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Multiple Devices

Project Output #1 of the

InterMedia
Erasmus+ Project
AT01-KA204-078005

euphoria Net

BRAIN_OG

15 aJter Associação Juvenil da Ilha Terceira

EIE European Initiative for Education

About the Project

The project serves to exchange experiences and develop digital skills, especially in the multimedia area within the participating organization's staff. Furthermore, the development and use of M&I learning materials should be worked out together, brought into context with multiple devices and developed in comprehensive documentation. A particular focus is put on methodology and approaches to support seniors in this digital-oriented learning and trainings. Furthermore, the organizations will use the gained experience and knowledge to promote Erasmus+ programs - and in this sense especially courses - to all generations in their home countries.

The project aims to increase the knowledge and skills in the participating organizations to create and use M&I content, with particular attention to multiple devices and a specific focus on seniors.

Contact and further information

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Contents

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1. THE TERM "MULTIPLE DEVICES"

The modern learner uses various devices during the learning process. Some learners own more than one device.

1.1. What are "Multiple Devices"[1]

Multiple devices are electronic tools to process and display data, information, and multimedia content. Currently, we can distinguish several types of devices. Most of them are portable today.

- **Computers or desktop devices**

  They are the classical roots of all mentioned devices. Computers usually accept data (from a network or using an external keyboard), process them using specific programs and produce results like data, images, texts, multimedia content or similar output. Computers also can be used as input devices for web-based applications. Computers usually are big, heavy, use a big screen, and are not mobile.

- **Laptops and notebooks**

  Laptops and notebooks are similar devices, but the laptop usually emulates the desktop device (bigger, heavier, not so compact, in most cases, better equipped). Notebooks were designed as more compact devices and handier. The basic functionality is like laptops, but specific devices (like a DVD drive) are often missing. Currently, notebooks are optimized for connectivity (to the cloud).

Image 1: Learning with a typical laptop:

  Both types of devices use a mechanical keyboard.

- **Chromebooks**

  Chromebooks are similar to laptops. They arrived in 2011 and had limited functionality. Today's Chromebooks use Chrome OS as an operating system and offer Flash drives for storage. The essential software is the Chrome browser which enables cloud-based working with software like the Google Drive Tools.

  Chromebooks are not natively compatible with Windows or Mac software and can use many Android apps offered for tablets (and smartphones). One of the biggest hurdles is the inability to use Microsoft Office. However, there are some Microsoft compatible apps available now that can be installed on Chromebooks.

  Chromebooks have the advantage over Android tablets of a larger screen, a fixed hardware keyboard and more memory.

[1] https://www.tibl-project.eu/web/en/what-are-multiple-devices/

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- **Tablets**

Image 2: Learning with a tablet

Tablets are more or less reduced notebooks. A smaller screen, not so powerful processor, minimized operating system, no hard disk, and other minimizations characterize a tablet. Most tablets use either the Apple IOS or Google's Android. From the screen (or display), these tablets offer a typical size a little bit bigger than smartphones but smaller than tiny notebooks – they bridge this specific gap in display size. A mechanical keyboard is not available and replaced by a particular area at the touch screen as a standard. Many tablets currently can be enhanced by mechanical keyboard. There exist tablets which include a phone feature (and therefore can be seen as big smartphones).

- **Smartphones**

Smartphones are "all in one" microcomputers that can be used as a phone. The screen size is limited (due to transporting them in the pocket of your trouser. A mechanical keyboard is not available and replaced by a particular area at the touch screen as a standard. The enhancement with an external keyboard is not foreseen.

- **Convertibles**

Image 3: New on the market – convertibles

A convertible is a notebook where the keyboard can be turned to the rear of the display to enable the device to work as a tablet. It is a kind of hybrid of tablet and notebook and always needs a touchscreen.

- **Multiple devices in learning**

The InterMedia Project will develop the methodology to use all multiple devices in all kinds of earning. Developing the mentioned methodology needs an elementary analysis of all the mentioned devices' potential and creating a well-fitting concept to deliver the learning content in a suitable way to supply all the used devices.

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1.2. Typical devices used by learners

At the start of the project, the consortium asked former participants of courses and partners of other projects about their learning devices. The feedback was given in a web-based feedback tool[2] and got visualized. The bigger the word is displayed, the more often respondents mentioned this device. A laptop is the preferred learning device.

Figure 1: Visualized feedback from learners

There are other devices named. In some cases, it is not clear how this device will be used (for example, a DLSR camera).

Finally, we selected five major groups for the survey about the use of devices in the context of three different learning units.

- Personal computer
- Notebook
- Chromebook
- Tablet
- Smartphone

Device	Percentage
Laptop	38%
Desktop PC	20%
Smartphone, Mobile Phone	28%
Chromebook	6%
Tablet	8%

With the survey, we followed the devices named in the AnswerGarden feedback.

[2] https://answergarden.ch/

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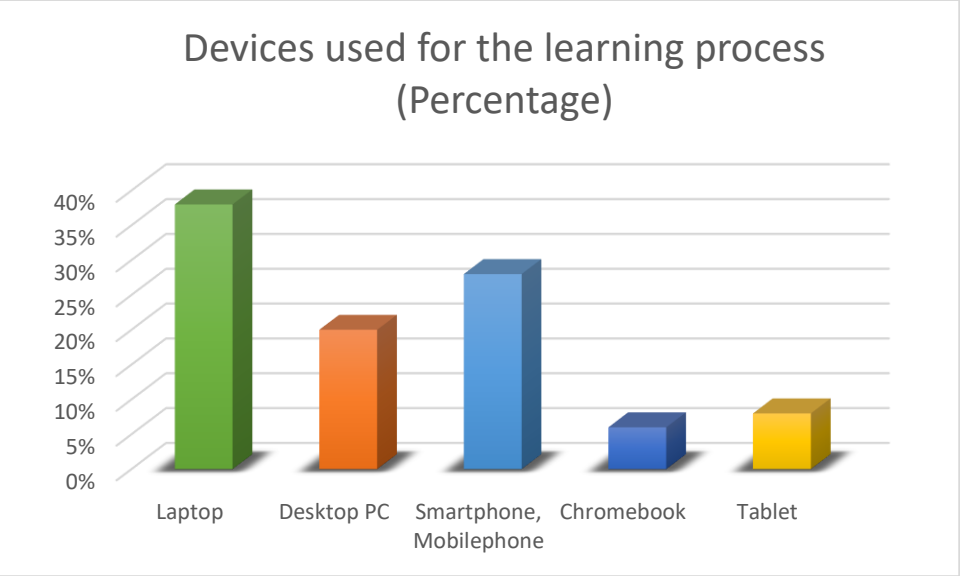

Figure 2: Devices used for learning

2. THE DEMO APPLICATIONS

The demo-applications focused on three typical situations of learning processes:

2.1. Inserting some text (Demo 01)

This learning unit focuses on the problem of inserting text. This task may be simple on a desktop PC but using a smartphone may become a challenge: the missing physical keyboard and the small screen size make entering text tedious.

2.2. Interactivity in the frame of a virtual lab (Demo 02).

This learning unit cares about the work with pointing devices and the precise placing of elements. Smartphones only offer the finger as a pointing device, and this is not a very precise tool.

Hint: There exist tablets with a pen as a pointing device; this makes the placement of elements in the virtual lab easier. Only a minority of tablets work with these pens.

2.3. A multimedia-based and interactive application with drag and drop. (Demo 03)

The drag and drop of elements and to move them to a precise place is in the foreground of this learning unit. Additionally, the tool uses some space on the screen and can be difficult to handle on small smartphone screens.

2.4. Intention of the demo-apps

The demo apps' basic idea was to generate learning material as usual in multimedia learning and test them on various devices.

After experienced learners testing these modules, we could make statements on the devices' basic requirements and the optimal conditions for courses.

Example: The study shows that many users have problems and are not satisfied with smartphones when entering text. The problem is the place covered on the screen by the virtual keyboard and the missing physical keyboard. This problem may result in the recommendation for courses where participants must enter text often: This course is only partially suitable for smartphones.

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3. THE SURVEY

Various people (personally known to the project partners) have been invited to participate in the survey and contribute with their experience).

Hint: The invited people all have profound digital competencies, and all were well-experienced in Technology-Enabled Teaching and Training (TEL). The sample included 81 people.

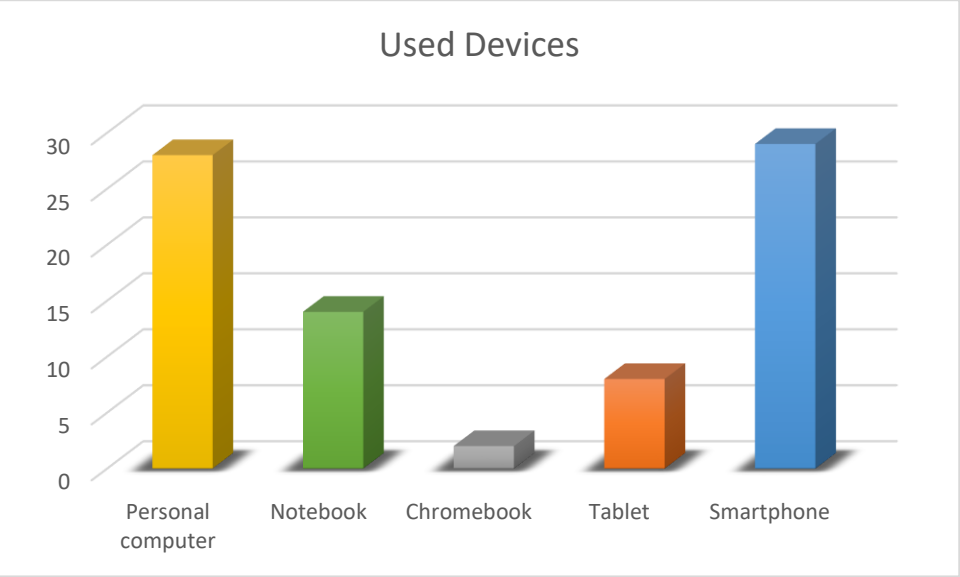

Figure 3: Distribution of devices in the sample

3.1. Image Formats (Demo 01)

This first demo deals with images. The learning unit explains various image formats and asks finally - in a self-evaluation - the user to insert the correct words into a cloze test.

In the learning-unit, specific terms in context with images are explained.

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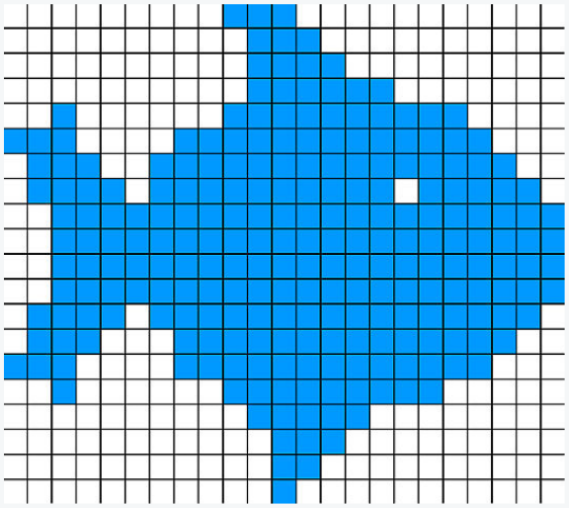
About images

Summary of image file formats

Image file formats are standardized means of organizing and storing digital images. An image file format may store data in an **uncompressed format**, a **compressed format** (which may be lossless or lossy), or a **vector format**. Image files are composed of digital data in one of these formats so that the **data can be rasterized** for use on a computer display or printer. Rasterization converts the image data into a **grid of pixels**. Each pixel has a number of bits to designate its color.



JPEG

JPEG (Joint Photographic Experts Group) is a **lossy compression method**; JPEG-compressed images are usually stored in the JFIF (JPEG File Interchange Format) file format. The JPEG/JFIF filename extension is JPG or JPEG. Nearly every digital camera can save images in the JPEG/JFIF format, which supports eight-bit grayscale images and 24-bit color images (eight bits each for red, green, and blue). JPEG applies lossy compression to images, which can result in a significant reduction of the file size.

Figure 4: Screenshot from the learning unit

This is a Self-Evaluation

Read the paragraph below and fill in the missing words.

Raster images are constructed by a series of _____ , or individual blocks, to form an image. JPEG and PNG are all raster image extensions. JPEG is a good choice for _____ compression of still images (currently the most popular). This format supports different _____ models, from black & white up to true color.

Consider to prefer PNG when more precise reproduction of the image is required. SVG is a _____ image format; ideal for user interface elements, icons, diagrams, etc., that must be drawn accurately at different sizes.

Most digital cameras store _____ in JPEG format, because due the _____ you can store more photos on one camera card than you can with other formats.

Submit

Figure 5: Screenshot from the self-evaluation

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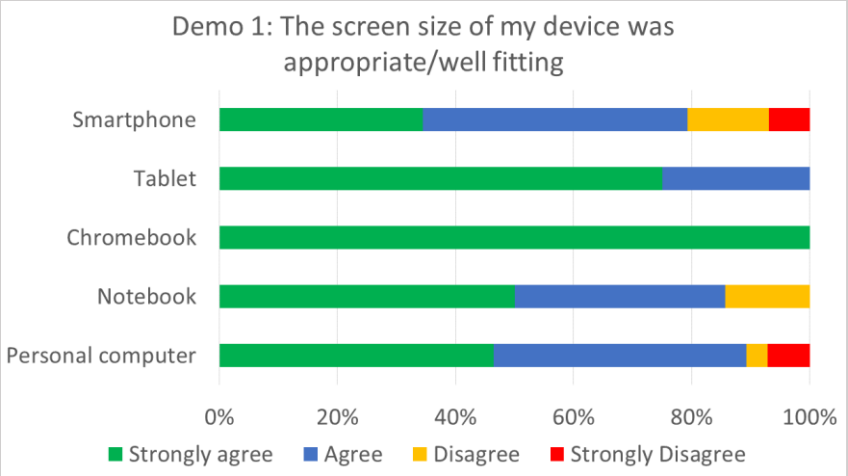
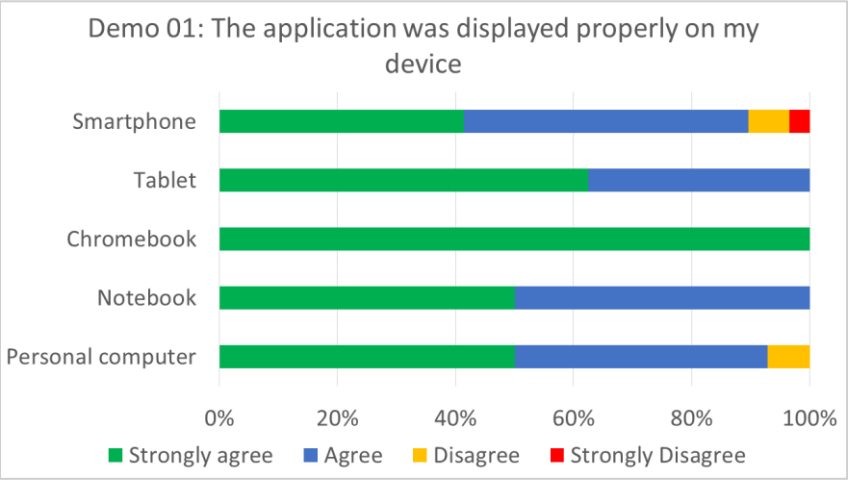


The graphics show a certain missing satisfaction of the users – especially smartphone users. The content is not displayed satisfactorily. Interesting is that also Notebook users and people learning with personal computers show that.

Conclusion: Creating multimedia-based and interactive learning content must consider the necessary space on the screen. This consideration may help almost all users.



People are satisfied with the display of the learning unit. However, smartphone users show again that the presentation does not fit convincingly.

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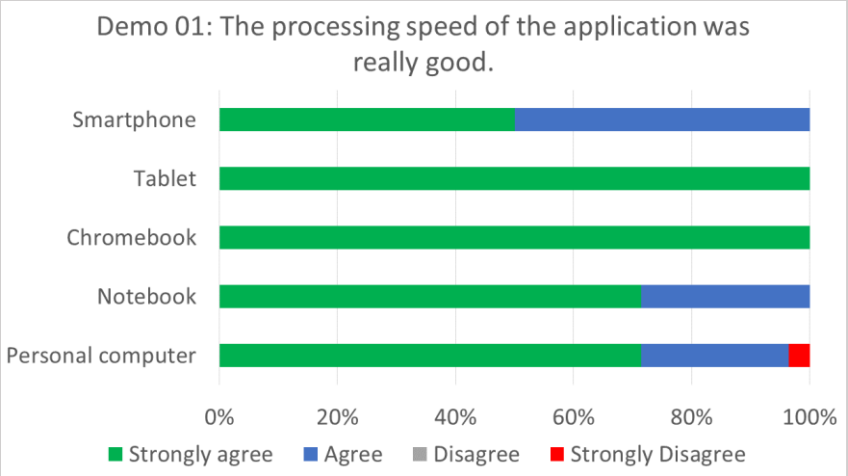
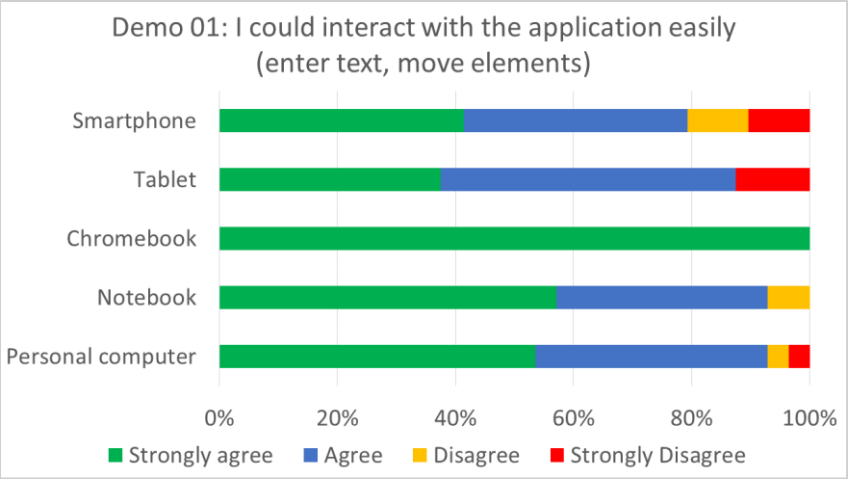


No device shows significant weakness in the display of the content. Web Browsers' well-done implementation for the devices handling HTML 5 content quickly might explain this feedback.



Approximately 20 % of the smartphone users were not satisfied with the interaction when doing this example. The need to enter text may explain this value. Some users found this problematic because of the missing (physical) keyboard. The same feedback comes from tablet users – a device also missing a physical keyboard.

Conclusion: Learning material that makes intensive use of a physical keyboard (this means that the learners have to write a lot) is not well-fitting for smartphones (and maybe tablets). Learners must be made aware of this before the course.

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3.2. Simple Electric Circuit (Demo 02)

The second demo app provides a virtual lab. It has as an assignment to the learner to create a simple electric circuit.

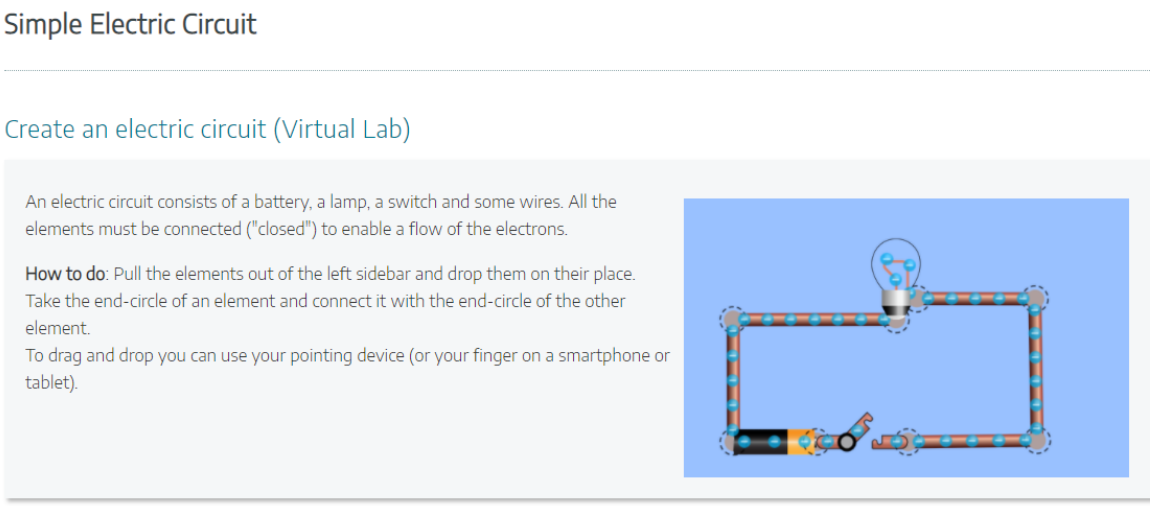


Figure 6: Create a simple electric circuit assignment

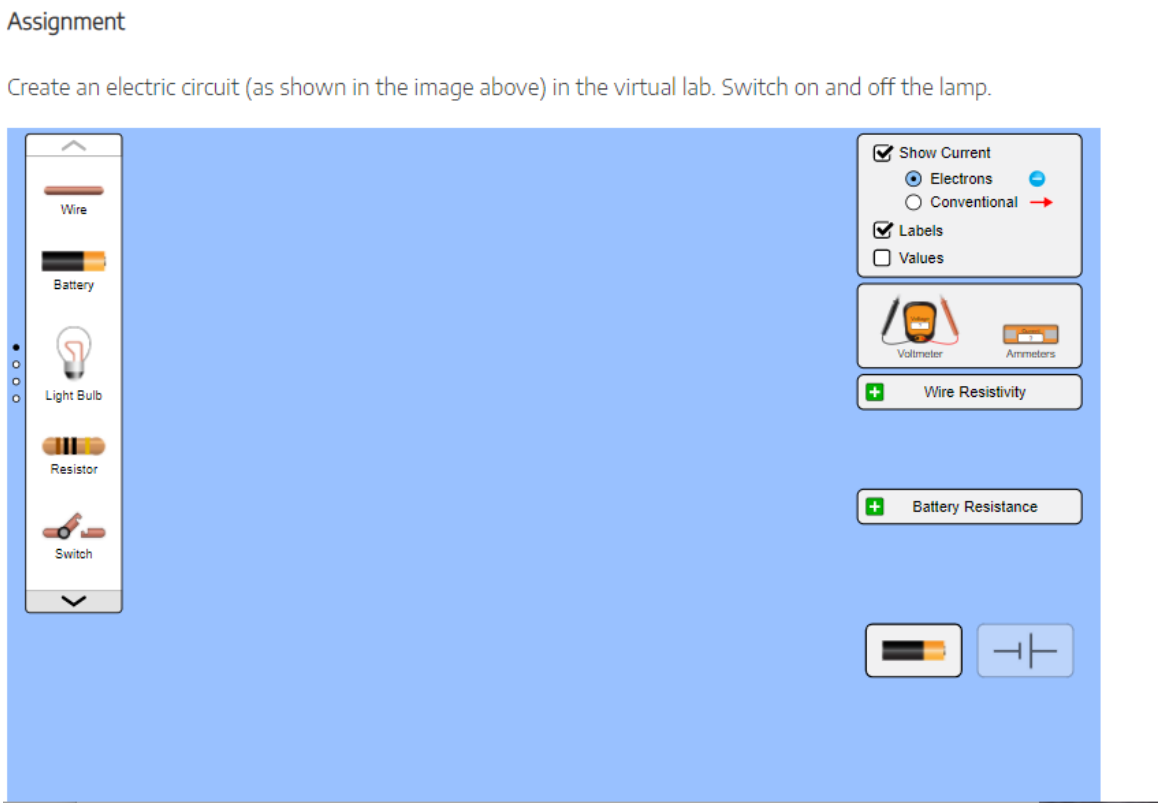
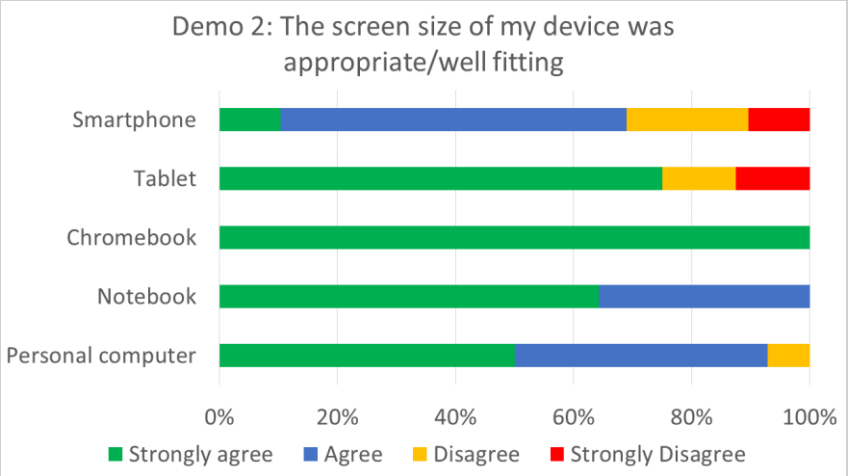
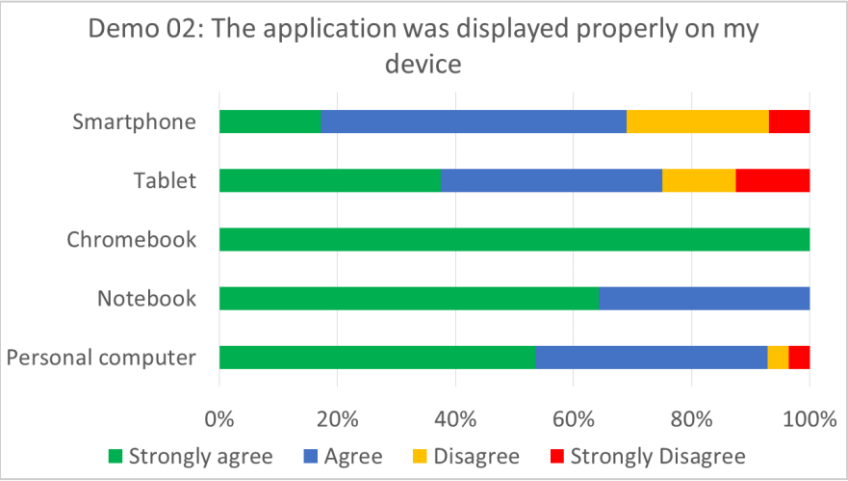


Figure 7: Virtual lab to solve the assignment



The learners show a high degree of dissatisfaction when working with this application. The cause is undoubtedly in the representation: the screen area is too small to show all the details of this virtual laboratory. The same situation also applies to tablet owners, who even predominantly criticize the display (and only have a small screen).

Conclusion: Working with multimedia material with many screen items needs a bigger screen size than smartphones (or tablets) offer. In courses using such things, it is recommended to inform the learners that the smartphone and even a tablet are unsuitable.



The display on the smartphone and tablet screen was unsatisfying for the learners.

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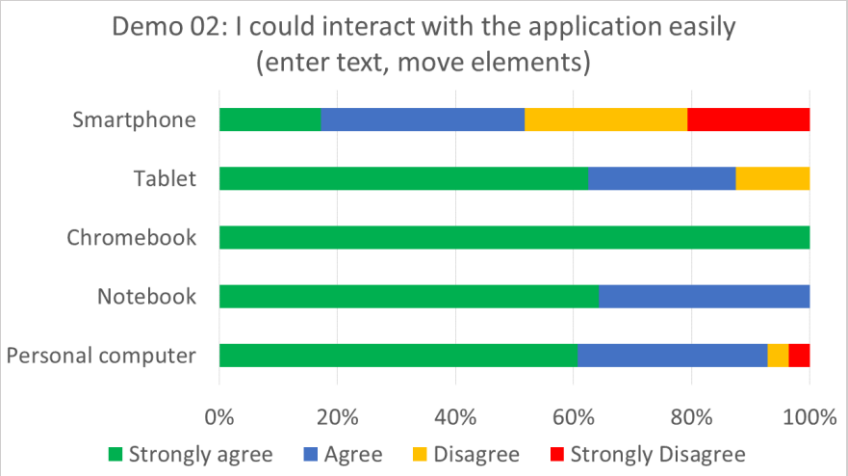
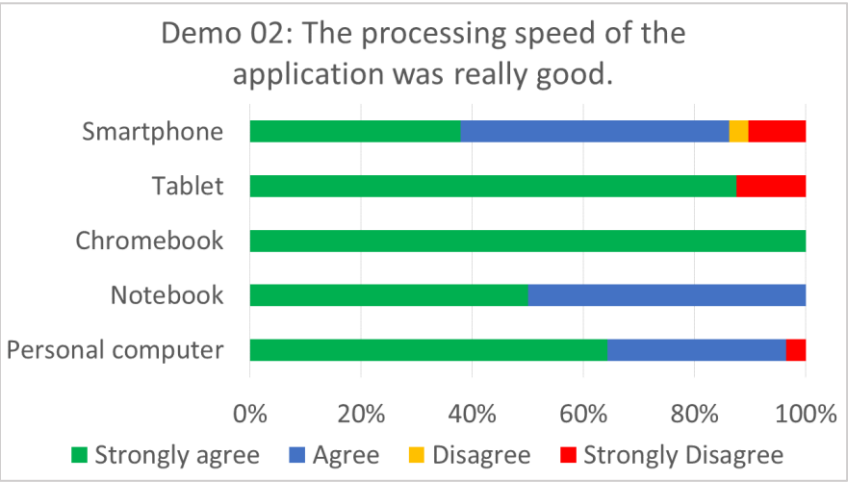


The interaction with the virtual lab without any suitable pointing device is problematic. This issue might be the reason for the smartphone users' feedback (and tablet users as well).

Conclusion: learning apps that use pointing devices are only partially suitable for smartphones (and tablets). In courses using these items, learners must be informed about smartphones or tablets before the class starts.



Even simple smartphones with their low-performance processors do quite well in these simulations.

Note: the simulation uses the browser's canvas and is created in HTML 5, supported by standard (and commonly used) browsers. A different way of programming the simulation can lead to worse results.

3.3. Windows File Extension names

The third learning unit cares about Windows file extensions.

An introducing reading part presents various common file extensions.

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The learner must bring together the fitting pairs in the next step: file description ó file extension (a drag & drop assignment).

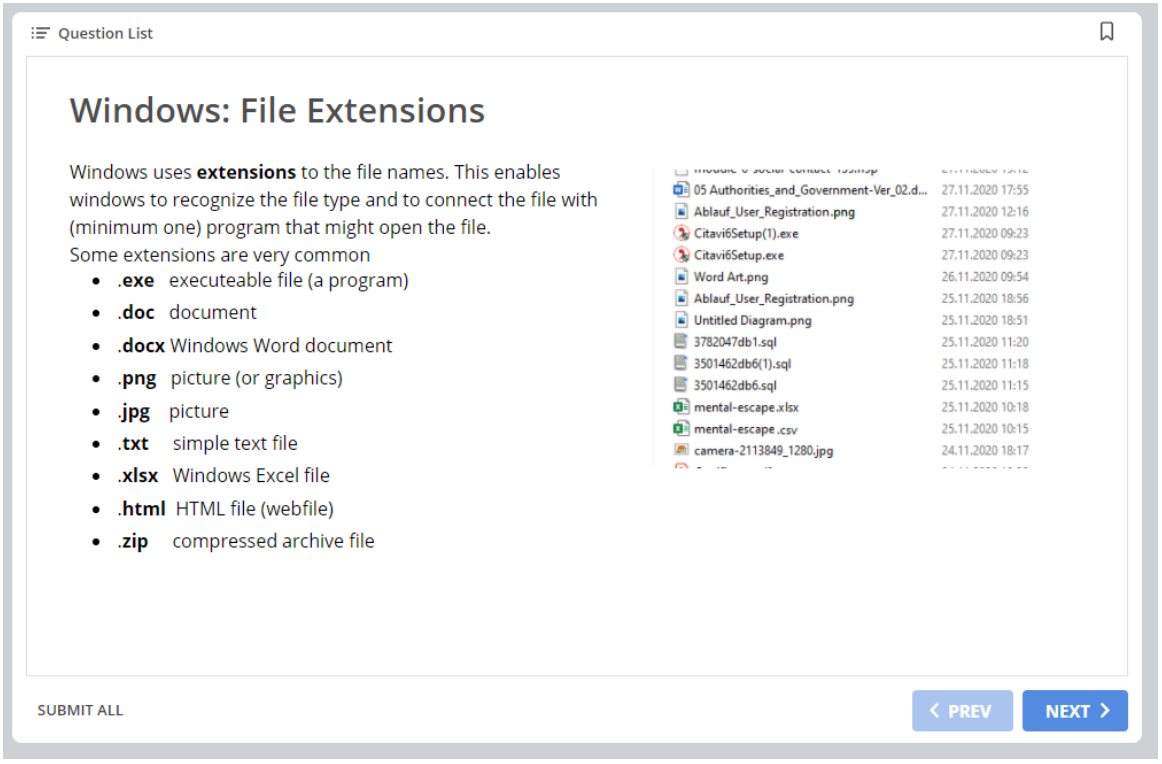


Figure 8: The learning content presents various file extensions

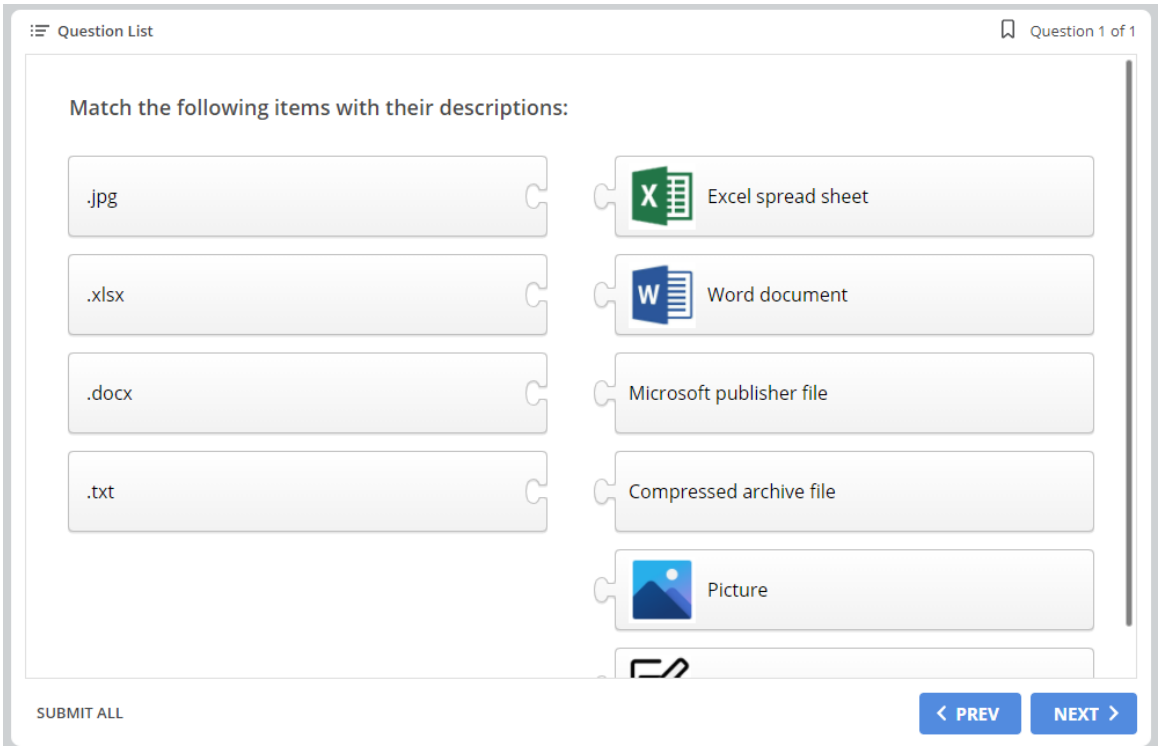
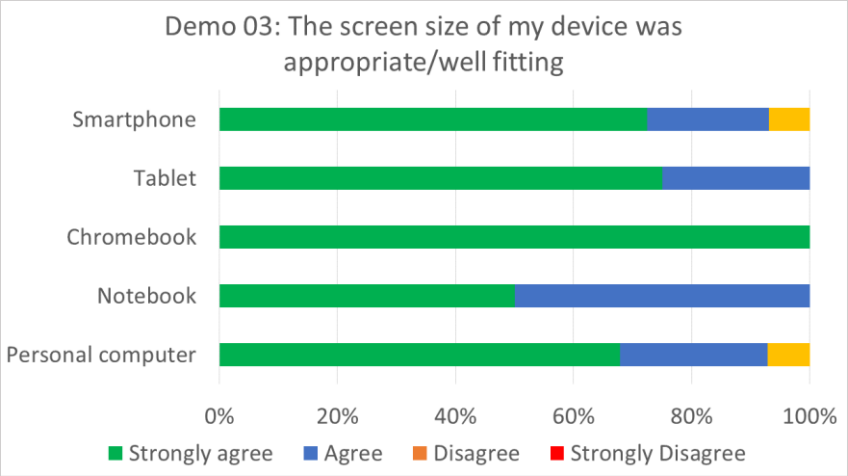
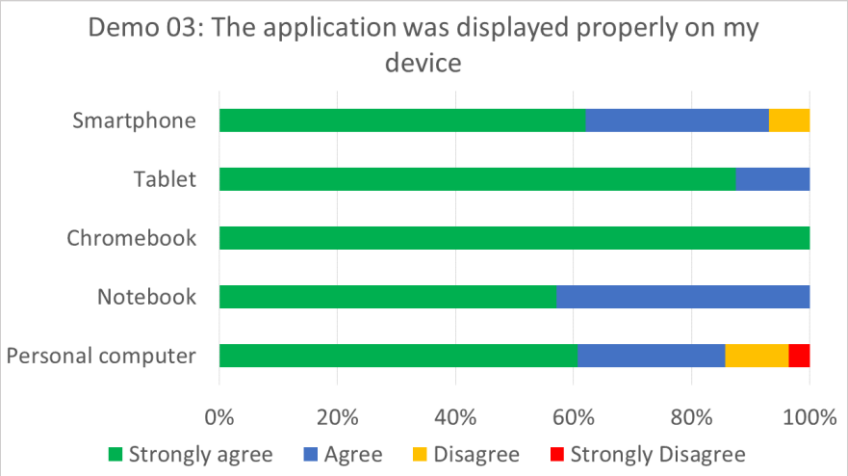


Figure 9: Find the matching elements (and evaluate your choice)



The learners were satisfied with the drag & drop application.



While the users of most of the devices stated their satisfaction with the display of the drag & drop application, some Personal Computer users were not satisfied.

Conclusion: From the answers to the open questions, it is clear that the display requires scrolling.

Recommendation: When designing multimedia applications, it must be ensured that the entire application can be seen on the screen and that scrolling is avoided.

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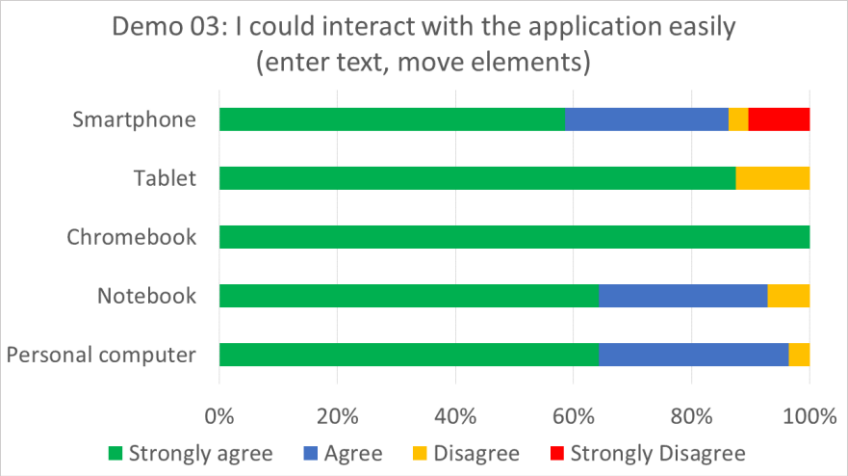
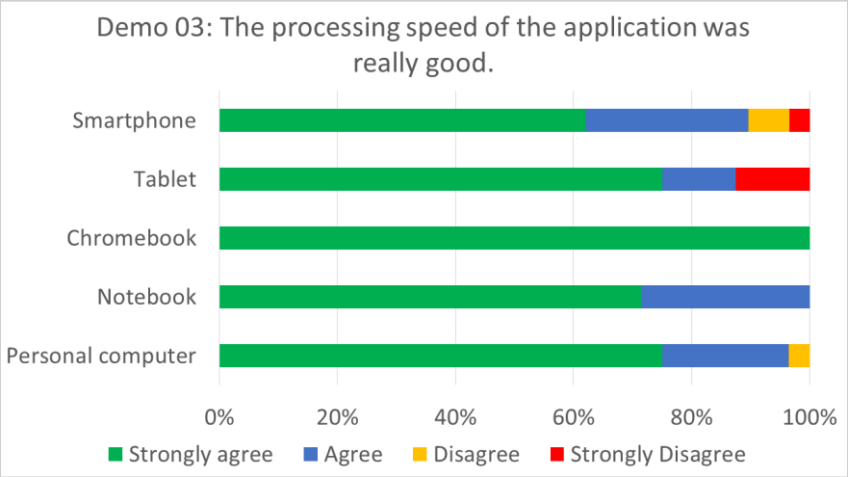


The smartphone learners were not satisfied with the given interaction. Since it was a drag & drop activity, the missing pointing device 8and the imprecise use of the fingers on the touch screen) might be the problem.

Conclusion: Drag & Drop activities do better with devices with a suitable pointing device.



This interactive application was not based on HTML but on different technology. This technology used more processor power. It, therefore, was not evaluated as really good in the aspect of the operating speed – especially on smartphones (that have the weakest processor of the tested devices).

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4. CONCLUSION & LESSONS LEARNED

Learner can use all invested devices. All of them display the created standard learning apps. Nevertheless, differences exist in efficiency, handling, and usability.

Some interesting conclusions can be drawn from the learners' feedback, which will be included in the given recommendations.

4.1. About Smartphones

Smartphones are working well in displaying videos or for quickly search (for example, looking up something in Google). Activities like working in an interactive virtual lab, entering text, or specific drag & drop assignments are not suitable.

Active learning VS passive learning

The type of learning process mainly impacts the efficiency of the selected devices. This is especially true if we consider smartphones: we have them at our disposal anytime and anywhere. Due to the size of the screen and the lack of pointing devices, the user experience is more complicated. As a result, smartphones are mostly used for passive learning, e.g. to absorb information by watching a video, reading articles or e-books or listening to podcasts. They are not user friendly when it comes to active learning, where the student is actively involved in the instructional process by engaging activities and discussions.

This statement is partially valid for tablets, mostly when they are missing a physical keyboard. With a keyboard and a bigger screen size, tablets seem to be quite well-working devices for learning.

All other devices are generally seen as quite useful end devices for active learning. Asking back the users who were not satisfied with the personal computers showed that they are older people who used a small screen (or low screen resolution) and will care for bigger screens in the future.

4.2. Layout of multimedia-based and interactive learning content

The layout and the content presentation must fit the selected devices. Versatile learning content must fit to the environmental conditions and training settings.

These preconditions cover

- The screen sizes
- An existing pointing device (if needed)
- The existence of a hardware keyboard (if needed)

Before starting the learning process, the learners must be informed on time about the possible restrictions due to the learning work to be expected for specific devices.

4.3. Context between offered learning material and learners' experience

A relationship exists between the offered learning applications and the learners' experience (digital competences as well as the expertise in handling multimedia material).

Learners must learn to use the different types of presentation of learning content with their devices. Specific training is necessary to close any existing gaps among the learners.

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5. RECOMMENDATIONS

Evaluation of the study and analysing the results led to the following recommendations:

[1] **Information**

Learners must get precise information about suitable devices before each course. This information must be part of the course description. Limited use of devices must be explained, for example, “All interactive assignments can be managed with any device, only the virtual lab can only be carried out with a smartphone to a limited extent.”

[2] **Age of the learners**

Feedback from the study indicates that the use of devices is age-dependent. Especially older people have problems with smartphones due to the small display, the tiny text, and the missing pointing device.

[3] **Conceptual planning**

The planning of multimedia-based and interactive content must take into account several cornerstones:

- Multimedia-based content must cover a maximum of one screen page (dependent on the user device).
- Scrolling is to be avoided in any case
- Interactive elements must be big enough to move them with fingers (on touch screen devices, like smartphones, tablets, or Chromebooks).
- Applications must be kept simple using the standard resources of the devices. The recommendation is to use web-based delivery with a web browser, technically implemented via HTML 5

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6. USED SOFTWARE

For the creating of the demo learning units, various software tools have been used.

6.1. Demo 01

This application is made with eXe-Learning. This tool enables the development of independent web-based content (delivering pure HTML5 pages). The tool has several assessment technics included.

6.2. Demo 02

This tool is also created with eXe-Learning. As the virtual lab, an Open Educational Resource (OER) is inserted, the Phet simulation “electric networks”.

6.3. Demo 03

This app has been developed using iSpring. This tool is an Add for PowerPoint and enables the creation of web-based learning content. There exists a free version of this software.

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ABOUT THE PROJECT PARTNERS

AJITER

Youth Association of Terceira Island - AJITER, is a non-profit institution that was started in **April 2003**, starting from the essential objective of promoting and strengthening youth associations in the Azorean community, as an innovative way to promote the integration of integration into the community it is inserted in, and fight against generalized indifference that, at times, is very harmful to our youth.

Since then, there has been a lot of work developed, we have had a social and community intervention in the most varied **areas of relevance to youth**, from education for citizenship, through education for health, prevention of risk behaviour, solidarity, combating social exclusion, sports, promoting access to the new information society, enhancing the historical and cultural heritage of Terceira Island, among many others.

EuphoriaNet

Euphoria Net Srl is an Italian company set-up in March 2019 with the main scope of providing services in the project management field, in terms of supporting organizations in carrying out and managing projects as well as providing training on this topic. Euphoria is specialized in the educational field and works in projects related to bringing innovation in such fields.

The three main areas of activities are the following:

[1] Project management: we follow all the aspects related to EU projects.
[2] Training courses: we organize training courses especially for schools of any grade, Universities and associations on the following topics: project management, digital competencies, entrepreneurship, boosting STEM at school, EU citizenship, personalized learning, soft skills and innovative methodologies.
[3] Organization of events and communication strategies: we organize dissemination strategies within projects, including the set-up of project branding, communication, mapping stakeholders, organizing, and coordinating events all over Europe.

Our headquarter is in Rome, but we travel all over Italy to deliver our training courses and to Europe to implement EU projects.

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BrainLog

BrainLog is a non-profit organization developing and managing national and international funded projects focusing on innovation and education within business development, web and mobile applications, entrepreneurship, innovation within sport and wellbeing, non-formal education, and social inclusion in Denmark.

Europäische Bildungsinitiative EBI/EIE

The "Europäische Bildungsinitiative" EBI - (in English European Initiative for Education EIE) - is an international Private Non-Profit Education and Training Association located in Wiener Neustadt /Austria. EBI's mission is to endorse an innovative approach to education, training, and culture. Target groups are schoolteachers, teachers, and trainers in general education as well, in adult education.

The three departments of the EBI are a teaching unit, a technical department, and a special research group. The offered training focuses on project management, Flipped Learning 3.0, eLearning, Technology Enhanced Learning (and Teaching, TEL), Distance Learning, Online Distance Learning, Blended Learning, and other related topics.

The EBI/EIE is the coordinator of this project and regularly involved in European Projects (Erasmus+).

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