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Francisco José García-Peñalvo
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OPALESCE – Online Portal and Active Learning System for Senior Citizens in Europe

Giselle Janeiro
Gerontologist
Rua João Gerardo, Fazendas de
Almeirim
giselle.g.janeiro@gmail.com

Luís Jacob
RUTIS' President
Rua Mário Viegas, Santarém
rutis@rutis.pt

María José Rodríguez-Conde
GRIAL Research Group
Research Institute for Educational
Sciences,
University of Salamanca
mjrconde@usal.es

ABSTRACT

Currently we live in a postmodern world where everything revolves around technology. Anywhere we go, we are faced with information that is processed and shared in real time via digital media. Every day we are presented with new technological innovations that bring benefits to society, whether in the areas of information, transportation, education, health among others.

The digital divide can be especially severe with the elderly, who typically are not as comfortable with new technology as other demographics. Most senior citizens never got used to computers and the concept of how they work is so different from what senior citizens worked with that the learning curve is very steep.

Due to these current social demands, as well as for economic and social stability it is important that no groups are left behind, the consortium of OPALESCE project looked for a way of exploring and enhancing all the positive impacts of the new technologies, especially the mobile touch-screen devices like smartphones and tablet computers combined with distant learning and introduce them into the informal adult education in an innovative and interactive way.

OPALESCE project has as main goal the creation of a distance learning system that senior citizens with no previous computer experience can learn in one hour and implement it in a way that attracts a large number of users and content providers.

This article constitutes a summary of the background information important for the development and achievement of OPALESCE's products and objectives.

CCS Concepts

• **Social and professional topics**–Seniors.

Keywords

Distance Learning; Learning Concept Design; Interactive Task System; Micro Units; OPALESCE.

1. INTRODUCTION

There are several studies that show the importance of the

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integration of the digital media into the everyday life. The quote of Galerneau/ Zibit "Modern communication technologies, and the knowledge economy, have brought unprecedented change requiring both new skills and competences" [2] shows the impact of this change that transforms Europe into a knowledge-based and information society in which new technology methods of communication and information sharing became more and more important.

Analyzing the younger generations, it is more than acceptable to affirm that they are fully integrated in this world that is so influenced by the new technologies and digital media. Nowadays digital media is completely integrated in younger generations learning processes, the same we cannot say about older generations, especially the elderly that have had no computer or digital media in school. This fact as well as the rapid change in society may make this demographic group more likely to suffer the risk of being left behind since they are not comfortable with the new technology. For this reason, it is very important to pay a special attention to this group.

Despite the fact that the elderly are not comfortable with the new technologies they can benefit in multiple ways from it. Isolation and loneliness can be minimized through the interaction with other people using chats, e-mail or even skype, as well as they can enhance their independency and decrease their helplessness. The elderly can also improve their cognitive systems and reduce episodes of depression by using the new technologies to engage with new learning activities.

With OPALESCE, the consortium intends to enhance all positive impacts of the new technologies by developing a web-based Distance Learning System that will be optimized for the use of mobile touch-screen devices like smartphones or tablet computers.

Regarding the Distance Learning System, the consortium wanted to focus on two main parts, the Learning Concept Design and the Interactive Task System.

The Learning concept Design is a learning concept bespoke to the idea of an easy to learn system based on a so called Micro Units, small learning resources that adhere a given structure and a certain quality standard. It will be concerned with the questions of how senior citizens learn and how the content provided via the Micro Unit is displayed most beneficial on mobile touch-screen devices. Thus, this concept will also be the blueprint for the creation of the learning resources circulated on the online-platform.

The Interactive Task System is concerned with the question, how the learning progress of the elderly can be assessed in an interactive way, suitable for the small screen of mobile touch-screen devices, and appropriate to measure learning outcomes.

Anyway, here, the focus of the assessment will be to provide the learners with feedback, to help them enhance and improve in any field, but not to mark them.

The development of the OPALESCE Learning Concept Design and Interactive Task System and the creation of the Micro Units are based on three theoretical approaches: Andragogy, Didactics in E-Learning and Cognitive Theory of Multimedia Learning.

2. THEORETICAL BACKGROUND

2.1 Andragogy

Since the OPALESCE project aims to develop learning solutions for adults, especially the elderly, it was important to have an understanding of Andragogy, the theory of adult learning, in order to have the basis for the creation of our Distance Learning System and the design of the Micro Units for learning.

Malcolm Knowles was considered to be one of the most known and important scientists in the field of Andragogy. As an educator who theorized adult education he defined Andragogy as the art and science of helping adults learn [3]. Four fundamental assumptions were developed about adult learners:

- (1) "The learner's self-concepts develop from dependent to self-directed learners as they mature. Therefore, particularly adult learners prefer self-directed learning but they like to get help when it becomes necessary.
- (2) Over their live-spans, learners accumulate experiences that become important resources for learning for themselves and others. Furthermore, adults prefer active experience based learning over passive learning.
- (3) Adult learners must see the real life need to become ready to learn something new. Therefore, educators need to help the learners to discover these needs.
- (4) Adults want to learn something that will have a direct effect on their competencies, so that they can exploit their potential." [8]

For the development of the Micro Units of the OPALESCE project, the consortium paid a special attention to three other assumptions regarding adults and their learning also referred in the studies conducted by Knowles [8]:

- (1) Adults can learn. Even if the speed of learning decreases as people mature the intellectual power does, in general, not.
- (2) Learning is an internal process. The process of learning is understood as an internal one, controlled by the learners themselves. This process includes intellectual, emotional, and physiological functions. Learners are not seen as empty containers ready to get filled with facts. Learning is seen as a dynamic process, based on learning objectives that can be accomplished based on learning experiences which are defined as interactions between learners and their environments.
- (3) Superior conditions of learning and principles of teaching. It is assumed, that "there are conditions of learning that are more conducive to growth and development than others." [3]

2.2 E-Learning

The acronym OPALESCE, is enough to show the concern of the consortium in creating an Online Portal and Active Learning System. For this reason it was necessary to focus on E-Learning as well as pedagogical and didactical principles.

It is astonishing the development of E-Learning over the last decades. Despite this rapid popularity, the concept and understanding of E-learning seems to vary by person which makes it difficult to find a clear and precise definition. The consortium agreed with the understanding of Sauter, A. M, Sauter, W. and Bender, H. (2004) in which is referred that the term "e-learning" derived from the advertising industries and described learning arrangements and scenarios where information or communication technology is used to support the learning process or to provide learning materials and contents [8]. Nevertheless, we emphasize as well that e-learning is not only about how technique is arranged to support learning, but about utilizing these new opportunities to develop innovative concepts for learning.

After analyzing several literature from different contexts like e-learning, vocational training and pedagogic literature we found some principles that are relevant for the project OPALESCE:

- (1) Fixed vs flexible curriculums and content structures.
- (2) Description of learning objectives
- (3) Meaningful learning and complex problem orientation
- (4) Consideration of previous knowledge and rising complexity
- (5) Integration of reflection and de-contextualization phases
- (6) Practical application and integration of practicing and exercises
- (7) Evaluation of learning accomplishment and needs
- (8) Accessibility of learning resources / Just in time learning
- (9) Cooperative models of learning

These principles have the common denominator of the constructivists view on learning processes and they gave us a good basis for the design of a Micro Unit structure.

2.3 Cognitive Theory of Multimedia Learning

In OPALESCE, the consortium will develop a web-based Distance Learning System that provides the users with Micro Units of learning contents that are optimized for the access via mobile touch-screen devices. In order to understand how learning can be fostered best in multimedia learning environment it was given special attention to the three sciences of learning by MAYER [6-8]

2.3.1 The science of learning

The science of learning focuses on the cognitive processes behind information processing and learning.

According to Mayer, learning in multimedia environments are based on cognitive principles, cognitive processes during learning and kinds of representation during learning.

- (1) Cognitive principles:
 - a. The dual channel assumption that states that there is a channel for auditory information which processes the printed words and another for visual information responsible for processing the nonverbal sounds. [1-4]
 - b. The limited capacity assumption which states that the channels described above have a limited capacity of information that can cause a cognitive overload. [1-5]
 - c. The active processing assumption which indicates that the learner is cognitive active by attending to relevant

information, organizing it into coherent cognitive representations and integrating it in long term memory. [6]

(2) Cognitive processes:

- a. Selecting words and images. Since there is a limited cognitive capacity it is a necessity to separate the relevant and irrelevant images and words. [4] The relevant information will be transferred from the sensory memory to the working memory. [6]
- b. Organizing words and images. All relevant information will be connected and coherent mental representations will be built in the working memory. [6]
- c. Integrating. All verbal models and image models will be connected and integrated in order to create representations that will be stored in the long-term memory. [6]
- (3) Kinds of representation during learning: [4]
 - a. External representation. External representations, like words or images are presented to the learners.
 - b. Auditory or visual sensory copy. Auditory or visual stimuli impinge the sensory channels.
 - c. Sound or image. Relevant information is transferred as images or sounds to the working memory.
 - d. Pictorial or verbal model. The learner connects the information and creates mental models.
 - e. Knowledge. The pictorial and verbal models are brought together and knowledge is built.

2.3.2 The science of assessment

According to Mayer [6] when referring to the assessment of learning outcomes and transfer in multimedia environments it is necessary to focus on the learning outcomes, the instructional effectiveness and individual differences in learning. Since the learning outcomes are more relevant to the project OPALESCE we will focus only on those.

Mayer, [6] distinguishes and describes three different kinds of learning outcomes:

- (1) No learning, where the learners fail to select, organize or integrate new information to the long-term memory.
- (2) Rote learning, where the learners select and organize new information and build mental models, but don't integrate them into prior structures.
- (3) Meaningful learning, where the learners run five cognitive processes in a coordinated way. The learner selects, organizes and integrates information into the long-term memory.

Mayer, 2011, also distinguishes two main kinds of assessments:

- (1) Retention tests, that focuses on what a learner remembers and can be designed as a recall test or a recognition test.
- (2) Transfer tests that focus on the learner's ability to use what he has learnt to solve a new problem.

2.3.3 The science of instruction

As referred previously, the cognitive capacity is limited and, having that into account, we want to describe design principles that should be adhered in the creation process of multimedia learning in general and the Micro Units of OPALESCE in particular. These principles are designed having, also, into account the Triarchic Theory of Multimedia Instruction which refers that there are three kinds of demands regarding the limited processing capacity [6]:

(1) Extraneous processing. Learning essential material is not supported; overload occurs, when extraneous material is included in the learning situation, so that the learner cannot focus on the essential material [5-7]

(2) Essential processing. Creation of a mental representation of the essential material. Cognitive Overload can occur, when the presented material is too complex [6]

(3) Generative processing. Integration of the mental representations into existing knowledge [5]

Cognitive overload occurs when the above processes exceed the learner's capacity [5]. Related to this, Mayer described three instructional scenarios that are concerned with the management of the cognitive overload on the one hand, and its underutilization on the other hand. The instructional scenarios can be described as follows [6]:

(1) Extraneous overload. The amount of extraneous and essential processes is exceeding the cognitive capacity of the learners, so that generative processing cannot take place. Therefore, extraneous processing must be reduced.

(2) Essential overload. Occurs even under abstinence of extraneous processing when the processing required for mental representations exceeds the learners capacities. The learners will not be able to make sense of the materials, so that the essential processing must be managed.

(3) Generative underutilization. Learners do not build meaningful learning outcomes even if cognitive capacity is available, because they might not be motivated enough to engage in deep essential processing. Here, generative processing must be fostered.

After presenting an understanding of how learning takes place and how learning processes can fail, we want to present principles now that are designed to reduce extraneous processing, to manage essential processing, and to foster generative processing. These principles are based on the findings of Mayer [6].

(1) Coherence Principle – extraneous information should be excluded.

(2) Signaling Principle – Cues related to the organization of essential material should be highlighted.

(3) Redundancy Principle – Information should not be presented twice.

(4) Spatial Contiguity Principle – Corresponding information should be placed near to each other.

(5) Temporal Contiguity Principle – Corresponding information should be presented simultaneously.

(6) Segmenting Principle – Learning material should be presented in user-paced units and not as a single one.

(7) Pretraining Principle – People learn better when they already have knowledge about basics.

(8) Modality Principle – Animation and narration is better than animation and on-screen text.

(9) Multimedia Principle – Words and pictures are better than words alone.

(10) Generation Principle – Learners are asked to create own materials based on what they have learnt.

(11) Personalization Principle – Words should be in a conversational rather than in a formal style.

(12) Voice Principle – Text should be spoken in a friendly human voice, not in a machine voice.

3. OPALESCE LEARNING CONCEPT DESIGN

In the OPALESCE project the core element of the Distance Learning System is the so called Micro Units.

In this project Micro Units are described as very short learning courses that focus on a certain topic and have defined learning goals. They are to understand as learning resources adhering sound didactical and pedagogical principles that can either be used in a stand-alone or combined way. They are typically embedded into a Microteaching Setting that combines different Micro Units to a complete session. Their key-characteristic is that they consist of a number of views which are based on different pre-defined multimedia elements and resource formats. Dependent from the chosen element, different learning support functions are embedded into the system to help the learner's progress and succeed. These Micro Units can be accessed via the web based learning system.

In contrast to learning resources in formal and/ or professional contexts, here, the Micro Units are designed by the users of the system themselves or other interested persons. These persons are typically not educators, pedagogues, or other professionals in the field of the design and creation of learning resources. Therefore, there is the necessity of a so called Learning Concept Design, which is to understand as a blueprint for the creation of learning content that will be accessible on the web-based Distance Learning System. Based on scientific findings in the field of didactics, andragogy, and cognition, it claims to answer the questions how learning content can be presented best on mobile touch-screen devices, and how the learning progress can be assessed by using small feedback tests. Such findings were comprised and reduced to their very inner core, so that they are easy to understand and easy to follow. Thus, every person is enabled to create learning resources that are appropriate to the target group.

It is necessary to stress that each of the Micro Units should be prepared to be used either in a stand-alone or complementary way. Particularly the last aspect addresses what we have called a microteaching setting. The structure of the Microteaching Setting is the following:

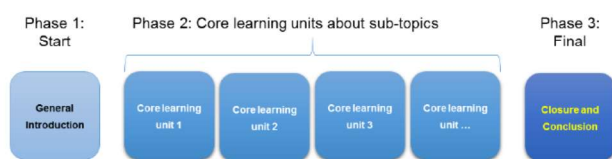


Figure 1. Structure of the OPALESCE Microteaching Setting

a) General introduction

The introduction offers an overview for the learners and provides them with general information about the topic and the relevant aspects in this field, which are addressed in the sub-topics. It also provides hints for learning and the aspects for general discussion in the community.

The duration of this part should be 3 - 5 minutes, to make sure that only the necessary information is provided in a short suitable form which gets to the point.

b) Core learning units

The core learning units are divided with regard to sub-topics. Every core learning unit has a duration of up to 15 minutes. It comes with a starting phase, which provides the learning with an activating beginning in which the learner will be informed about the aims of this part and importance of this sub-topic for real life situations. Based on this, the explanation will be provided and the tasks are processed in the next phase. Moreover, the assessment can be integrated and the learner will be informed about the next steps in the learning process.

In each of the core learning units exist an approximate time structure of 15 minutes (maximum) in total. With regard to the topic or sub-topic a core learning unit could also be shorter. Below is the structure of an OPALESCE core Micro Unit based on an approximate time structure of the mentioned 15 minutes.

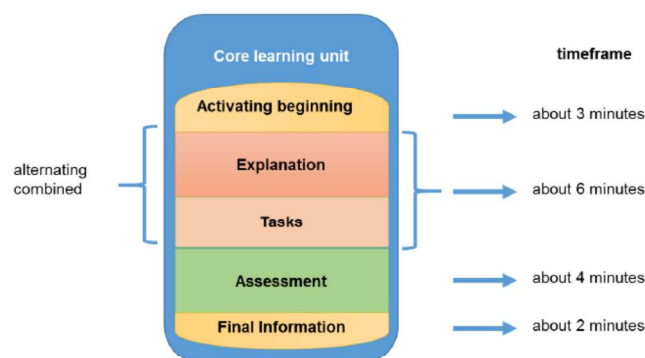


Figure 2. Structure of an OPALESCE core Micro Unit

c) Closure and conclusion

In the phase of closure and conclusion the learner will get a rough overview on the learned elements in the sub-topics and get a general orientation. It will also provide the possibility for reflections on the whole topic and the processes and links to adequate discussions. This final part also comes up with hints to additional information and offers a summarizing view to help the learner with the contextualization of the whole Microteaching Setting. With a duration of approximately 5 minutes this part of the setting is also smaller than the core learning units.

4. OPALESCE INTERACTIVE TASK SYSTEM

The Interactive Task System (ITS) is an interactive exercise system that aims to assess the learning progress of the users. Therefore, we will be concerned here with the identification of appropriate assessment formats, particularly under consideration of the requirements and limitations of mobile touch-screen devices in this context. A scoring system is part of the ITS, too.

Considering that there are no educators in the Distance Learning System that will directly influence the learning processes of the learner's, it is the self-reflection, the identification of one's own weaknesses, and thus providing the learner's with everything necessary to improve in a self-directed approach what should be focused in OPALESCE.

When having a look back on the structure of the Micro Unit setting, we will see that formative assessment purposes were already considered, due to the aspect that each of the Micro Units has an assessment part at the end. Thus, the learner's will receive feedback on their learning process several times, and they can

decide on their own if they are keen to progress and to use more difficult resources, or if they would like to repeat the basics again. When the learner's will only use one Micro Unit, then the assessment is summative. Additionally, the learners could be provided with a Micro Unit that focuses on assessment only at the end of a Resource Suite. A specialty we need to have in mind when talking about the assessment of the learning success of the OPALESCE systems' users is, that we are talking about informal learning on the one hand, and about adult learners on the other hand. Therefore, the assessment forms have to be designed in a way that shows the learners the merit for their own learning process. The learners need to understand that it is not the idea to mark them, which would be the case in formal learning processes. Hence, we should not only be concerned with choosing the correct assessment forms, but also with designing them in a way that is not perceived as getting assessed or marked by the learners and that helps them to reflect on what they have learned and thus to foster sustainable learning processes.

Anyway, following we will describe different potential assessment formats that could be used within the web-based and the app-based version of the OPALESCE Distance Learning System. Each of them follows the idea to help the learner's reflect on what they have learned, to support the learning transfer, and to assess if generous learning took place [8]. Nevertheless, due to the technical limitations of the system we have to take into account that there will be a trade-off between the objectives of the assessment and the feasibility of different assessment formats in such a Distance Learning System.

a) Single-/ Multiple-Choice Tests - The learners will be provided with a more or less complex question and four potentially correct answers. The correct one's need to be chosen.

b) Matching Tests - The learners will be provided with a set of incomplete information on the one hand, and a set of bricks that could be used to complete these information on the other hand. The learners are required to assort the correct brick to the corresponding incomplete information.

c) Catch the fake - The learners are provided with a series of statements one following another in a five to ten second rhythm. The statements are either correct or wrong. The correct one's need to be identified.

d) Puzzles - The learners get provided with different slices of a graphic that need to be put back on the right place in a logical way.

e) Arrange-the-Sequence - The learners are asked to put different parts of a process or logical sequence back in the right order.

f) What's to do next? - The learners are provide with a problem and a selection of possible solutions. They need to choose the correct one.

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