of the Test.



Scale value of the answers.



The student / trainee should mark their level in each question.



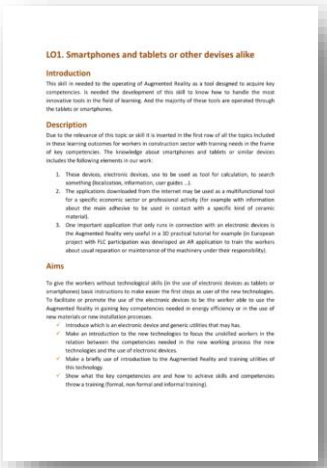
At the end of the test, according to the answers given, the application proposes to the student / trainee the lessons that he/she should check.

2. Ar.Key App

LO1. Smartphones and tablets

To give the workers without technological skills (in the use of electronic devices as tablets or smartphones) basic instructions to make easier the first steps as user of the new technologies.

This LO1 include the following:



LO1. Smartphones and tablets or other devises alike

Introduction

This skill in needed to the operating of Augmented Reality as a tool designed to acquire key competencies. Is needed the development of this skill to know how to handle the most innovative tools in the field of learning. And the majority of these tools are operated through the tablets or smartphones.

Description

Due to the relevance of this topic or skill it is inserted in the first row of all the topics included in these learning outcomes for workers in construction sector with training needs in the frame of key competencies. The knowledge about smartphones and tablets or similar devices includes the following elements in our work:

1. These devices, electronic devices, use to be used as tool for calculation, to search something (localization, information, user guides ...).
2. The applications downloaded from the internet may be used as a multifunctional tool for a specific economic sector or professional activity (for example with information about the main adhesive to be used in contact with a specific kind of ceramic material).
3. One important application that only runs in connection with an electronic devices is the Augmented Reality very useful in a 3D practical tutorial for example (in European project with FLC participation was developed an AR application to train the workers about usual reparation or maintenance of the machinery under their responsibility).

Aims

To give the workers without technological skills (in the use of electronic devices as tablets or smartphones) basic instructions to make easier the first steps as user of the new technologies. To facilitate or promote the use of the electronic devices to be the worker able to use the Augmented Reality in gaining key competencies needed in energy efficiency or in the use of new materials or new installation processes.

- Introduce which is an electronic device and generic utilities that may has.
- Make an introduction to the new technologies to focus the unskilled workers in the relation between the competencies needed in the new working process the new technologies and the use of electronic devices.
- Make a briefly use of introduction to the Augmented Reality and training utilities of this technology.
- Show what the key competencies are and how to achieve skills and competencies throw a training (formal, non-formal and informal training).

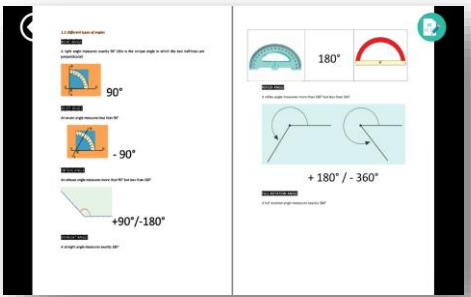
Lesson

Video tutorial.
https://www.youtube.com/watch?v=d9-CxSGOUeM

LO2. Triangles and angles operations

The aim of this unit is to make the user able to recognize the different types of angles and triangles at glance and how to measure the angle degree with traditional tools (protractor) or with “building site tools” (by using three wooden boards).

This LO2 include the following:



Lesson

Video tutorial

Example of Exercise:

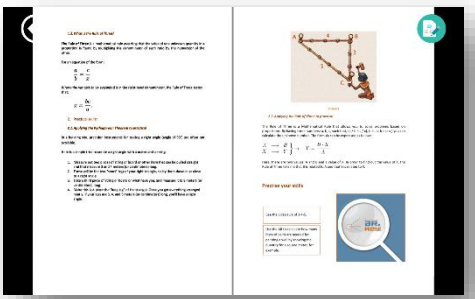
Calculate the ramp length for the given measures. Then, drag from the left step of the entrance to measure and set the ramp.

LO3. Rule of three

The aim of this unit to make the user (student / trainee) able to:

- Trace an angle of 90º with simple tools available in construction site (without precision measurement tools).
- Solve proportions by using a mechanical method.

This LO3 include the following:



Lesson

Video tutorial

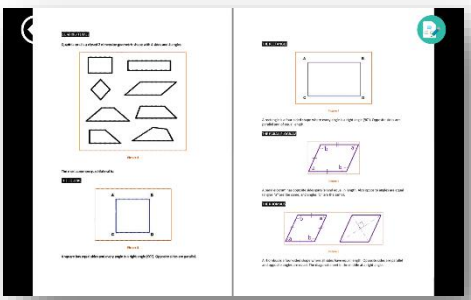
Example of exercise:

If you have 8 liters of paint for 2 bedrooms, how many liters of paint would you need for 3 bedrooms? Note that all rooms have the same wall area.

LO4. Geometric shapes

The aim of this unit is to make the user (student / trainee) able to recognize the different types 2 dimensions and 3 dimensions geometric shapes at glance.

This LO4 include the following:



Lesson

Two video tutorials:

Hexagon Video
Rhombus Video

Example of exercise:

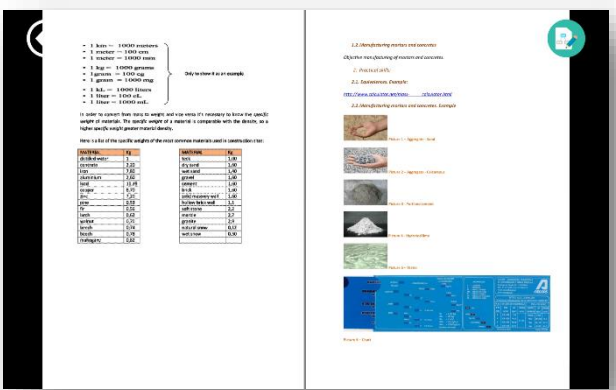
Find at least the minimum number of objects of each shape. Note that the geometry shapes can be regular and irregular.

LO5. Equivalences between several measures

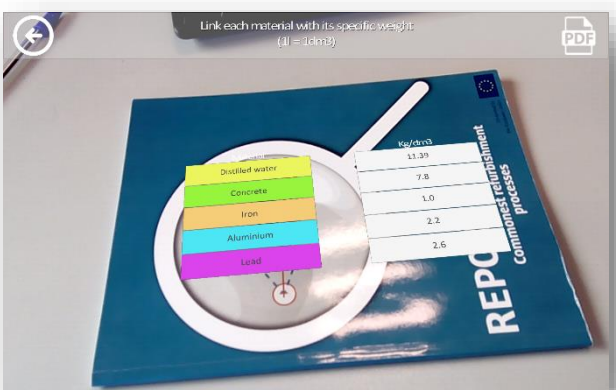
The aim of this unit is to make the student / trainee able to transform the different measures of the most common material used in construction sites without specific measurement tools.

- Acquire theoretical knowledge to utilize the basic mathematical in the manufacture of mortars and concretes.
- Apply the equivalences between several measures, for example cubic meters – liters, to utilize in the manufacture of mortars and concretes.

This LO5 include the following:



Lesson



Example of exercise:

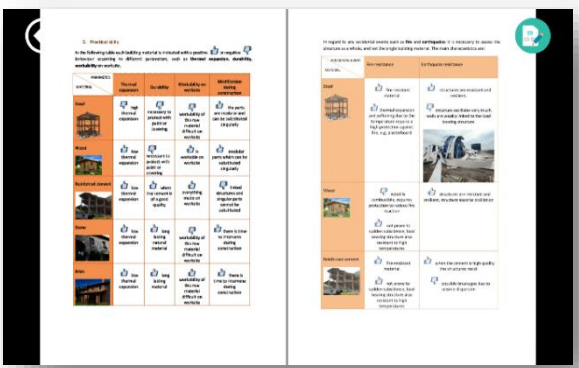
Link each material with its specific weight.
(1l = 1dm3)

LO6. Knowledge of materials behavior

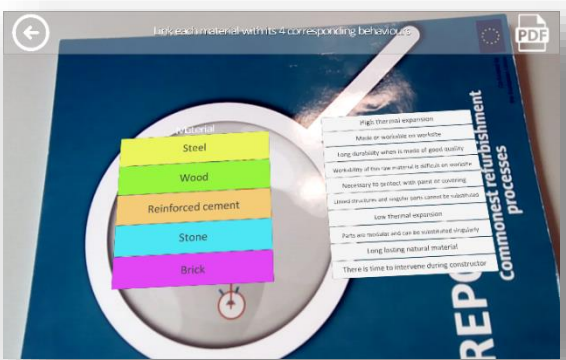
The aim of this unit is to acquire theoretical knowledge of material characteristics, apply this knowledge to the proper use of worksite materials, and identify the integrate use of materials in construction.

- Know how to identify different building materials.
- Know how to choose the best organizational process so as to use different materials at the same time.
- Apply the acquired knowledge to new building as well as the renovation of existing buildings.

This LO6 include the following:



Lesson



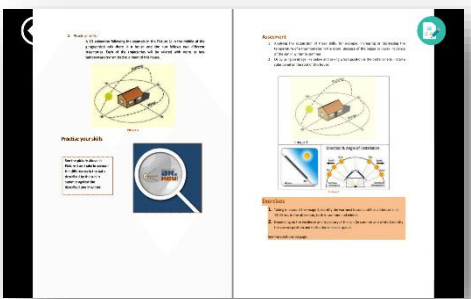
Example of exercise:

Link each material with its 4 corresponding behaviours.

LO7. Geography

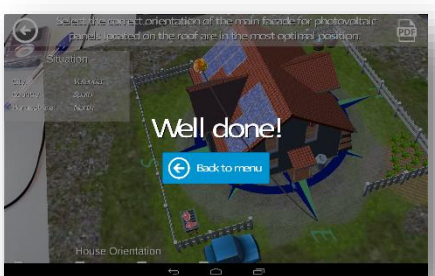
The aim of this unit is to acquire Acquire enough knowledge to understand the influence of the geographical orientation in the isolation and climatization of a building. Apply the knowledge to a practical situation related to the geographical orientation, as in the installation of solar panels for example.

- ✓ To give geographical knowledge enough to the trainee to understand why a south orientation of a room may generate an influence in the climatic conditions of this room in comparison with another one orientated to the north.
- ✓ To give geographical knowledge enough to the worker to understand why a south orientation of a room may generate an influence in the isolation needs of this room in comparison with another room of the house orientated to the north.
- ✓ To understand the different sun trucking in relation with the season of the year.
- ✓ To know the better position of a solar panel in regard with the position of the house and the sun (orientated to the south, north, east or west).



Lesson

Example of exercise:
Link each material with its 4 corresponding behaviours.

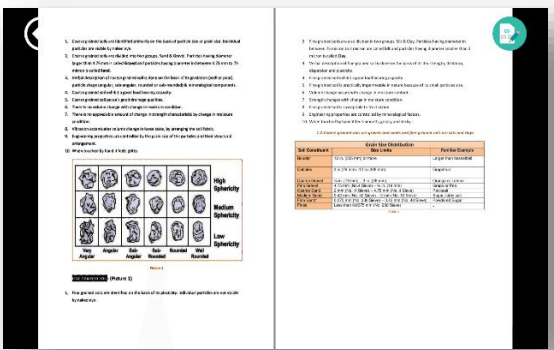


LO8. Knowledge of geology

Acquire enough knowledge to understand the influence of the soil and visually classify the soil. Apply knowledge to a practical situation related to the soil identification.

- ✓ To give geological knowledge enough to establish a consistent method for field staff to follow when completing the description of soil and rock samples obtained from field sampling efforts
- ✓ To give geological knowledge enough to the workers to understand the consistency of the soil.
- ✓ To be able to identify and describe the subsoil condition
- ✓ To be able to compare between logs that were created by different geologists is essential for creating subsurface interpretations.
- ✓ To be able to identify the structural components of a building system

This LO8 include the following:



Lesson

Example of exercise:

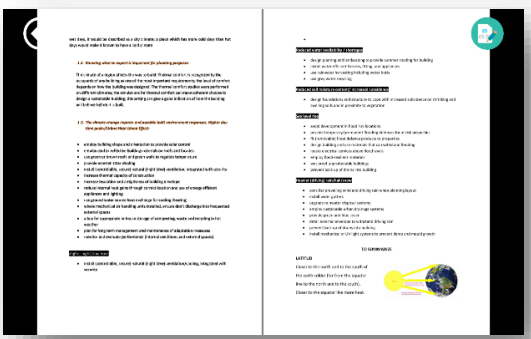
Use AR to determine the right position of two house together due to distribution of the loads.
Note: Look ar the subsoil to see the uniformly distributed presurre scheme.

LO9. Knowledge of climatology

Acquire enough knowledge to understand the influence of the weather over the build environment. Apply this knowledge to a particular situation (a building work or any other construction work) and identify the impact over the construction in some particular area because of this specific characteristic (the different weather conditions determined by the geographical situation).

- ✓ To give climatology knowledge enough to understand the factors that influences the clime.
- ✓ To give climatology knowledge enough to the workers to understand the importance of the clime in build (organization of the works, characteristics of the materials to use, the water volume to be evicted by the gutters, time to cure the concrete…)
- ✓ To be able to identify and describe the clime diversity.

This LO9 include the following:



Lesson

Example of exercise:

How climate data informed decisions in the build environment. Draw arrows FROM THE RIGHT (climate considerations) TO THE LEFT in the right response (implication on the system).

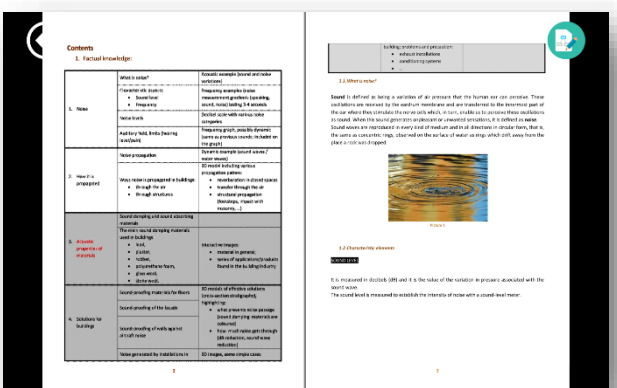
LO10. Acoustic properties of the materials

Acquisition of elementary understanding of sound and noise concepts and how these are reproduced in the building. Understanding how propagation of these can be hindered in current building procedures in relation to materials used as well as solutions for external, internal and floor partitioning.

- ✓ Understand when a sound transforms into noise, acquiring an intuitive relation between noise intensity and its measurement (DB scale).
- ✓ Understand what the noise acceptability limits are for living spaces (in terms of a scale in conformity with the regulations and good practice).
- ✓ Workers have to acquire noise propagation processes from the building structure and living spaces and understand what the limits of traditional building materials are.
- ✓ They have to know which materials are used together with structural ones in order to determine absorption and sound-proofing of noise; the role mass plays, the characteristics and how they are generally used.
- ✓ Understand what the current building solutions in the main operations are; the partitioning (internal and external, interface between opaque and transparent surfaces), floor and systems built into the structure.

Understand how these solutions can be invalidated by bad installation at works.

This LO10 include the following:



Lesson

Example of exercise:

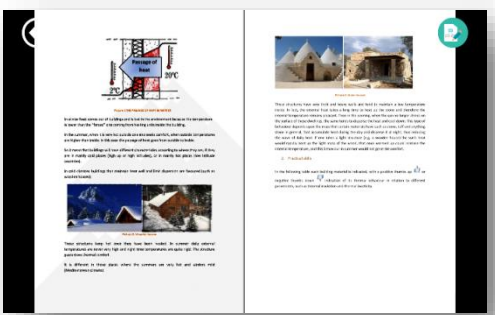
Drop the insulating materials into the wall and see the effects on the waves. Then, decide which one is the best option, the second option and the worst option for this situation by clicking on the buttons on the left.

LO11. Thermal properties materials

Acquire technical competence of thermal characteristics of materials, apply this know-how to the correct use of materials on worksite, and indicate the mixed use of building materials.

- ✓ Know how to indicate different materials for thermal insulation of buildings.
- ✓ Know how to choose the best implementation to use different material at the same time.
- ✓ Apply acquired know-how for new buildings and the renovation of existing ones.

This LO11 include the following:



Lesson

Example of exercise:

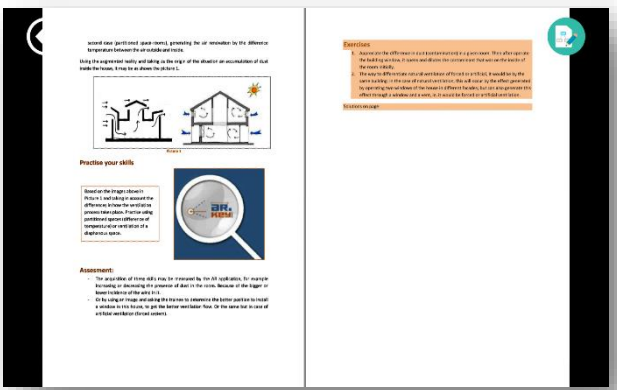
For each material decide if they are good or not at thermal insulation and thermal inactivity. Use the slider below to change the outer temperature and check its effect in the house with the thermal vision.

LO12. Knowledge of building ventilation

Acquire theoretical knowledge related to ventilation and its basic principles. Apply theoretical knowledge in practice developed in renovation and refurbishment of housing, especially if changes are made to move a wall.

1. Facilitate the theoretical knowledge to justify the movement of airflow.
2. Understand the movements of the air, and the flow generated. Elements that let modify it.
3. Apply theoretical knowledge proposed for the design of elements that facilitate ventilation: distribution of internal partitions, windows, or ventilation columns.
4. Be able to determine the need for ventilation of one room of the house or all of it, according to uses that are designated for it.

This L12 include the following:



Lesson

Example of exercise:

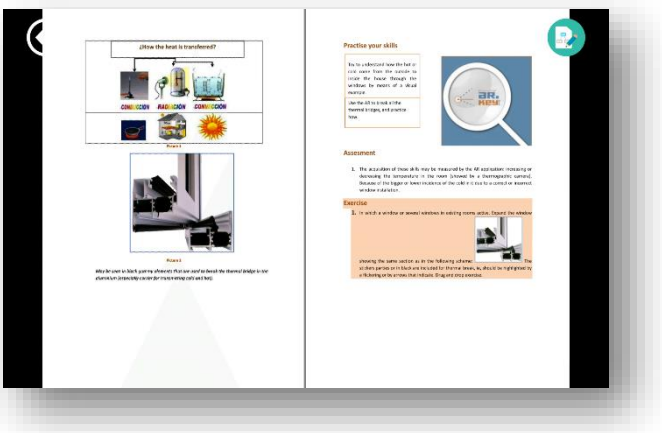
Open windows let the dust enter the huts, check how the dust over the rooms changes when the windows are opened or closed. When all the rooms have the windows closed, the house will be clean and the exercise will be finished.

LO13. Thermal bridges

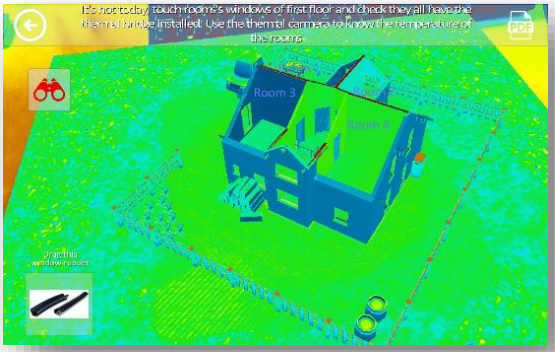
Acquire theoretical knowledge related to weather elements (hot and cold, especially) and how it (conduction, radiation, convection) is transmitted. Apply this theoretical knowledge to the practice developed in renovation and refurbishment of housing, especially if they are made specific operations such as the replacement and installation of windows.

- ✓ Facilitate the theoretical knowledge, in this specific case, what is a thermal bridge?
- ✓ Understand the physical reasons that generate the cold transfer through the insulating elements, such as windows.
- ✓ Apply theoretical knowledge proposed for the proper installation of insulation elements like windows.

This L13 include the following:



Lesson



Example of exercise:

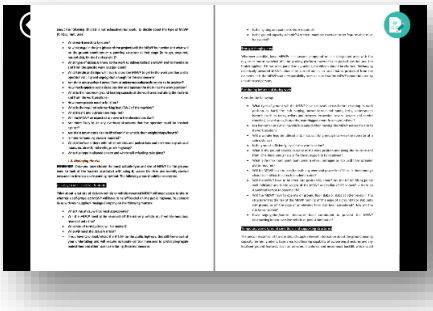
It's hot today, touch room's windows of first floor and check they all have the thermal bridge installed. Use the thermal camera to know the temperature of the rooms.

LO14. New construction elevation and transportation machinery

Acquire enough knowledge to select, manage and use of new construction machinery MEWP (mobile elevating work platforms)

- ✓ Apply knowledge to be able to operate safely one elevation machine. Using as a check list the knowledge that is proposed below.

This L14 include the following:



Lesson

Example of exercise:

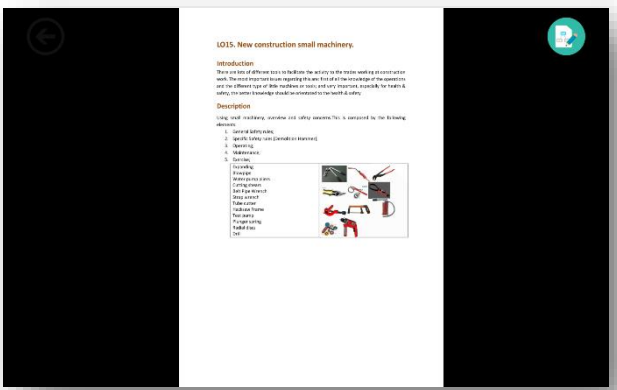
Drive safely the MEWP aound the house.

LO15. New construction small machinery

Acquire enough knowledge to understand the general safety rules.

- ✓ Apply knowledge to be able to operate with one power tool machine (the hydraulic hammer will be the tool used as the model to the other power tool machines).

This L15 include the following:



Lesson

Example of exercise:

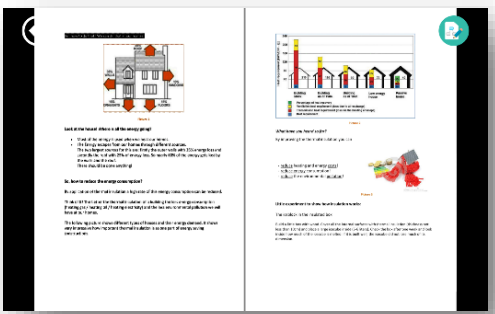
Drag and drop each element in the correct place in order to assemble and disassemble the different parts of a Hydraulic hammer

LO16. New technologies applied to maintenance and renovation

Acquire basic knowledge about new technologies-materials and the relation between thermal protection, energy need and climate protection. Acquire knowledge about the effect of thermal insulation

- ✓ Acquire knowledge to choose and apply appropriate insulation for roofs
- ✓ Acquire knowledge to choose and apply appropriate insulation for walls

This L16 include the following:



Lesson

Example of exercise:

Drag and drop each element in the correct place and correct order to assemble the insulation from inside in the roof.

LO17. Look thermographic

The goal: understand the use of a thermographic camera.

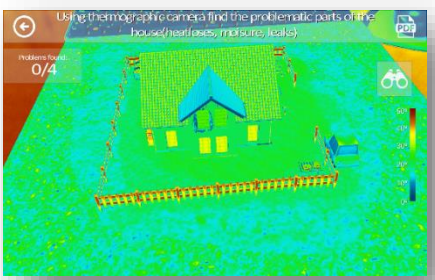
- ✓ Acquire basic knowledge about thermal significant of the colors showed by the camera.
- ✓ Acquire knowledge about usefulness of this tool in renovation, rehabilitation works about the energy saving matter.
- ✓ Acquire knowledge to use a thermographic camera

This LO17 include the following:

Lesson

Example of exercise:

Using thermographic camera find the problematic parts of the house (heat loses, moisture, leaks).



3. Annex. How to use Android

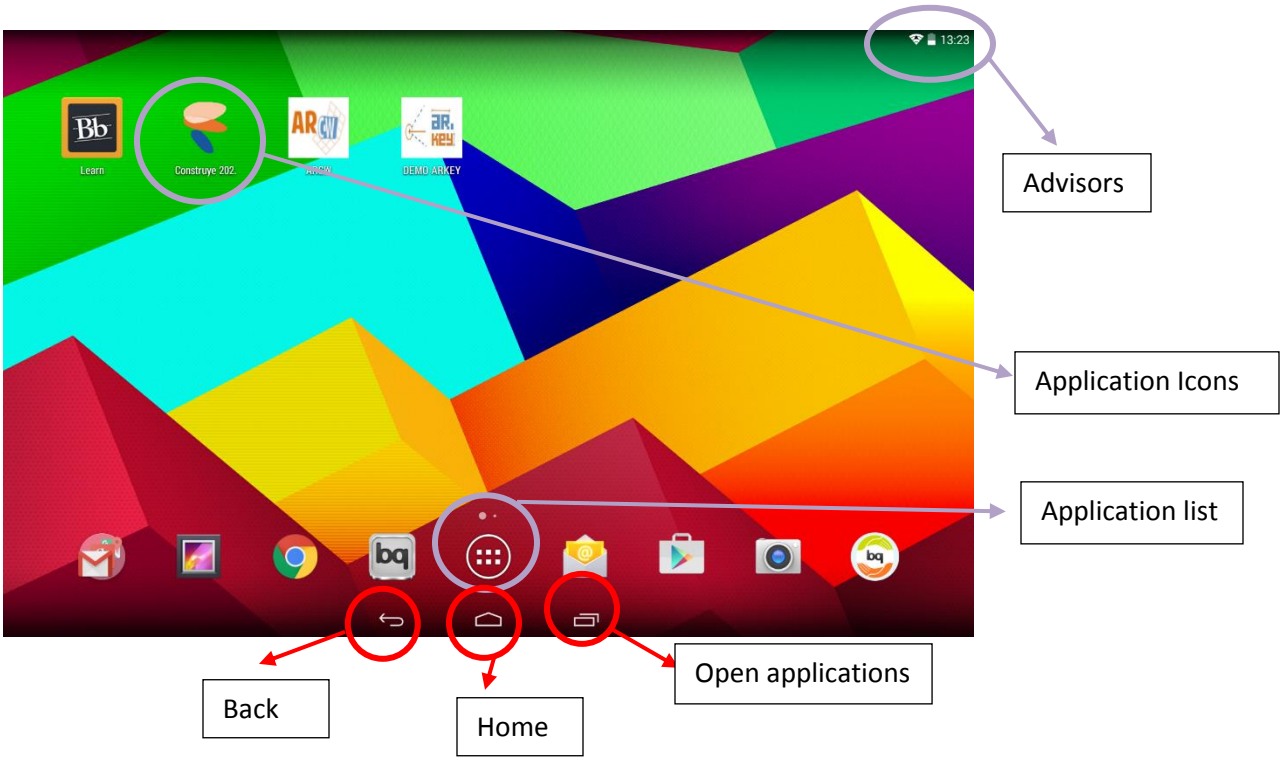
HOW TO USE ANDROID (smartphons – tablets)

PREREQUISITES
Operating system: - Android 4.4 kit kat - Apple´s iOS
Internet connection: - 3G - Wi-Fi
Gmail Account – Play store

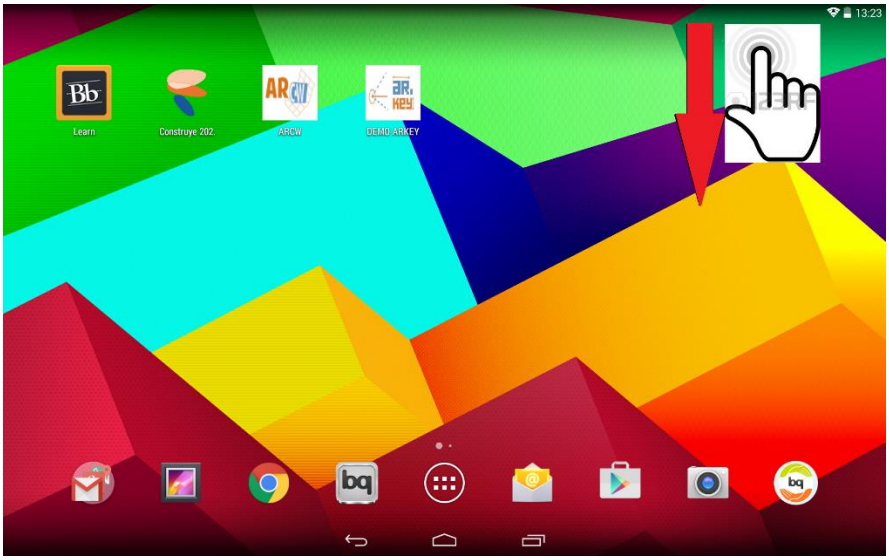
1. CONECT AND UNLOCK “To activate and use the tablet or smartphone: press button on the left or right profile, to unlock, put your finger on the lock and drag to the right, and thus you can work with the tablet.”

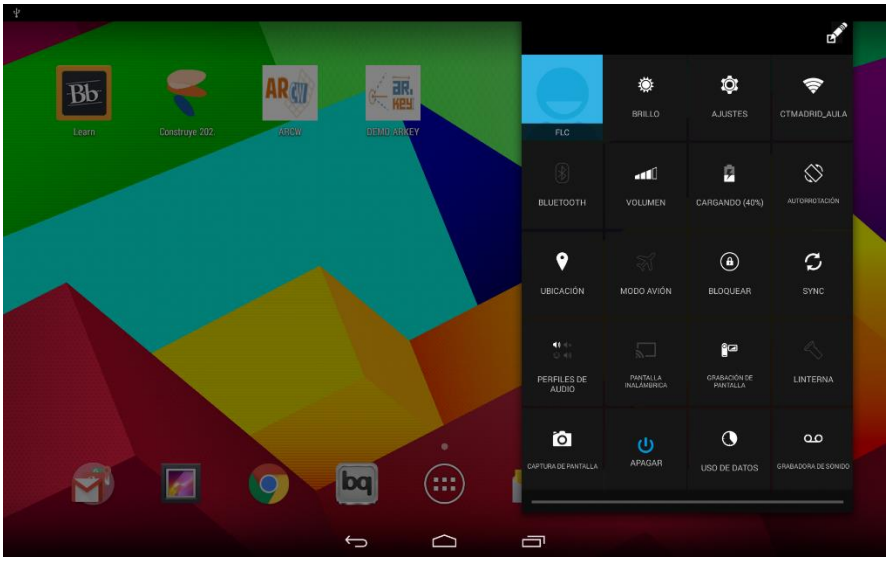
2. BEGINNING: “Before you start working with the tablet, you must enter some details and choose other settings (language, WiFi network connection or 3G connection ...)”

DESKTOP AND IT´S ICONS: “The initial screen, although it can vary, it will be like this and includes the three main navigation buttons  .



3. GOOGLE ACCOUNT: While you can use the phone without providing account details, you’ll miss out on so much of the Android experience. Only if you have a Google account, for example, you can obtain apps from Google Play (online shop for Android apps), and so much more so this is highly recommended.





4. TURNING Wi-Fi, Bluetooth, GPS ON and OFF: To access these buttons, swipe down from the top of the screen. Initially you'll see status information in which case you should touch the icon in the top-right corner. Now you can turn Wi-Fi, Bluetooth and Location (i.e. GPS) on and off.

5. FIND AND INSTALL APPS: To use the apps already installed in the smartphone or tablet, push on the button  and will appear all the apps, including the Google Play one  .

In the Play Store app, select the 'Apps' tab at the top. A few popular apps will be suggested but, in all probability, you'll be looking for something in particular. So touch the magnifying glass icon at the top and then search as we described for finding a YouTube video. All apps that match your search criteria will be listed – scroll down and select any you think meets your requirements to see more details. If you like what you see, touch 'Install' and, if you're happy to do so, tap 'Accept' when you're asked for various permissions.