HOW TO ELABORATE A DEMONSTRATOR IN INSPIRING SCIENCE EDUCATION PLATFORM

Radoslav Yoshinov, Monka Kotseva

Laboratory of Telematics – Bulgarian Academy of Science, Sofia, Bulgaria
yoshinov@cc.bas.bg, mkotseva@cc.bas.bg

***Abstract**: Inquiry based approach in the classroom is the modeling of the real scientific research skills of investigation, critical thinking, imagination, intuition, playfulness, and thinking for a real world problem. For the realization of an ISE Demonstrator, we adhere to the scenario template and step-by-step guidance for planning the lesson using the five step scenario template.*

Today, because of the Rosetta Stone, we can interpret many ancient texts and inscriptions of Egyptian hieroglyphic and demotic scripts found on sheets of papyrus and monuments throughout Egypt. The Rosetta Stone Demonstrator enables teachers to use in their lessons factual material that is related to Egyptian culture. The purpose of this demonstrator is students to become aware of the interactions between different languages and their structure.

***Keywords**: Inquiry based science education, Demonstrator, Rosetta Stone assessment, problem solving skills, technology-based learning, eLearning Tools, Egyptian script learning, eLearning Tools, Egyptian script*

1. Introduction

The ISE project funded by the EU aims to develop key competencies. Each competency should be seen as a combination of three elements (knowledge, skills and attitudes) knowledge of which varies depending on the context requires.

ISE Demonstrators are part of service-oriented architecture where learning experiences are dynamically constructed taking into account user profiles and pedagogical templates based on inquiry based science methods.

2. Inquiry based science education

Traditionally, learning was organized in lessons and courses covering predefined objectives. Inquiry based approach in the classroom is the modeling of the real scientific research skills of investigation, critical thinking, imagination, intuition, playfulness, and thinking for a real world problem.

The best way to communicate the characteristics of scientific inquiry is through examples from your research, demanding evidence, application of logic and imagination, predicting and explaining the phenomena, avoiding bias, using codex of professionalism and accepted ethical principles.

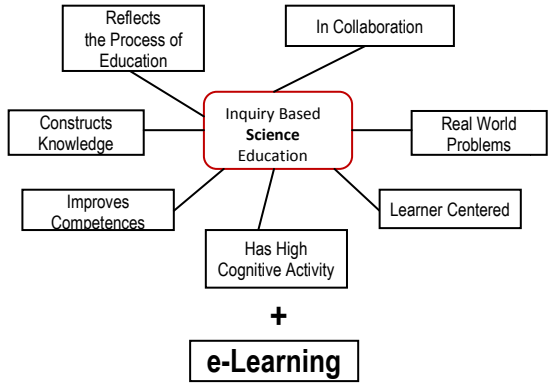

Fig 1 Inquiry based science education

Usually it is used through the ISE Learning Portal, where the material (a Demonstrator, learning course, learning scenario, etc.), stored in the ODS/ISE repositories is broken into smaller independent pieces named learning objects that can be used as they are or in combination with other materials, covering the learning needs of the users on demand any place and at the right time[1].

There two main ways for creating the Demonstrators, used in the ISE Portal.

The first step is to create it with the authoring tools of the ODS/ISE environment and the second way is to embed externally maid Demonstrators in the ISE/ODS environment.

The second way raises two questions.

What content is proper to be embedded and how technologically it should be done.

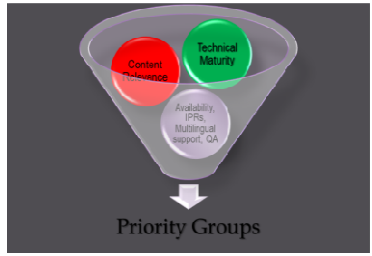

Fig 2 Importing External Resources

Technical maturity

Meaning "how ready" is the repository to be integrated into the ODS/ISE content infrastructure. Is the Metadata support IEEE LOM or Dublin Core compliant etc.

Relevance of resources to the ODS target audience and goals.

Target audience

Topics covered, reusability of resources in various educational contexts or outside their country of origin, the pedagogical approaches

Other parameters such as: Availability of the resources; IPRs and copyright licenses, Multilingual support, Quality procedures etc.

Different pedagogical approaches may be used, requiring different implementations of learning objects. Many times the pedagogical approach is strictly bound with the learning object, reducing the possibilities for reusing this object in different contexts.

Technologically they should be done using the web protocol based approach in implemented, for the systematically communications between the eLearning Tools and ISE.

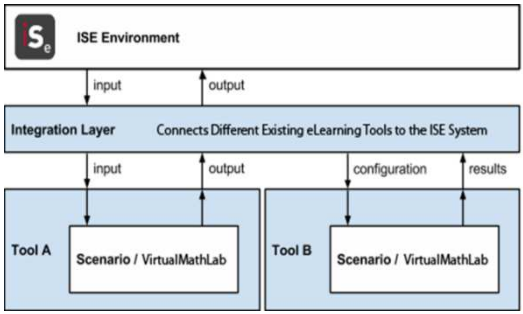

Fig 3 . Web protocol based approach

To define the steps of elaborating a new Demonstrator in the ISE/ODS environment, we need to clearly state base definitions to be used.

The proposed definition to be used for learning object is a collection of digital materials — pictures, documents, simulations — coupled with a clear and measurable learning objective.

The proposed definition to be used for learning scenario is a priori description of a learning situation, independently of the underlying pedagogical approach. It describes its organization with the goal of ensuring the appropriation of a precise set of knowledge, competences or skills. It may specify roles, activities and required resources, tools and services[2].

The proposed definition to be used for lesson plan is instructor's road map of what students need to learn and how it will be done effectively during the class time.

Based on these three definitions the authors bring out the following definition for **ISE demonstrator**: *Realized learning scenario, based on appropriate lesson*

plan(s), consisting of learning objects, elaborated using inquiry based science methods.

3. What are the steps to elaborate a new ISE Demonstrator?

For the realization of an ISE Demonstrator, we adhere to the scenario template and step-by-step guidance for planning the lesson[5].

The authors used the five step scenario template for the ISE Demonstrators:

Identifying the target audience and analyze their needs was the first step for elaborating the demonstrator. The important part was to define the competence level of the targeted auditory for the subject of the ISE Demonstrator and their expectations on the outcomes. In the second step was important to identify the learning needs of the target group and the expected outcomes of the ISE Demonstrator. (When the target audience is well known, one can determine their wants accurately and formulate the ISE Demonstrator outcomes accordingly). The learning outcomes shaped the goals of the ISE Demonstrator. They were to be achieved by means of objectives, formed like tasks implemented in the ISE Demonstrator accordingly. To pick the most relevant ones determining the learning outcomes a DIF (using **D**ifficult, **I**mportant, **F**requent parameters) analysis was done. The third step included choosing the situation for the ISE demonstrator forming the appropriate level of interaction. Choosing the appropriate type of ISE Demonstrator (Skill-Based, Problem-Based, Issue-Based, Speculative, or Gaming) formed the forth step. The fifth step included the design of the ISE Demonstrator from Identification of a realistic trigger event, through creating a believable and relatable protagonist toward turning feedback into effective instructional tools. Specifying concrete objectives for student learning helped to determine the kinds of teaching and learning activities to be used in class, while those activities defined how to check whether the learning objectives have been accomplished.

In addition to keep ISE Demonstrator Quality standards on every step we had to take into account the following criteria. The elaborated ISE Demonstrators should be well-defined, inquiry based, working (with all links and material available), simple to use, adopt and change. They should be relevant, inspiring and motivating to learners and teachers, connected with real world problems and to a Big Idea of Science. The last, but very important step was the evaluation process of the ISE Demonstrator.

4. How did we apply these steps on the "Rosetta Stone" ISE Demonstrator?

At some point during the fourth century, all knowledge of ancient Egyptian scripts was lost, leaving no method available to decipher the language of hieroglyphics which had been richly preserved on ancient Egyptian monuments,

stone tablets, and sheets of papyrus. Fortunately, while on an expedition to Egypt in 1799, Napoleon's army discovered an artefact which has become known as the Rosetta Stone. This stone contained the inscription of a decree issued in 196 BC by Ptolemy V Epiphanes. The decree was repeated three times in two languages, Greek and Egyptian, with the Egyptian version appearing twice, once in hieroglyphics and once in demotic, a cursive form of the hieroglyphic script. Fortunately, there is an abundance of information on ancient Greek dialects and therefore, the stone's Greek version of the decree contained the key to decipher the meaning of the ancient Egyptian texts. Today, because of the Rosetta Stone, we can interpret many ancient texts and inscriptions of Egyptian hieroglyphic and demotic scripts found on sheets of papyrus and monuments throughout Egypt.

One of the big challenge in crafting a learning experience is figuring out how to engage the learners. All groups of learners are different from one another – they all learn in a different way – they have different styles of learning. There are many ways to create engaging and interactive learning. The key is to engage the learner and create an experience that is memorable and enjoyable as well as educational. Moreover, taking into account the previous knowledge (background) of Learners can significantly reduce learning time, since learning activities that are intended to fulfill learning goals that have been already fulfilled at a satisfactory (for the Learner) level in the past could be excluded from the learning experience. All these factors have to be decided by the teacher himself. Keeping in mind the objective and subjective factors, the teacher can change the lesson in depending education level.

The first step before we start the implementation of the scenario was to determine the age category to which is directed the educational material.

Ancient Egypt is of interest to small and large pupils, since today is difficult to explain how the Egyptians have reached such heights of development of society, culture, art and construction, more than 3500 years BC. Restricting the age category helps in determining the depth of facts interpretation. Determinant of putting age limits are the national requirements for the education program in "history and civilization" of the Bulgarian school, where the 7-th class is determined.

Since the material is not completely historical, as it relates to language learning and linguistics and art and methods such as induction, analogy etc, it can be used in optional courses and compulsory classes.

For the realization of the demonstrator, we adhere to the scenario template and step-by-step guidance for planning the lesson taking into account the requirements of the education program in "history and civilization" of the Bulgarian school for the 7-th class.

Formulated were some questions to verify the general level of knowledge of the material related to the history of Egypt. Before answering questions students were

asked to track video to recap the most important elements related to the power of Egypt and the building of the pyramids.

The teacher was facilitated to draw the attention of students to the main purpose of the lesson - Egyptian script and its main characteristics and elements of the shaped letter - pictograms and ideograms

Proposed were several tasks illustrating these concepts. The main objective of these tasks was to connect shaped letter use in everyday life e.g. signs, road signs and emoticons. In the proposed and elaborated tests was provided a field where students could record their answers. It was elaborated with the Google form tool, which allows the teacher to collect and analyze the submitted responses. These tests were designed to test the observation abilities of students in reading unfamiliar circuits or signs, which was an important prerequisite for orientation in real life.

In the next step of the scenario, the teacher gave factual opening and attempts to read the Rosetta Stone. He directed students to the main findings, which had made Champollion in his discovery. A hypothesis was raised what could be done to match hieroglyphic writing to the Latin alphabet and thus planning the investigation how students could express their thoughts by the means of Egyptian hieroglyphs. While resolving the proposed tasks students themselves had to make the correlation between the Latin alphabet and hieroglyphic writing.

Important part of the demonstrator was oriented toward analysis and Interpretation. In this phase of the lesson students were given the opportunity to decipher and code texts. To achieve this ability it was necessary to translate the texts written in hieroglyphic letter in English and then in Bulgaria and vice versa. This exercise was very similar to the deciphering of the Rosetta Stone, as Champollion did, based on his knowledge of Greek and Coptic languages and alphabets (the languages in which the Egyptian inscription was done)[3].

With the help of questions the teacher facilitated reaching the conclusions that on this principle of change of the letters with hieroglyphs or with other characters was based the encryption of texts and as application the digital codes of computer code tables and characters.

Taking into account the level of competence of the students the teacher could show the table with the character set in the computer. He could create an example, using the Code function in Excel, which displays the codes of the characters[4].

5. Evaluation and assessment of the "Rosetta stone" Demonstrator

Many current teachers have limited experience with DEMONSTRATORS software from the learners' perspective and may be novices as well using this technology for teaching. Unlike textbooks, software structure of Demonstrator is often not transparent and can be difficult to "skim" for both content and program

operation. Additionally, it could be difficult to get a fully operational version for evaluation.

So evaluation of the Demonstrator referred to the process of investigating it to judge its appropriateness for a given subject learning setting, identifying ways it may be effectively implemented in that setting, and assessing its degree of success and determining whether to continue use or to make adjustments in implementation for future use. We could think of these three stages respectively as selection, implementation, and assessment. Considerations of implementation could and arguably should be an integral part of the selection process. Assessment was carried out by the target group for which the Demonstrator was elaborated. It was invincibly made by teachers/tutors - professionals who should use it in the educational process and by learners - direct users of this content. The evaluation was done as traditional assessment using conventional methods (driven by checklists or forms, guided by appropriate methodological frameworks or linked to theory and research-based criteria) and as performance based assessment, measuring student's creativity and the level of application of the obtained knowledge in real-life contexts. The key in evaluation was to determine whether the teaching presence in the Demonstrator (that either do not involve tutorial software or represent blends of tutorial and tool-oriented applications) in combination with the content was effective for the given objective[6].

The authors used the modified Jamieson, Chapelle, and Preiss (2004) criteria which was operationalized for a judgmental analysis of the Demonstrator. The following parameters were accounted:

- *learning potential of the Demonstrator:* The degree of opportunity present for beneficial focus on form;
- *Learner fit of the Demonstrator:* The amount of opportunity for engagement with the Demonstrator under appropriate conditions given learner characteristics;
- *Meaning focus:* The extent to which learners' attention was directed toward
- the meaning of the Demonstrator;
- *Authenticity of the Demonstrator:* The degree of correspondence between the learning activity and target activities of interest to learners out of the classroom;
- *Positive Impact:* The positive effects of the Demonstrator activities on those who participated in it;
- *Practicality:* The adequacy of resources, supporting and being used in the Demonstrator.

Conclusions

The Demonstrator has lower cost, high availability of equipment, elaborates economy of time, provides less hazard from dangerous materials, guides the direction of the thinking process. The benefits of creating a Demonstrator are in the following directions. It makes the activities easily visible, shows personal excitement over the event that is taking place, engages the students in making observations, suggestions, predictions, evaluations, and in assisting.

The Rosetta Stone Demonstrator enables teachers to use in their lessons factual material that is related to Egyptian culture. The purpose of this demonstrator is students to become aware of the interactions between different languages and their structure. To boost their motivation for learning new languages by revealing the unity in diversity, and the common features of various cultural and linguistic forms.

In the demonstrator, the comparative method by which the Rosetta Stone has been translated was used. This is the basic method for solving linguistic tasks as they are presented to students. Linguistic tasks are essentially logical tasks. They help us to look more closely at the symbols displayed, and search for matches, for explanations of what we see, to connect it with our previous knowledge, and develop our observation skills. As a "added effect" we expand our knowledge and the relationship between the various disciplines taught in school.

References

1. P Balatsoukas, A Morris, A O'Brien Learning Objects Update: Review and Critical Approach to Content Aggregation. - Educational Technology & Society, 2008
2. Klerkx, J., Duval, E., Meire, M. (2004). Using Information Visualisation for Accessing Learning Object Repositories, In Proceedings of IV04 8th International Conference on Information Visualisation, London, England, 465-470.
3. Chapelle, C.A. (2003). English language learning and technology: Lectures on teaching and research in the age of information and communication. Amsterdam: John Benjamins Publishing
4. R.Yoshinov, M. Kotseva (2016) The steps for elaboration of the "Rosetta stone" demonstrator. Proceedings of Inspiring Science Conference 2016, April 22-24 , Athens.
5. ISE Teachers Guide (2015), ISE consortia.
6. L Jervis (1999). Laboratory work in science education: An evaluation with case studies. University of Plymouth, 1999