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irresistible

Including Responsible Research and innovation in cutting Edge Science and Inquiry-based Science education to improve Teacher's Ability of Bridging Learning Environments

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1. Executive Summary

Each module developed in the IRRESISTIBLE project should integrate Web 2.0 technology, Apps or other ICT. The idea is to use these new technologies not only to support learning, but also to increase engagement, to use different media for presenting in exhibitions, and to connect formal and informal learning sites.

The Web2.0/App Guide (deliverable D4.1) as well as the workshop held in Kiel/Germany in March 2014 (deliverable D4.2) should enable the partners to include different tools into the modules.

The goal of deliverable D4.3 is to give an overview of the ICT tools used in the IBSE teaching modules, to discuss the challenges with integration, as well as to present options to improve the use of ICT tools in phase II of the IRRESISTIBLE project.

The delivery is comprised of three parts: In the first section, the approaches used to collect the data in the study are described, followed by a discussion and a final conclusion leading to three action items. The study is based on three different data sources:

(1) a first survey on ICT tools in the preliminary state of the modules as well as used for the development process within the CoL, February 2015

(2) data on the use of ICT tools from the analyses of the modules (D5.5 module evaluation) as well as data from the questionnaire that ran to identify strengths and weaknesses of the modules (self-perception of developers), both September 2015

(3) the collection of examples of how ICT tools are integrated in the IRRESISTIBLE modules ("best practice examples"[1]), October 2015

The findings from the different approaches suggest at least two main challenges when including ICT tools in IBSE teaching modules: the 'unfamiliarity' of teachers with ICT, as well as a feasible IT infrastructure at school. The 'unfamiliarity' of teachers is not only to be seen as the direct capability of using a tool, but to be understood in a broader context, e.g. including security and legal issues. A profound IT infrastructure at school is key to include tools during the whole learning process (and not only at singular events), e.g. by having computers in the classroom or offering Wireless LAN to enable students to use their own smartphones.

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[1] The best practice examples were included here in a preliminary version to use them for immediate improvement of the modules (as suggested by the reviewers). The final version will be discussed on the 2nd ICT workshop and then be incorporated in deliverable D4.4 "Guide on using Web 2.0, Apps and ICT tools in IBSE modules".

To render direct action possible within the IRRESISTIBLE project to improve the use of ICT tools in phase II, but also in addition to that use the chance to generally improve ICT use at school, three action items are proposed:

(1) An improved version of the Web2.0 / App Guide will be published, including not only more tools working with regular personal computers, but also a brief section on security and copyright issues relevant for teachers when using ICT tools (deliverable D4.4).

(2) Especially for teachers within the IRRESISTIBLE project, training sessions are suggested, either to be done in a workshop introducing several relevant tools and using them for 'example use cases' as done during the project's ICT workshop (explicit training), or the training could be done in an implicit way by using the tool(s) for the module development.

(3) Although IT infrastructure is not the scope of this project, two simple workarounds are suggested to ease the integration of ICT tools in the modules.

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2. MAIN PART

2.1 Survey on ICT Tools used in the Modules

2.1.1 Survey

This survey was performed in February 2015[2], i.e. offers an insight into the developmental state of the modules. The aim was to get a general overview of the tools used and the purpose they are included for in the teaching modules. This survey should foster the discourse on the integration of ICT tools during module development and the data should help those module developers that by now have only little or no tools incorporated to strengthen their framework.

The modules were finalized in summer 2015, so the final selection of tools is found in the module evaluation (see section 2.2 Analysis of the Modules and Accompanying Questionnaire).

The questionnaire developed to ask which tools were used in the modules contained three sections:

- Section one asks for general information as the country, the name of the person filling in, as well as the name of the module.
- Section two systematically questions the use of tools for different tasks, following the categories created in the Web2.0/App Guide[3].
    - Project organization
    - Searching for Knowledge
    - Measuring data
    - Processing data
    - Taking notes and working on data
    - Sharing and publishing results
    - In each category, the tools from the guide were listed, added with a field "other:".
- Section three asked, which tools were used during the CoL work, e.g. to work together and to share data.

The full questionnaire was set up as Google Form and is attached in Annex A.

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[2] Since most modules were not yet in a (pre)final state at the due date of the deliverable, the deadline for the questionnaire (and thus the deliverable) was postponed to February 2015.

[3] http://www.irresistible-project.eu/images/irr-mat/Web20_App_Guide_final_090314.pdf

2.1.2 Results

The questionnaire was answered online by all ten participating countries: Portugal, The Netherlands, Turkey, Romania, Poland, Germany, Israel, Finland, Italy, and Greece. In each country one member of the Community of Learners (CoL) answered the questionnaire.

The results are presented in the order of the categories listed in the Web2.0 / App Guide (questions 1-7). Question 8 reports the tools that were used by the CoL during their work phase (module development). The following item 9 gives an overview on the number of tools used from each category and in each country.

1. *Which tools for project organization do you use?*
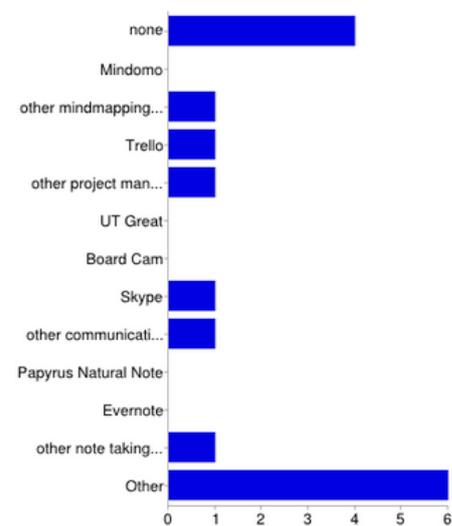
Other:
Edmodo (2x), Popplet, Redmine, Scopia, cmap

2. *Which tools for searching knowledge do you use?*
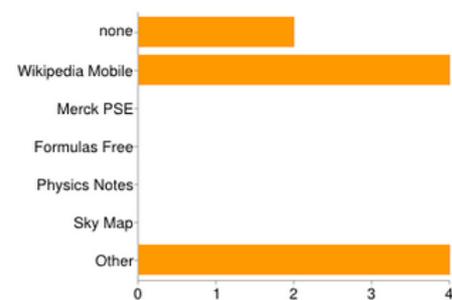
Other:
Google (2x), Scientific Journals, Wikipedia, „the internet"

3. Which tools do you use to measure data?
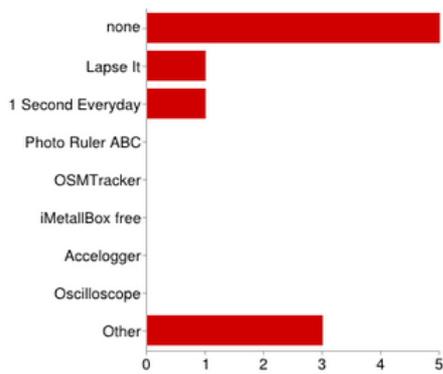
Other:
Voltmeter, iPad photographs or videos, video / audio recording of smartphone (various)

### 4. Which tools do you use for processing data?
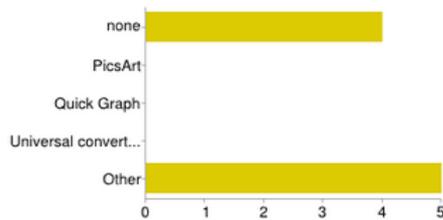
Other:
video analysis software (iMovie), Kahoot (for gaming), Prezi for presentation, Microsoft Excel, video cutting software (various)

5. Which tools do you use for taking notes and to work on the data?
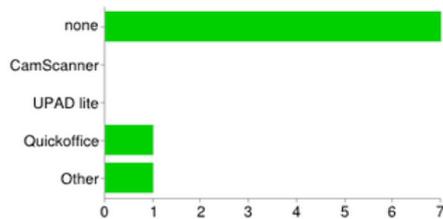

Other:
Google drive

6. Which tools do you use for sharing data? (collaborative work)
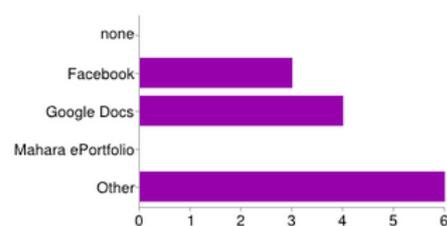
Other:
Novell, Prezi, Glogster, Edmodo (3x), Dropbox (2x)

7. Which tools do you use for publishing the results? (exhibition and other ways)
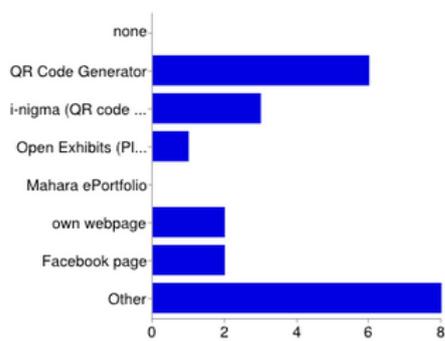

Other:
Powerpoint presentation, videos on iPads in the exhibition, Aurasma, Canva, local project site, wikispace, homepage of the schools, video player in exhibition (MX player), web quiz building app "Älypää" (roughly translates to Brainiac)

8. Which tools do you use within you CoL developing the modules? What do you use them for?

Almost all countries relied on cloud storage like Dropbox, Google Drive and OneDrive when developing the modules. Those two countries not using cloud storage were working with an E-learning platform (Moodle, Redmine), offering more or less the same functionality. Besides E-mail, the most common ways of digital communication were Facebook, videoconferences and messenger apps like WhatsApp.
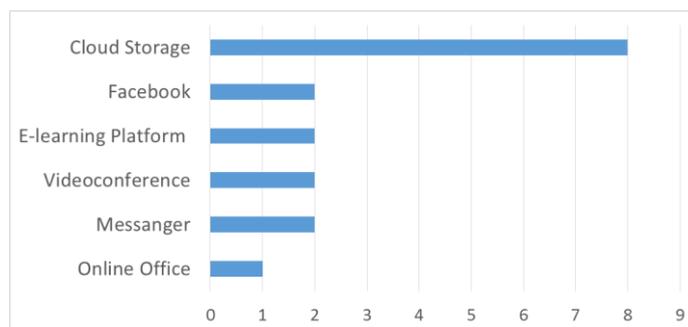
Use of ICT tools by the CoL members when developing the module.

9. Distribution of tools by category and county

Within the modules, ICT tools are most commonly used for publishing the results (e.g. presentations, exhibitions) and for sharing data and collaborative work (e.g. cloud storage, e-learning platforms). The amount of inclusion of ICT tools varies from country to country, reaching from 13 in Turkey and ten in Israel to five in Poland and Portugal and two in The Netherlands.
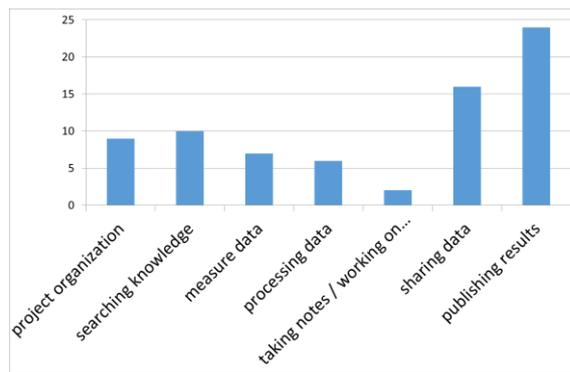
Number of ICT tools used from the different categories.
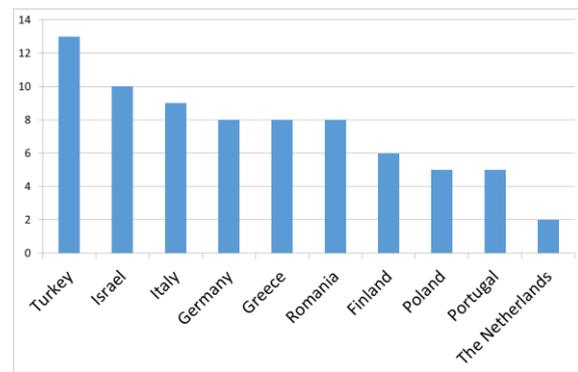
Number of ICT tools used within the modules of the respective countries.
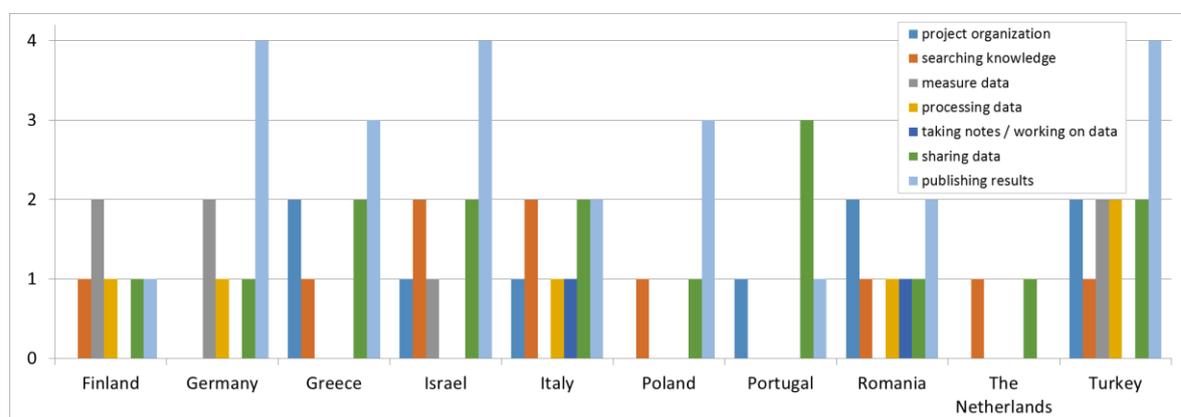
Number of tools used from each category per country.

2.1.3 Conclusions

The study shows, that all groups use Web2.0 / App and ICT tools in their preliminary versions of the modules. Most often such tools are used for sharing data and for publishing and presenting results. ICT is as well used to research information and access knowledge, but usually this is not done by special tools (e.g. apps like Wikipedia Mobile, Merck PSE, …), but more often in a 'classic' way using a web browser.

It is interesting to see, that most of the tools used in the modules are rather computer than smartphone based, indicating that the use of (student) smartphones in class is still not daily routine, even in special situations like these teaching modules. The reasons will be explored in the survey as part of the module evaluation (see section 2.2.2 Results from the Accompanying Questionnaire).

The number of tools used in the preliminary modules varies broadly, from 14 in the Turkish and ten in the Israeli module down to five in the Polish and Portuguese module and only two in Dutch module. This might be related to the general length of the module (the modules developed in Turkey and Israel belong to the longer modules in the set), but could also be influenced by other

factors as the topic itself or the ICT affinity of the developing CoL. The module evaluation (deliverable 4.5) as well as the discussion on the 2nd workshop will shed some light on these connections.

The work inside the CoL obviously followed the established way of today's digital cooperation, mostly using communication tools like Email, Facebook and WhatsApp, as well as Cloud-Storage for sharing data (Dropbox, Google Drive, OneDrive).

The next section of this deliverable will present the use of ICT tools in the final modules, as derived from the module evaluation and the accompanying questionnaire.

## 2.2 Analysis of the Final Modules and Accompanying Questionnaire

2.2.1 Content Analysis of the Modules, ICT Tools

Within the Framework paper for module evaluation (deliverable D5.2, July 2014), a set of criteria for the modules has been developed in order to provide the CoLs with guidelines for module development. These criteria are used as a checklist during module development in every CoL. In table 3 of the deliverable, the criteria for the modules are listed with the first point in section 3 "What platforms, ICT environments and materials does the module use/provide?" asking for the integration of ICT tools: "How does the module integrate Web 2.0 activities?"

The module evaluation for deliverable D5.5 was carried out as an external evaluation (in contrast to the self-evaluation proposed in the framework) in September and October 2015. Regarding the question of the use of ICT tools in the modules, a total of 54 tools was found in the 15 final modules that were analyzed.

For the evaluation only those tools were counted that definitely were named and applied in the module. It might happen that teachers used more or different tools during the evaluation phase of the module (i.e. counts and tools appearing in the questionnaire of Feb. 2015), that were either not included at all or not directly mentioned in the module description. One example is *web search*: All modules rely on content researched and explored by the students, wich is usually done (at least in parts) in the internet. If in the module the process is stated as "use the web to research question xy", this would count as "searching of knowledge". If the task in the modul is called "research an answer to this question at home" this would not count as *web search* (aka "searching of knowledge") in the module evaluation, although to 95% the students might work on this task using the www and thus ICT tools. This explains why "searching of knowledge" with an ICT tool is not present in all 15 modules.

The following diagram shows a list of tools used in the various modules.
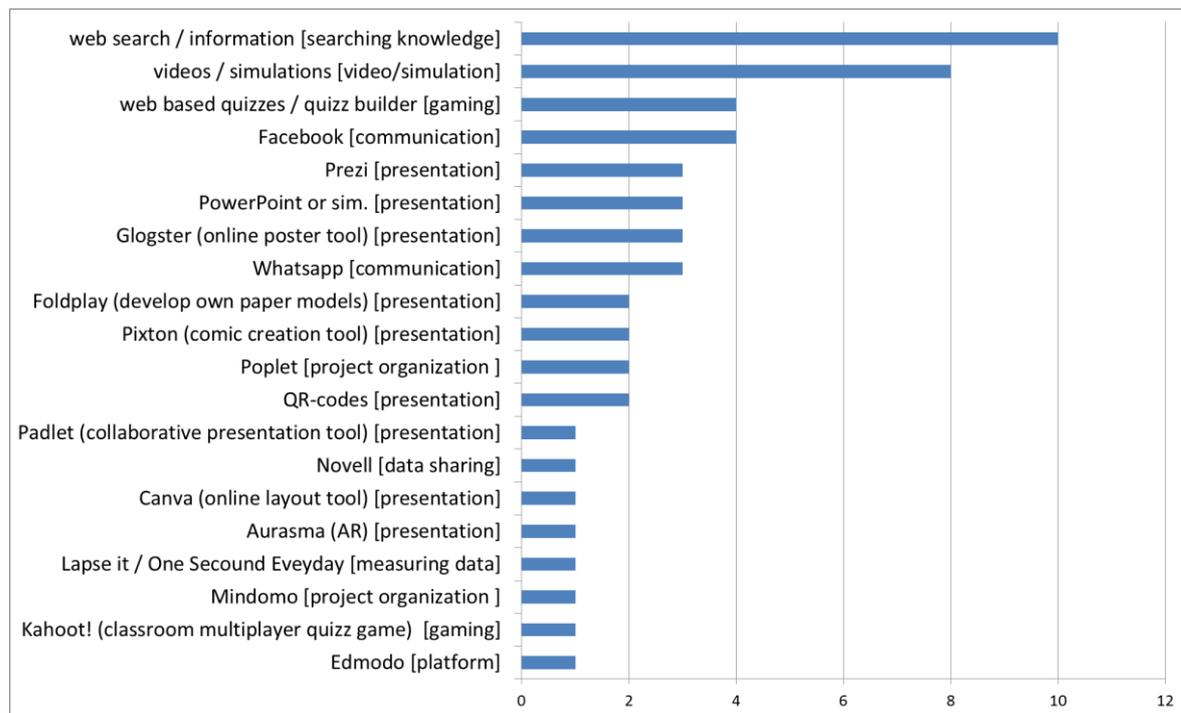
ICT tools used in the teaching modules (count over all 15 final modules analyzed)

To analyze how these tools were used in the modules, they were assigned again to the categories developed for the Web2.0 / App Guide and used in the February 2015-survey. The trend that only tools from some categories are used in the modules (which was already visible in the February survey) was even more intensified, with no tool explicitly named for data processing and taking notes/working on data. The trend to use tools for presenting the outcomes even increased, with now more than half of the tools used being in this category. This might be due to two trends: on the one hand, using a standard tool like Excel might be so common that it is not explicitly mentioned in the module description. On the other hand, several tools that are used for presentation are at the same time collaborative tools to develop the content (e.g. Padlet, Glogster, Pixton) so probably would have to be counted in other categories as well.
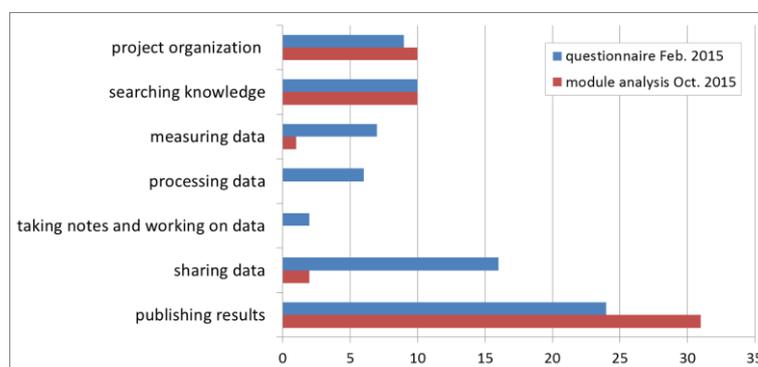
Tools by category (category system from the Web2.0 / App Guide), comparing data from questionnaire (preliminary modules) with data from the module content analysis (final modules)

To get a more detailed view of the application of the tools, the category presentation and project organization were split into sub-categories: The category presentation was divided into the sub-categories presentation (tools like PowerPoint, Prezi), videos and simulations, and gaming; the category project organization was split into the sub-categories communication (tools like Whatsapp, Facebook) and project organization (tools like Mindomo, Popplet).
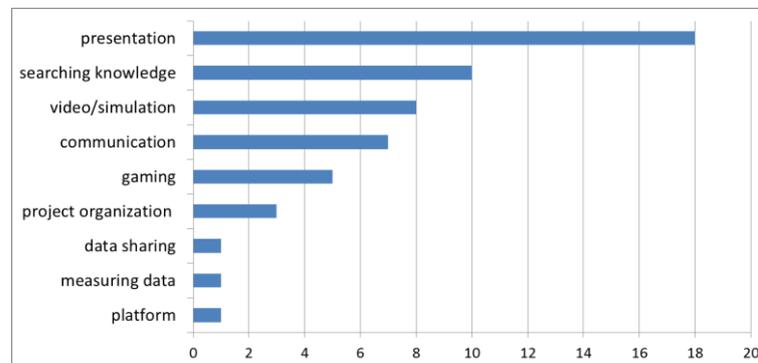
Tools by category (new category system)

Looking on the use of ICT tools in the individual teaching modules, several use patterns are obvious: Modules utilizing only a few tools usually rely on tools for researching information in the web and on videos – a very typical case in classic teaching modules. If these are enriched, this is often done by adding presentation tools like PowerPoint or Prezi. Modules using many ICT tools often show an increase in presentation tools, using several different tools of this category. On the one hand this might be an indicator for a rich and diverse student-curated exhibition project including several representations originating from different tools, on the other hand might again be an indicator that these tools are used for collaborative development processes as indicated above.

The following figure shows the ICT tools (grouped in categories) used in the individual teaching modules. For example, the module "Geoengineering" developed by the Portuguese CoL applies eight ICT tools:

- one tool for project organization (Popplet)
- one tool for searching of knowledge (web search)
- five tools for presentation (Glogster, Prezi, Pixton, Padlet, Foldplay)
- as well as videos to present content in the exhibition

In general, many tools are multi-purpose and sometimes used for different tasks. For instance, Padlet is a tool to collaboratively develop "a wall": this can be used to collect content, to sort and organize it, and in the end to present it virtually or in an exhibition.
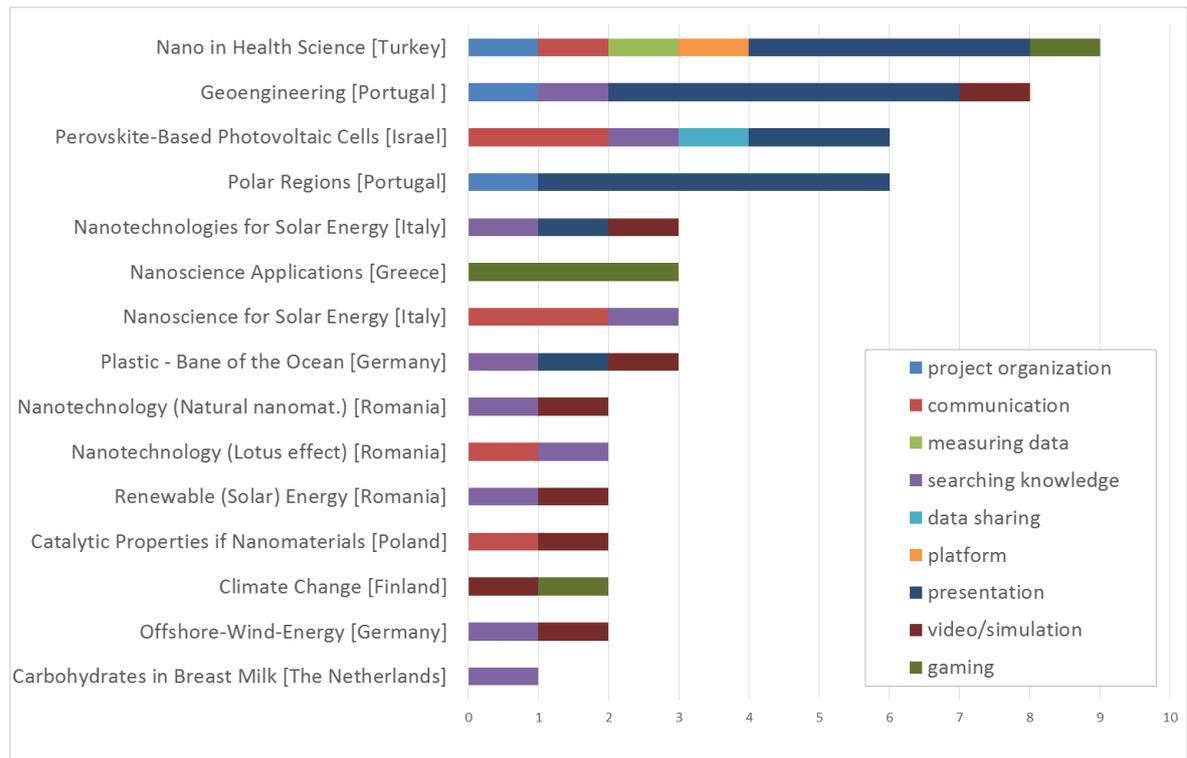
ICT tools (grouped by category) used in the individual teaching modules.

2.2.2 Results from the Accompanying Questionnaire

Along with the module evaluation, a questionnaire was run to identify strengths and weaknesses of the different modules, asking the CoL that developed the module for their self-perception and points to improve when adapting the module to other countries in round II. The survey ran in September 2015 and answers from 10 CoLs in nine countries (Italy 2 CoLs, Romania missing) were collected.

Within this survey, one additional question targeted the moderate use of ICT tools in the modules, asking for reasons as experienced by the CoL.

Question: *Not all modules do really include Web2.0 and Apps, often they are implemented as an add-on. In your eyes, what are the reasons for the hesitant implementation of these technologies?*

The answer format was a free text field, the answers were categorized into 11 categories shown in the following figure.
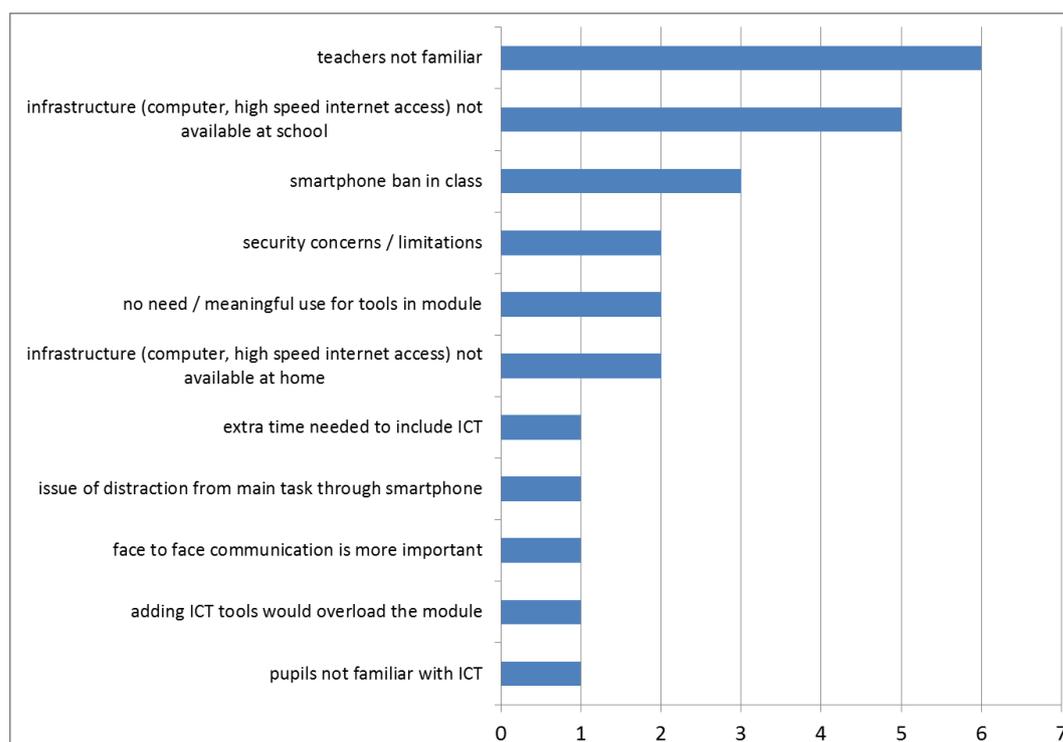
Reasons that impede the implementation of ICT tools in the teaching modules, answers from 10 CoLs in nine countries.

By far the most often mentioned issue (60%) is that teachers are not familiar with ICT tools. In half of the countries, a firm hardware infrastructure is not available at schools thus hindering the general use of the tools in the modules. Security concerns of the teachers as well as a general student smartphone ban in class are relevant issues as well – the latter in combination with a less decent infrastructure at students homes (e.g. not a majority of students owning a smartphone)

might be an indicator for the broad use of computer-based ICT tools in the module (as in contrast to the smartphone-oriented Web2.0 / App Guide).

2.2.3 Conclusions

In general this module evaluation reveals the broad range of implementation of different ICT tools in the teaching modules. The range is from very classic modules that typically make use of web search, videos and sometimes presentation tools like Prezi and PowerPoint, to highly ICT enriched modules that characteristically employ tools from several different categories, with most of these modules having an emphases on a variety of presentation tools.

The amount of ICT tool integration in the modules is influenced by several factors, sketched in the following:

- How much ICT load can be put on the teacher when carrying out the module? 60% of the CoLs noted that teachers are not familiar enough with ICT. In addition, the security concerns and the general smartphone bans at school identified by the survey might be related to this as well.

- Is there a decent infrastructure to make use of ICT without putting too much time into making it work? In half of the countries, a firm hardware infrastructure is not available at schools.

- Is there a meaningful use case for ICT in the module? This strongly depends on the topic and the teaching approach.

- Is there room for adding more components (in this case ICT tools) to the module without overburdening teachers and students? Within the IRRESISTIBLE project IBSE, RRI, formal-informal venues as well as student curated exhibitions are courting the limited time frame.

- How high is the general ICT affinity of the CoL developing the module? A nice example are the Portuguese modules: although stating severe infrastructure problems at many schools the modules are among those with the highest ICT tool count.

The next section of this deliverable will present several best practice examples of ICT tools used within the context of the IBSE modules.

2.3 Collection of Best Practice Examples

2.3.1 The Survey of Best Practice Examples

In the original project proposal the collection of best practice examples was scheduled in deliverable D4.4, to be collected after a workshop held to exchange the experience with different ways of implementing ICT tools in the teaching modules. As a result of the midterm review meeting, it was decided to collect the best practice examples as soon as possible to give the developers in project phase II the opportunity to improve the use of ICT tools in the modules by gathering inspiration from the examples.

The examples were collected in October 2015 with a standardized information sheet to be filled in by one of the CoL members from each country. The sheet was structured in four sections requesting different information (full sheet attached in Annex B):

- General Information: asking for module name, class of example

- ICT Tool and Use: requesting the name of the tool, hardware, phase in the module, use case, way of integration …

- Teacher Experience: level of the ICT experience of the teacher using the tool in class

- Documentation: asking for example data, screenshots …

The survey was answered by six partners from five countries, describing eight examples of best practice ICT use. Four countries stated that they wouldn't consider their use of ICT in the modules as "best practice" but rather as standard use case and thus didn't answer the survey. The full answers are attached in Annex C.

The examples and the judgement of being "best practice" are based on the self-assessment of the individual partner providing the example. For this study, no examples were excluded (e.g. because of inferior quality), the order of presentation is no ranking but in alphabetical order of the countries.

The following section gives a brief overview on the best practice examples. The following deliverable D4.4 "Guide on using Web 2.0, Apps and ICT tools in IBSE modules" will include these examples in an improved version (e.g. including a better documentation for readers not familiar to the structure of the IRRESISTIBLE teaching modules).

2.3.2 Results of the Survey

The following best practice examples were briefly analyzed - mainly with focus on the potential to improve the use of ICT tools in the teaching modules in phase II of the project:

1. Finland: *Apple iMovie* to make videos about climate change for show at museum

2. Greece (1): *Edmodo* as online platform for teacher and student collaboration

3. Greece (2): *Skype* to conduct teleconferences with experts far away from the school's region

4. Greece (3): *Scratch* online application used to develop a digital game

5. Greece (4): *Glogster* and *Scratch* for the design of four interactive digital posters

6. Israel: Tools for collecting data and knowledge to be presented in the exhibition

7. Portugal: *Popplet* as tool for building concept maps

8. Turkey: *Edmodo* is a simple platform for teacher and students to share ideas, announcements and materials, as well as communication base

From the module evaluation questionnaire survey (see section 2.2.2 "Results from the Accompanying Questionnaire" in this deliverable) it is known, that the main issues hindering the use of ICT tools in the modules are teachers' unfamiliarity with ICT tools (60%), as well as an insufficient IT infrastructure at schools (50%). Having this in mind, the best practice examples were primarily analyzed looking on these factors and how the developers coped with it. The following table lists the best practice examples, indicating the country that developed the module, the ICT tool used, the main purpose why it was included in the module, as well as the technical infrastructure the tool was used on and teachers experience with ICT.

Country	ICT Tool	Main use case in the teaching module	Technical system the ICT tool was used on	Teacher Experience with the specific tool / in general
Finland	**iMovie**	Tool for producing videos for exhibition as well as for reflection	School/University iPads	Teachers are fluent users of iPads
Greece (1)	**Edmodo**	Teachers: share content, distribute quizzes, assignments, and manage communication; students: collaborate, communicate and share content	Computers at home	Teacher used it before in other teaching occasions, using it was a suggestion of the teacher

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Country	ICT Tool	Main use case in the teaching module	Technical system the ICT tool was used on	Teacher Experience with the specific tool / in general
Greece (2)	**Skype**	To conduct teleconferences with experts far away from the school's region	Computers in classroom	Teachers had used Skype before but not in class for educational purpose
Greece (3)	**Scratch**	Development of a digital game which was the main part of the exhibition	Computers at Technology Laboratory of the Eugenides Foundation (EF)	Teacher had no experience in using Scratch, but students got support from EF-Technology Laboratory staff as well as museum ICT expert
Greece (4)	**Glogster and Scratch**	Glogster and Scratch were used for the design of four digital posters for the exhibition, additional PowerPoint slides act as an interface for the exhibit guiding to the posters	Computers in classroom and at home	Teacher was familiar with these tools and had used them in teaching before
Israel	**audio and video recording**	Tool for collecting data and knowledge needed to be presented at the exhibition, presentation in student exhibits	computers / students' laptops in classroom, digital recorder / camera	The teacher of this class is familiar with most of the ICT, believes that ICT improves student's learning
Portugal	**Popplet**	Building a concept map that highlights the main characteristics of the topic	students computer at home OR computer-room at school	Teacher has used Popplet before, some experience in using ICT tools, but outside of classroom
Turkey	**Edmodo**	Platform to post students reflections and to share ideas about the exhibit	Personal computers, tablets and smart phones	For this teacher it was the first time using Edmodo in class, but had practiced before using it as a CoL member

2.3.3 Conclusion

The collection of best practice examples clearly indicates that regular personal computers – either at school or at home – are the main tool when working with ICT in the modules. Only two examples include the use of tablet computers or smartphones, with the Finnish example building solely on tablet computers – for the production of videos as well as the reflection process. The Turkish example uses tablets and smartphones to complement personal computers when using the Edmodo platform. An interesting example is the use case described in the example Greece (3), where the development process of a digital game using the tool Scratch is done in the Technology Laboratory of the Eugenides Foundation, utilizing their computers and personal support of Lab staff for the students.

In terms of teacher experience it is clearly seen that teachers using ICT tools in a skillful way (thus resembling a best practice example) usually are ICT experienced teachers, either in terms of the specific tool used or on a more general basis. The Greece (3) example already mentioned above is here an exception, were the ICT tool skills are transferred to the Technology Laboratory staff. An interesting example – that might work as role model for the improvement in phase II – is the example from the Turkish module: The teacher had no experience in using the e-learning platform Edmodo before starting with the IRRESISTIBLE project, but the Turkish CoL used the platform as interactive tool for developing the module thus trained their teachers within the process with a real use case.

3 DISCUSSION

The first study performed in February 2015 within the module development phase revealed that there are many different ideas present to include ICT tools into the modules. Next to the tools presented in the Web2.0 / App Guide and during the workshop a multitude of similar as well as new tools was mentioned to be under investigation for module inclusion. A clear focus to use ICT tools for specific tasks in the module could be explored, namely *project organization*, *searching for knowledge*, and *presentation of results*. Another tendency observed was the use of more personal computer based solutions in contrast to the more smartphone oriented tools presented in the Web2.0 / App Guide. Both trends indicate that the use of (student) smartphones seems not yet being everyday life in many schools, thus hindering some use cases aimed at, e.g. measuring data on a field trip with smartphones and favoring tasks like *project organization* and *presentation of results* usually carried out with personal computers.

Within the final modules, not only the total number and variety of tools decreased, but the trend to use ICT tools in the three main areas *project organization*, *searching for knowledge*, and *presentation of results* even increased, as documented in the module evaluation. This discrepancy might be due to the partners giving different tools a try during module development but removed it from the final version. Why?

The survey that was performed parallel to the module evaluation sheds some light on the difficulties of using ICT tools in the modules and thus gives at least some indications for the process: "Teachers are not familiar with ICT tools" was the most often mentioned obstacle to include ICT in the modules (named by 60% of the respondents). So it might be the case, that teachers in the CoL developing the module feared a decreased acceptance of their module with their co-teachers when having too many ICT tools included. Difficulties with technical infrastructure are the second most common named issue for ICT integration. Many of the tools need a decent internet connection for working properly which seems to be problematic in many schools. Using stationary personal computers in a computer room or in the classroom is 'common use', whereas using student smartphones with a Wireless LAN connection at school is definitely not 'common use'. These infrastructure hurdles as well seem to be a valid reason to reduce the number of tools used in the modules. Two other reasons hindering the use of ICT are general smartphone bans at school as well as security concerns. Both are quick (and effective) solutions to block a problem, that might be solved in a much better way empowering teachers with the necessary background and giving them time in class to address these problems: banning smartphones is the quick solution to reduce distraction – engaging the students to make use of the technology they have in their hand but train them to use it in a decent way and prioritize tasks would be much more helpful for their future perspective. Security concerns are a broad field of challenges, from copyright issues to secure data storage in cloud space. Again, not using tools like student developed (public) webpages and cloud space is the simple solution – making students respect copyright and find ways to work with open content or to discuss security issues when saving data on cloud space and finding solutions to encrypt these data prepares students for their future. But this calls for teachers being highly qualified in using ICT, staying up-to-date during their teaching life, as well as some extra time in the lessons to address and discuss these challenges.

Following this it is not surprising, that all except one teacher being responsible for the implementation of the eight best practice examples collected within the survey in October are skilled ICT users. The one exception is a teacher that was trained using the tool during the module development, highlighting this proper way to engage teachers.

The best practice examples reveal different approaches to using tools in the modules. But again these are examples that – looking at the broad range presented in the Web2.0 / App Guide – need to be considered as more "classical" tools (except probably for the tool Scratch). Nevertheless, the seamless integration into the module is key to a successful overall experience for the students.

Last but not least, several partners mentioned that there's no need or no meaningful use for ICT tools in their modules. Others stated (not only in the questionnaire above, but also in many discussions during phase I of the project) that the modules were so heavily loaded with content requirements (as from the proposal: Responsible Research and Innovation, Inquiry based science education / 6E-Model, connection of formal and informal venues, student curated exhibitions and the use of ICT tools), that one had to make concessions once in a while to create a module that was teachable at school.

4. CONCLUSIONS

The different studies presented above reveal, that all modules make use of Web2.0 / App and ICT tools, but to a very different extent. The spectrum ranges from using only one tool in the module to including 15 different tools. Most often these tools are used for *project organization*, *searching for knowledge*, and *presentation of results.* Building on existing infrastructure at schools, tools using a standard personal computer are far more common than smartphone or tablet based tools.

Considering the whole evaluation of the use of ICT tools in the modules presented above, there are clearly two important points that should be addressed in the future – in phase II of the IRRESITIBLE project, as well as in future projects and teaching that includes ICT tools in general:

1) Make teachers become familiar with ICT tools

The most often named reason that hinders a better implementation of ICT tools in the modules is the unfamiliarity of teachers with ICT. So the idea of this and future projects must be to empower teachers in using various tools on different IT platforms, but also to gain a better understanding of security and legal issues.

For raising awareness to use ICT in teaching, the Web2.0 / App Guide seems a good starter: When presenting the guide to teachers in different occasions like teacher trainings and information days, most of them are highly interested – remarkably not only younger teachers, but more or less all age groups. But it seems that the integration in regular school teaching is hard, with at least some of the reasons being discussed above.

As pointed out in the discussion section, an increased knowledge of teachers on security and copyright issues might not only resolve some security concerns of teachers, but also might work against the problem of a general 'smartphone ban' at schools that keeps students away from using a key tool of their own future.

2) A sound infrastructure is key for success in using ICT tools

The studies above give several hints that a weak IT infrastructure at many schools in the participating countries is problematic when using ICT tools: Directly brought up by 50% of the CoLs in the project within the questionnaire accompanying the module evaluation, indirectly visible by the choice of tools and their integration into the modules.

For a seamless integration of ICT tools in the module, a (more or less) permanent access to the tools is necessary. If teachers – as it is common practice in many countries today – have to move with their class to a separate computer room (which probably is not even available for all the lessons) it is hard to realize a continuous, ICT accompanied project flow. This is much easier put into practice by either using computers in the classroom, or students own smartphones – with the latter giving the chance to propagate the project over the boundaries of classroom and school.

But both, especially the approach using students' smartphone require a more comprehensive IT infrastructure as it is everyday life in schools today.

Action

To further empower teachers in using ICT, one action will be an improved version of the Web2.0 / App Guide, including not only more tools working with regular personal computers (thus easier being used in standard school settings), but also to include a brief section on security and copyright issues relevant for teachers when using ICT tools (since the legal situation varies from country to country, this only can be a kind of general overview).

Another approach to empower teachers could be training sessions for the teachers, e.g. when adapting the IRRESISTIBLE modules for phase II. The training could either be done in a separate workshop introducing several tools and using them for 'example use cases' as done during the project's ICT workshop (explicit training), or the training could be done in an implicit way by using the tool(s) for the module development (as presented in the Turkish best practice example).

Although not in the scope of this project, a general improvement of IT infrastructure at school (esp. Wireless LAN and high-speed internet access) is needed to create a foundation for using ICT tools. Currently using personal computers at school or at home seems the common way, but soon this will be replaced by student smartphones. As intermediate approach, it might be an option to install a temporary WLAN access point (cost < 100 EUR) in the class that works on the module allowing the use of students' smartphones. Another promising approach is the one presented in the Greek module, using the ICT infrastructure and support of a third party like a science center or student lab.

These action items hopefully offer a foundation to further empower the teachers within the IRRESISTIBLE project and beyond to use ICT tools in class in a skillful and agile way.

5. ANNEX

Annex A: Questionnaire Web2.0/App-Tools

Questionnaire: Using Web2.0 / App - Tools in the module

Dear all, this very short questionnaire is for Deliverable 4.3. Each Module in the IRRESISTIBLE project shoud make use of Web2.0 / App / ... - Tools. So here we ask you which tools you use with your students in your module. In the structure we follow the six categories of the Web2.0 / App - Guide. At the end, we have one question about the tools you use in your CoL work.
Thanks for the time to answer the questions! Lorenz

* Required

What is your Name? *

What is your country? *

What is the title of your module?
(working title is good enough)

Which tools for project organization do you use?

☐ none
☐ Mindomo
☐ other mindmapping tools (which? please note below)
☐ Trello
☐ other project management tools (which? please note below)
☐ UT Great
☐ Board Cam
☐ Skype
☐ other communication tools (which? please note below)
☐ Papyrus Natural Note
☐ Evernote
☐ other note taking tools (which? please note below)
☐ Other: _____

Which tools for searching knowledge do you use?

☐ none
☐ Wikipedia Mobile
☐ Merck PSE
☐ Formulas Free
☐ Physics Notes
☐ Sky Map
☐ Other: _____

Which tools do you use to measure data?

☐ none
☐ Lapse It
☐ 1 Second Everyday
☐ Photo Ruler ABC
☐ OSMTracker
☐ iMetallBox free
☐ Accelogger
☐ Oscilloscope
☐ Other: [_____]

Which tools do you use for processing data?

☐ none
☐ PicsArt
☐ Quick Graph
☐ Universal converter free
☐ Other: [_____]

Which tools do you use for taking notes and to work on the data?

☐ none
☐ CamScanner
☐ UPAD lite
☐ Quickoffice
☐ Other: [_____]

Which tools do you use for sharing data? (collaborative work)

☐ none
☐ Facebook
☐ Google Docs
☐ Mahara ePortfolio
☐ Other: [_____]

Which tools do you use for publishing the results? (exhibition and other ways)

☐ none
☐ QR Code Generator
☐ i-nigma (QR code reader)
☐ Open Exhibits (Player/SDK)
☐ Mahara ePortfolio
☐ own webpage
☐ Facebook page
☐ Other: [_____]

Which tools do you use within you CoL developing the modules? What do you use them for?
(e.g. Dropbox for sharing work in progress, Trello for keeping track of the project, ...)

Submit

Never submit passwords through Google Forms.

100%: You made it.

Annex B: Questionnaire Best Practice Examples

Best Practice Examples of using Web2.0/App/ICT Tools

The idea for this collection of best practice examples is to give teachers an idea, how they could easily include ICT tools in class. So this will be a collection of 'short profiles' of different tools that could be adapted in a simple way. It should support our teachers in IRRESISTIBLE phase II, as well as be published on the website to be available (and probably inspire) other teachers around Europe.

Thanks for your support!
Lorenz

General Information
Module:

Class of example (grade, student age, number of students):

ICT tool and use
Name of the Tool (usually one tool, if combining several very closely, name more then one):

Hardware the tool is used on in this example (computer-room at school, computers/laptops in classroom, students computer at home, students own smartphones, … – several options possible):

Phase in the module the tool is used (6E phases, probably more than one):

What is the tool used for (short description, +/- one sentence):

Describe how the tool is used and how it is integrated in the module (1/2 page):

What are the main reasons why this tool works so well here? (2-3 arguments)

Teacher experience
Has the teacher used the ICT tool before, or was it first time in the module?

In general, how experienced is the teacher with using ICT tools in class?

Recommendations for other teachers for using this tool?

Documentation
Can you please provide a few screenshots of the tool, ideally with real data? (I will clean personal information before publishing)

Annex C: Full Answers to the Survey "Best Practice Examples of ICT tools"

1. Finland: Apple iMovie to make videos about climate change for show at museum

by Anna-Leena Kähkönen

General Information

Module: Finland / Adaptation to Climate Change

Class of example: Grade 6 (12 year old), 21 pupils (Antti Pyrhönen's class)

ICT tool and use

Name of the Tool: Apple iMovie

Hardware the tool is used on in this example: Apple iPads

Phase in the module the tool is used: Explore, Explain, Elaborate, Exchange, Evaluate

What is the tool used for: Editing videos shot with an iPad or otherwise. The tool can be used to clip and paste video, add music and effects, or edit colors etc.

Describe how the tool is used and how it is integrated in the module:

Pupils made videos about climate change for show at museum. This class decided to make a newscast report about the climate in 2050 as the whole class, and they acted the roles of reporters and designed short animations for the news videos.

- Beginning of video project (30 min)
    - Pupils are divided by the teacher into smaller groups
    - In small groups, they think of topics they would like to know more of and that they could make a video of
    - The class shares results of the brainstorm
    - Class decides on which topics are made into video presentations, and discusses if the videos will be made in a similar way (newscast, clay animation, PowerPoint presentation …) and what is the role of each group (does each group make one video, or do they have different tasks for preparation of the same video)
    - Younger pupils may require more directions or a checklist of things to do in group; older pupils can make a checklist as the first task of the group
    - The beginning of work, searching for information, seeking guidance from teacher
- Self-directed phase of video project (2 x 45 min)
    - Groups work on their own

The videos are put on display at the exhibit at museum. The pupils view them as part of the exhibit.

- During museum visit: Making a video on iPads or similar devices:
    - Answer in the video as a group: what did we learn today? Use the exhibition in your video. (15 min)

- After museum visit: What did we learn? (15 min)
    - Pupils watch the learning videos made by everyone.

       o   Pupils collect a list of "things" the class has learned during the project.

What are the main reasons why this tool works so well here?

1. Easy to make an exhibit without physical restraints; it can be shown online or as a part of a physical exhibit

2. Video editing is motivating and easy for pupils, they are more familiar with video making than e.g. posters

3. Multiple uses: documenting what students want to present to others, but also what they learnt during museum visit (by making the reflective video about "what we learnt today"), and returning to the videos afterwards in class

Teacher experience

Has the teacher used the ICT tool before, or was it first time in the module?

Student teachers had used iMovie before and were also fluent users of iPads in teaching. The teacher of the class was also already familiar with use of iPad movie editing, particularly for sports lessons.

In general, how experienced is the teacher with using ICT tools in class?

These student teachers had lots of experience of using iPads, but not necessarily other PC-based tools such as simulations etc.

Recommendations for other teachers for using this tool?

1. Trust the pupils to work as peer support to each other; some are bound to be very skilled movie editors and can help novices.

2. Time spent in video production depends much on how structured the instructions are; we have had pupils working self-directed, and they spend about 2 hours – if there are also lessons about storyboards or directing, or other learning about videos as art form, much more time could be spent on it.

3. The class should observe the principles of copyright when they make their movie; if they film each other or puppets that they make, there is little problem, but if the pupils use images, music, or animations found online, they need to find out if they are free to use, and credit the authors.

Documentation

Video tutorial for using iMovie on iPads or iPhones (iMovie for Beginners by Eric Timmer): https://www.youtube.com/watch?v=OuNdGKnxrEY

2. Greece (1): Edmodo as online platform for teacher and student collaboration

by Dimitris Stavrou

General Information

Module: Nanoscience and Nanotechnology applications

Class of example: 8th grade of the Experimental High School of University of Crete.

The class consisted of 16 students (9 boys and 7 girls) with a mean age of 14 years

ICT tool and use

Name of the Tool: Edmodo

Hardware the tool is used on in this example: Students' & teacher's computers at home

Phase in the module the tool is used: In all the 6E phases (as it was used by the teacher to assign tasks from one lesson to the next) but mostly in the Exchange phase when students had to collaborate extracurricular hours to design their exhibits.

What is the tool used for: The Edmodo is an online platform that enables:

- teachers to share content, distribute quizzes, assignments, and manage communication with their students.
- students to collaborate from distance, communicate and share content with each other and their teacher.

Describe how the tool is used and how it is integrated in the module:

Edmodo is a tool with multiple functions and the teacher used almost all of them.

At the beginning of the module Edmodo was used by the teacher as a means of sharing with her students extra content (as for example impressive videos of nanomaterials, short articles about various topics etc) to attract their interest and engage them in the module.

In the course of time she used the platform to assign them short tasks for their next lesson e.g. to read an article or to prepare some questions they would like to ask a scientist (before their visit at the research center).

Edmodo was a useful tool to send announcements to the students and to organize their following meetings but also to remind changes made to the program or the visits they would make in out-of- school settings.

But its indispensability became clear during the exhibits development phase. At that phase, students were divided in 3 groups of 5-6 members and had to collaborate and to exchange ideas till their exhibit to take shape. Students had to meet during the afternoons but their programs were already loaded. So Edmodo enabled them to communicate and to share their suggestions asynchronously (not in the same time), while working independently on their tasks. The teacher had the opportunity to follow their progress, to have the overall supervision and to intervene whenever students faced a dead end or when she wanted to give them a hint to a certain direction.

What are the main reasons why this tool works so well here?

At first, Edmodo is a tool easy to use, both for teachers and students, as it has a Facebook-like interface that resembles the social media networks. It enables the user to send personal messages, to others to join in groups etc.

So it was really helpful in the exhibit development phase, as students created different groups according to the exhibit they were tasked to construct, worked independently, shared their ideas and then collaborated when trying to compose their exhibit.

Teacher experience

Has the teacher used the ICT tool before, or was it first time in the module?

Yes, she had used it before in other teaching occasions. Actually, the use of Edmodo was her suggestion.

In general, how experienced is the teacher with using ICT tools in class?

We could say that she makes moderate use of ICT tools. She uses Interactive Whiteboard, Edmodo and during the teaching of the module her students conducted several teleconferences with experts from the science museum.

Recommendations for other teachers for using this tool?

Edmodo is a handy, user-friendly platform that doesn't have many prerequisites for using it. If your students possess computers at their home, it is a fun way to communicate with them, and in the same time to follow their progress.

3. Greece (2): Skype to conduct teleconferences with experts far away from the school's region

by Dimitris Stavrou

General Information

Module: Nanoscience and Nanotechnology applications
Class of example: 8th grade of the Experimental High School of University of Crete. The class consisted of 16 students (9 boys and 7 girls) with a mean age of 14 years old. 10th grade of the 2nd Experimental Lyceum of Athens. The class consisted of 17 students with a mean age of 16 years old

ICT tool and use

Name of the Tool: Skype

Hardware the tool is used on in this example: Computer in classroom

Phase in the module the tool is used: During the Engagement, Elaborate & Exchange phase (when communication with experts was needed)

What is the tool used for: We used Skype to conduct teleconferences with experts (science centers or science museums) far away from the school's region

Describe how the tool is used and how it is integrated in the module:

We used Skype to conduct teleconferences in several occasions. In our module one of the main objectives was students to come in direct contact and to discuss with the experts that contributed in the module development: the researchers from the FORTH (in Crete) and museum experts from EF (in Athens). As a result students whose schools were far away from the aforementioned institutions had to overcome the obstacle of the distance. Skype helped us eliminate the distance, enabling the conduction of tele-meetings with the experts.

So at the engagement phase, when (according to our module) students should visit the Interactive Exhibition of Science and Technology of EF in Athens and be toured around the exhibits, students of Rethymnon made a Skype connection with the expert there, who – holding his tablet – was guiding them through the various exhibits discussing their designing advantages and disadvantages. Likewise, at the exhibits development phase, the museum expert instead of visiting in person their class to advise them about the exhibits they had started developing (as he did with the schools of Athens), he was shown the exhibits via Skype in a particular tele-meeting and gave his advice from distance.

Respectively, at the elaboration phase, when students were supposed to discuss in person with the FORTH scientists in Crete about the nanotechnology applications they develop and RRI issues involved, students from Athens had the opportunity to pose them questions and talk to them via Skype.

In this way every student, no matter where his/her school was, had the same stimuli and the same experiences as the others.

What are the main reasons why this tool works so well here?

Firstly, students were excited for conducting a teleconference especially with experts from the science center and the science museum, as it was their first time, and somehow they felt like this procedure was adding prestige in their effort.

Secondly, as we said before, as our CoL and the institutions that were collaborating in developing the module were located in 3 different cities (Athens, Heraklio, Rethymno) if students limited their visits to the sites which they could have only physical presence at, they certainly would have missed important experiences, that were indispensable to fulfill the module.

Teacher experience

Has the teacher used the ICT tool before, or was it first time in the module?
Almost all teachers of the first CoL conducted Skype tele-meetings, to communicate either with the FORTH or the EF. But focusing on the teachers of the 2 schools we took as example, they both had used Skype before but not in the class for educational purpose.

In general, how experienced is the teacher with using ICT tools in class?
They make moderate use of ICT tools.

Recommendations for other teachers for using this tool?
Skype is a useful tool that enables the minimization of all distances. We would recommend it if for some reason you cannot reassure students' physical presence in a certain place, as it is really easy to use.

4. Greece (3): Scratch online application used to develop a digital game

by Christina Troumpetari

General Information

Module: Nanoscience and Nanotechnology applications

Class of example: Upper secondary education, age 16-17, two (female) students.

ICT tool and use

Name of the Tool:

Scratch online application (incorporated in PowerPoint presentation) was used for the development of the digital game entitled "From the Nanotechnology to the Prodigy". Scratch is a programming language and an online community where children can program and share interactive media such as stories, games, and animation with people from all over the world. As children create with Scratch, they learn to think creatively, work collaboratively, and reason systematically.

Hardware the tool is used on in this example:

The scratch application was developed at the Technology Laboratory (Utech Lab) of the Eugenides Foundation (P14) with the participation of the two students and the experts of the Lab such as graphic designers and ICT expert. Tools for processing photos were used at the stage of the development. For the display of the exhibit at the museum, a Laptop was used in which the game was loaded as well as a touch screen as an interactive display device in order to engage the visitor in a more interactive and appealing experience.

Phase in the module the tool is used:

The main use of the tool takes place in the framework of the Exchange Phase, Lesson 7: Construction of Exhibits.

What is the tool used for:

Scratch was used for the development of a digital game which was the main part of the exhibit entitled "From the Nanotechnology to the Prodigy".

Describe how the tool is used and how it is integrated in the module:

The main idea is to create a digital game for visitors learning on the subjects of breast cancer or HIV virus. The scenario is that in the future, a presumed patient has been diagnosed with breast cancer or HIV virus. The doctor recommends as a remedy to "attack" the cancer cells or the virus from an appropriate Nano robot, which will be introduced for this purpose, in the patient's body or blood.

The presentation method of the exhibit as organized by the students is the following:
This game consists of a PowerPoint presentation in combination with a scratch application. Visitors - through the presentation - opt to learn on subjects of breast cancer or HIV virus by selecting gender and disease. After, they play a digital game where they control a Nano-robot which attacks to the cancer cells or HIV virus, trying to destroy them. When the game is finished, the exhibit tries to put forward a query to the visitors on what will happen in case the robot attacks by mistake to a healthy cell.
Students presented their scenario during the visiting of museum staff to their class (Lesson 7). The idea

was discussed as excellent but needed objects, images and tools should be selected in order to interpret it and finally display it as exhibit. In addition, students and teachers had never designed museum–style displays (Lesson 7). To this end, students visited the Technology Laboratory of the Eugenides Foundation (P14) in order to discuss with the museum professionals various design issues. Following the visit, students had been started selecting images in order to support their scenario. The selected images were modified and improved by the graphic designers of the Lab under the guidance of the students. At the same time, students developed the environment and the instructions of the game as scratch application with the assistance of the museum ICT expert, at the Utech Lab.

What are the main reasons why this tool works so well here?

Scratch is a useful tool to create animations that help visualize difficult concepts such as nanotechnology. To this end, Scratch was selected to be used for the visualization of the students' storyline for their exhibit. Moreover, Scratch is web-based environment and it can be accessed as a free desktop by students, teachers, parents and other communities of users in various settings: schools, museums, libraries etc. across Europe.

Teacher experience

Has the teacher used the ICT tool before, or was it first time in the module?

Teacher had none experience or involvement in the scratch application.

In general, how experienced is the teacher with using ICT tools in class?

Recommendations for other teachers for using this tool?

For future use, teachers or students must be familiar with the scratch program.

Documentation

The scratch applications are available online in the following links:

- NanoRobot_vs_Cancer: https://scratch.mit.edu/projects/70498536/

- NanoRobot_vs_HIV: https://scratch.mit.edu/projects/70498516/

5. Greece (4): Glogster and Scratch for the design of four interactive digital posters

by Christina Troumpetari

General Information

Module: Nanoscience and Nanotechnology applications

Class of example: Lower secondary education, age 14-15, four students (3 male -1 female).

ICT tool and use

Name of the Tool: For the development of the said exhibit, two ICT tools were used Glogster and Scratch. Glogster (http://edu.glogster.com) is a Web 2.0 tool that allows users to create virtual posters combining text, audio, video, images, and hyperlinks and to share them with others electronically.

Scratch is a programming language and an online community where children can program and share interactive media such as stories, games, and animation with people from all over the world. As children create with Scratch, they learn to think creatively, work collaboratively, and reason systematically.

Hardware the tool is used on in this example:

The 4 digital posters and the scratch presentation were developed mainly by the students in the classroom and home with an intervention of the teacher on the editing of various elements (text, layout etc.). For the display of the exhibit at the museum, a Laptop was used in which the all material was loaded as well as a touch screen as an interactive display device in order to engage the visitor in a more interactive and proven way. Technical interventions were made by the museum staff in order to support the functionality of the exhibit such as connection with Internet, block the related links to not direct to other webpages etc.

Phase in the module the tool is used:

The main use of the tools takes place in the framework of the Exchange Phase, Lesson 7: Construction of Exhibits.

What is the tool used for:

Students used the ICT tools of Glogster and Scratch for the design of 4 digital posters entitled "Nanotechnology in the service of Medicine" and additional material. All the material was included in a PowerPoint presentation.

Describe how the tool is used and how it is integrated in the module:

Visitors interact with PowerPoint slides which act as an interface for the exhibit and which guide them to four different interactive posters concerning Nanotechnology in the service of Medicine. In addition, a scratch application is available in order to introduce visitors in the RRI aspects and to be the trigger on RRI issues. At the end of this application, visitors are asked to give their opinion which is recorded for the next visitor in order to see it.

Students presented their scenario during the visiting of museum staff to their class (Lesson 7). The idea was discussed and suggestions were made to the students concerning the design of the posters and the exhibit interface.

What are the main reasons why this tool works so well here?

Gloster and Scratch were the most appropriate ICT tools to support the storyline of the students. Students using Glogster have at their disposal a great variety of different elements such as text, images, podcasts, music, hyperlinks for Web pages, videos and furthermore other objects in order to create an interactive digital poster. Moreover, since Glogster is a web based platform, students had the opportunity to meet and worked as team from their homes and not exclusively in the limited time of school hours and also the result of their work can be shared online via Glogster community to many others students and educators. The Scratch application was selected in order to support the RRI features of the exhibit and to be elicited the visitors in a discussion on RRI.

Teacher experience

Has the teacher used the ICT tool before, or was it first time in the module?

Teacher was familiar with the use of these tools as he used them in his teaching.

In general, how experienced is the teacher with using ICT tools in class?

Recommendations for other teachers for using this tool?

The option of the Glogster is a very creative process and it is user-friendly application for the teachers.

Documentation

The digital posters and the scratch presentation are available in the following links:

- Poster 1 (general information on nanotechnology): http://nikosm.edu.glogster.com/nanotech/

- Poster 2 (introduction to drug carriers): http://nikosm.edu.glogster.com/drug-carriers/

- Poster 3 (example I: Fullerenes): http://nikosm.edu.glogster.com/fulerens-c60/

- Poster 4 (example II: Metal-Organic Frameworks): http://nikosm.edu.glogster.com/mof

- Scratch online RRI presentation: https://scratch.mit.edu/projects/55429288/#fullscree

6. Israel: Tools for collecting data and knowledge to be presented in the exhibition

by Ron Blonder

General Information

Module: Perovskite-based Photovoltaic Cells

Class of example: Class 1: 3 boys and 4 girls, 15 years old, in the 9th grade in Italian School, Haifa Israel.
Class 2: 18 boys, 19 girls, 17 years old learning in the 11th grade in a school in Rehovot Israel.

ICT tool and use

Name of the Tool:

1- PC (computers/laptops in classroom, students computer at home).
2- Projector (for presentations).
3- You tube animated films.
4- Digital animations:

Voki (http://www.voki.com/)
PowToon (https://www.powtoon.com/)
Go Animate (http://goanimate.com/videomaker).

5- Digital recorder, Digital camera: for recorded interviews, recorded photovoltaic solar cells experiment
6- Electronic exhibition- As a tool for preparing for the 3D exhibition

Hardware the tool is used on in this example:

Phase in the module the tool is used:

For each of the following 5 RRI dimension, is written the tools used:

1. Engagement: PC (computers/ students' laptops in classroom), Projector (for presentations), You tube animated films, special news broadcast using digital recorder, digital camera

2. Science Education: Electronic exhibition- As a tool for preparing for the 3D exhibition

3. Open Access: Digital recorder, Digital camera: for recorded interviews, Digital animations, Projector (for presentations).

4. Ethics: You tube animated films,

5. Governance: You tube animated films, Projector (for presentations).

For each of the following 6E stages, is written the tools used:

1. Engage: presenting a high-quality "special news broadcast" using digital recorder and digital Camera, as a tool for raising interest, engaging and challenging students to provide relevant information to the their guiding question

2. Explore: Student exploration of the subject is promoted by providing students with experiences (e.g., digital and live experiment on photovoltaic cells, RRI presentations).

3. Explain: Students collect data and knowledge to answer the questions by engaging in the science museum visit, in addition to using their computers as a tool for collecting the data and knowledge needed to be presented at the exhibition, later on.

4. Elaborate: Students are encouraged to elaborate on their findings during the exhibit-design phase of the module. The students connect the scientific content to RRI by using computers, animated videos, digital animations for (a) designing the RRI-related parts of their exhibits and (b) applying RRI to the research topics of the Weizmann Institute graduate students, in discussions with these students.

5. Exchange: Students are encouraged to communicate their findings and conclusions with the wider audience of their fellow students (who did not participate in the module), by presenting their exhibits to them, using different tools such as the digital camera recorded experiment of photovoltaic solar cell.

6. Evaluate: Students' learning of the main goal of the module (i.e., to foster positive attitudes towards RRI) is also measured by using online pre/post RRI questionnaire, what is also considered an ICT educational tool.

What is the tool used for:

Describe how the tool is used and how it is integrated in the module:

What are the main reasons why this tool works so well here?

For example, using the Youtube animated film or storytelling of Dr. Peterson and his attitudes regarding using lead, exposed the students indirectly to several 6E RRI dimensions, which were naturally integrated into the story as a part of the story consequence. The students raised few of the dimensions as a result of watching the film. They were exposed to ethical issues, the governance role and effect on scientific research, open access issues and who should be responsible.

Teacher experience

Has the teacher used the ICT tool before, or was it first time in the module?

In general, how experienced is the teacher with using ICT tools in class?

Recommendations for other teachers for using this tool?

Yes the teacher of this class is familiar with most of the ICT. This teacher believes that ICT improves student's learning and afford better teaching methods. Students' exposure to educational ICT has a significant and positive impact on students' attendance and concentration. ICT enables teachers to easily explain complex instruction, ensures students' comprehension, creates interactive classes and makes the lessons more enjoyable.

7. Portugal: Popplet as tool for building concept maps

by Rita Marques

General Information

Module: Polar Science

Class of example: 10th grade, 14-15 years old, 25 students

ICT tool and use

Name of the Tool: Popplet (http://popplet.com/)

Hardware the tool is used on in this example: students computer at home OR computer-room at school.

Phase in the module the tool is used: Explore

What is the tool used for: The tool is used for building a concept map that highlights the main characteristics of the polar regions after students have done some research on the topic.

Describe how the tool is used and how it is integrated in the module:

After doing some research about the Polar Regions (climate, biology, geology, geography), students have to organize their knowledge and represent it through a set of concepts and their relationships (indicated by a connection line between two concepts). The concepts must be represented in a hierarchical fashion with the most inclusive, most general concepts at the top of the map and the more specific, less general concepts arranged hierarchically below. The relationships between concepts in different domains of the concept map help us to see how some domains of knowledge represented on the map are related to each other. A final feature that may be added to concept maps are specific examples of events or objects that help to clarify the meaning of a given concept. Concerning the tool, students need to create an account (or they can try it out) and choose the free version, although limited in the number of concept maps it allows. After building their maps, they then share them (i.e., share their hyperlink or embed them, via blog or other platform) for evaluation regarding the evaluation criteria. Students are aware of this criteria since the onset of the task.

What are the main reasons why this tool works so well here?

a) It allows teachers to identify both, valid or invalid ideas held by students.

b) It allows the incorporation of images or videos (from YouTube, Vimeo) as representation of concepts, not only text.

c) In order to establish relationships between concepts, students have the opportunity to structure their knowledge about the topic, becoming more aware of what they know or don't know yet.

d) The concept maps can be easily built and shared.

Teacher experience

Has the teacher used the ICT tool before, or was it first time in the module?

Yes, teacher has used Popplet before.

In general, how experienced is the teacher with using ICT tools in class?

Teacher has some experience in using ICT tools, but outside of classroom since there are no computers available for students in class - only at computer-room. She normally integrates ICT in tasks (presentations, mostly).

Recommendations for other teachers for using this tool?

First of all, students don't usually know what concept maps are - for them, they're a list of words, structured in a linear fashion. So, teacher must explain them what are concept maps and how they must be build. If there is no time available in class for teacher to show, as an example, how to build a concept map using Popplet, it is very important to share a tutorial with students (although the tool is very easy to use and very intuitive).

As a tool for building concept maps, Popplet has a downside: it does not allow the user to write (in a quick way) a word on the connecting line, and this word is very important since it specifies the relationship between the two concepts. But students can place it, nevertheless, inside a box: then they will have two concepts connected through a line with a box, inside of which is the linking word. It's an alternative way of making the map more complete.

Another important issue is the assessment criteria: they should be delivered to students on the onset of the task.

8. Turkey: Edmodo is a simple platform for teacher and students to share ideas, announcements, and materials, as well as communication base

by Sevil Akaygün

General Information

Module: Nanotechnology Applications in Health Sciences

Class of example: 6th Grade, Age:12-13, 7 students

ICT tool and use

Name of the Tool: Edmodo

Hardware the tool is used on in this example: Personal computers, tablets and smart phones

Phase in the module the tool is used: The tool was used during the Explain phase because students posted their reflections on Edmodo, and also during the Exchange phase because they shared their ideas about the exhibit through Edmodo.

What is the tool used for: Edmodo is a simple platform that could be used as a Learning Management System (LMS) where the teacher and students share their ideas, announcements, and materials, through it. They also post comments and express their feeling such as 'Like'.

Describe how the tool is used and how it is integrated in the module:

The module is composed of 8 lessons, each of which is 80 minutes long. In every lesson, the teacher creates a page where students can upload their reflections or assignments of that lesson. Then they conducted online discussions about the past lesson. So, both the teacher and the students actively used Edmodo throughout the module.

What are the main reasons why this tool works so well here?

1. Edmodo is a good tool that allows interaction among the students and the teacher, so it was very appropriate for our module in which students work in groups, yet individually reflect on the tasks. Edmodo allows both group and individual works.

2. The interface of Edmodo looks like Facebook so it was very attractive and easy to use for students.

Teacher experience

Has the teacher used the ICT tool before, or was it first time in the module?

It was his first time as a teacher using Edmodo, but he had practiced it as a CoL member.

In general, how experienced is the teacher with using ICT tools in class?

He was very comfortable with it, no problem was observed.

Recommendations for other teachers for using this tool?

We have an Edmodo page for our CoL group, so they practiced and got used to. I think it might be recommended to have an Edmodo page/group for a bigger group where they can join as participants before being a teacher.