



O1-A4: Handbook

Prepared by the OPALESCE project-consortium

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Contents

Tables and Images.....	2
Figures.....	3
1 Introduction.....	4
2 Theoretical Background.....	4
2.1 Didactics in E-Learning.....	5
2.2 Andragogy.....	6
2.3 Cognitive Theory of Multimedia Learning.....	7
3 Micro Units.....	10
3.1 Structure.....	11
3.2 Elements and their Learning Support Functions.....	13
3.2.1 Text Elements.....	13
3.2.2 Graphic Element.....	14
3.2.3 Audio Element.....	15
3.2.4 Video Element.....	16
3.3 Assessment.....	16
3.4 Bibliographic Information.....	18
4 Guidelines for the creation of Micro Units.....	20
5 Annex.....	32
5.1 Micro Unit Examples.....	32
5.1.1 Example 1: Chopping Onions.....	32
5.1.2 Example 2: Individualization of one's own profile.....	38
5.2 Glossary.....	47
6 Bibliography.....	48

Tables and Images

Table 1: Learning Outcomes according to MAYER	9
Table 2: Multimedia Design Principles according to MAYER	10
Table 3: Phases of a Micro Unit.....	12
Table 4: Phases of a Microteaching Setting.....	13
Table 5: Elements available for the Micro Units	13
Table 6: Overview about the assessment formats	18
Table 7: Bibliographic Information of Learning Resources (modified by Beutner/ Teine)	18

Figures

Figure 1: Theoretical basis of the Micro Units	5
Figure 2: Principles of constructivism according to LE/WEBER/EBNER (2005)	6
Figure 3: Sciences of learning, assessment, and instruction (MAYER, 2005)	8
Figure 4: Cognitive Theory of Multimedia Learning according to MAYER (cf. 2011: 81)	8
Figure 5: Structure of an OPALESCE core Micro Unit	11
Figure 6: Structure of the OPALESCE Microteaching Setting	12
Figure 7: Guideline for the design of Micro Units	20

1 Introduction

This document as part of the project 'OPALESCE – Online Portal and Active Learning System for Senior Citizens System for Senior Citizens in Europe'¹ is a Handbook that addresses persons interested in the creation of a special kind of learning resources – the so called Micro Units. Micro Units, however, are short learning units that adhere a certain structure to safeguard didactical quality and learning quality and learning scientific soundness, and they are optimized for the use by seniors and elderly people via a mobile learning app (Table 2: Multimedia Design Principles according to MAYER

→

During the conceptualization phase of the Elements (→ 3.2), the Learning Support Functions (→ **Erro! A origem da referência não foi encontrada.**), and the Guideline for the creation of Micro Units (→ 0) we had the different approaches and principles mentioned above in mind and are confident that they will really help future Micro Units creators to adhere them in their last preparations as well and thus to create valuable learning resources.

Anyway, at this point of the Handbook we want to leave theory behind and to get more practically oriented. Therefore, we will have a closer look on the Micro Units following. Furthermore, we will provide many information that will help to create high quality Micro Units and a step-by-step guideline as well

Micro Units). This Handbook therefore is to understand as a guide that provides future resource creators, respectively the creators of Micro Units, with

1. concise insights into the Micro Units didactical and scientific background,
2. an understanding of the Micro Units themselves, their structure, the so called Elements, and assessment formats, and
3. a practical step-by-step guideline for the creation of Micro Units.

We have to acknowledge that this document focuses on the background behind the Micro Units and their creation only. Therefore, this document is complemented by a technical one that guides the resource creator through the process of making his Micro Unit accessible by the Distance Learning System (☐ Glossary).² Thus, it focuses more on the technical site and the systems User-Interface. Furthermore, we want to recommend every resource creator to have a look into the *Learning Concept Design and Interactive Task System* as well. This document provides way more encompassing, yet summarized insights into the theoretical background that lays behind the Micro Units.³

¹ For further information please have a look on the projects website (<http://opalesce.eduproject.eu>) or into the document of the Learning Concept Design & Interactive Task System.

² The document can be downloaded here: [Link to handbook on website!](#)

³ The document can be downloaded here: [Link to LCD & IST on website!](#)

2 Theoretical Background

The Distance Learning System is optimized for the use by seniors and elderly people which do have, to a certain extent, other learning preferences and needs than younger people. Therefore, it is necessary to have a look on different scientific and theoretical approaches to safeguard that the system meets the needs and demands of the targeted users, and to ensure that learning really is fostered best. Such approaches are located in the field of pedagogy, didactics, and learning theory in general - and their application in e-learning in particular. Special attention was paid to the field of andragogy, the “art and science of helping adults learn” (Knowles, M. S. 1980: 43). These two approaches to learning are complemented by MAYERS Cognitive Theory of Multimedia Learning (cf. 2005, 2011) that provides sound design principles for the preparation of learning content in e-learning environments. These different approaches, however, have to be seen as complementing each other, not as a hierarchy or sequence.



Figure 1: Theoretical basis of the Micro Units

Following we want to have short insights into the different theoretical approaches with the idea to provide the absolutely necessary theoretical background.

2.1 Didactics in E-Learning

Generally spoken, the term ‘e-learning’ describes learning arrangements and scenarios where information or communication technology is used to support the learning process or to provide learning materials and contents. This approach is accompanied by ever growing opportunities that need to be utilized. Therefore, however, there is the need for strong pedagogical and didactical principles that help to harness the opportunities (cf. Reimann, R. et al. 2012: 5; Ehlers, U.-D. 2004: 31; Arnold, P. et al. 2011: 18; Scheffer, U./ Hesse, F. W. 2002: 16; Schrammel, S. 2008: 119; Govindasamy, T. 2002: 288). Fortunately, a lot of research has been undertaken in these fields. Besides the application of principles that work in traditional settings as well, ideas from instructional design, and especially the application of principles of the constructivists learning theory plays an important role in the development of innovative e-learning scenarios (cf. Pechuel, R./ Beutner, M. 2013: 932f.; Gilakjani, A. B./ Leong, L.-M./ Ismail, H. N. 2013: 57). Hence, we focused on such ideas, approaches, and principles as well when we were conceptualizing the Distance Learning System and the Micro Units in particular.

The constructivists learning theory is based on the assumption that learners construct their own understanding of their surrounding and the reality, based on their perception and experiences. Knowledge, however, is constructed in an active and dynamic process and seen as a function of the learner's experiences, mental structures, and beliefs that build the basis for his interpretation of objects and events. The constructivism focusses on the individual and its active involvement into the learning process to foster his understanding and learning transfer. Learning "is understood to be a self-regulated process of resolving inner conflicts that become apparent through concrete experience, discussion, and reflection" (Gilakjani, A. B./ Leong, L.-M./ Ismail, H. N. 2013: 49f.; cf. also Alonso, F. et al. 2005: 219). According to LE/ WEBER/ EBNER, it is desired that learning processes are based on the learner's active participation and feedback, trial-and-error learning, leaving the learners the opportunity to choose their own path and to let them determine the pace, social exchange of knowledge and experiences, self-efficiency experiences, and problem-oriented learning in authentic contexts (cf. 2013: 5).

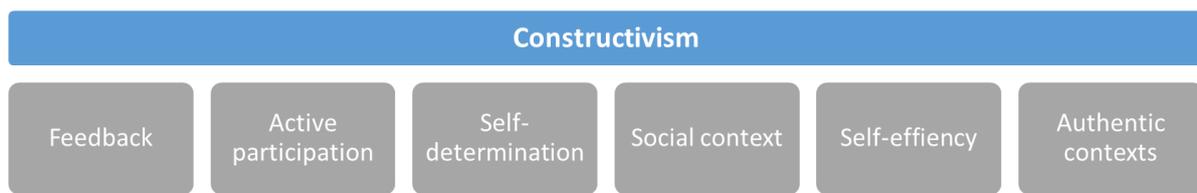


Figure 2: Principles of constructivism according to LE/ WEBER/ EBNER (2005)

This explanations and the graphic might help you to get an impression of how learning situations should be designed, to provide the learners with the opportunity to have valuable experiences that foster learning, to stay motivated, and to learn sustainably.

Besides the constructivists learning theory the conceptualization of the Micro Units took other pedagogical and didactical principles that derive from context like e-learning, vocational training and pedagogic literature in general into account as well. Here, we also had in mind that the Micro Units will be used for informal learning processes. The following list should provide an overview about central principles written as some kind of hierarchical list you should follow when desgning a high-quality Micro Unit (cf. Dichanz, H./ Ernst, A. 2002: 56; Tam, M. 2000: 57; Alonso, F. 2005: 221; Tramm, T. 2004: 2; Gilakjani, A. B./ Leong, L.-M./ Ismail, H. N. 2013: 49; Caniëls, M. C. J./ Smeets-Verstraeten, A. H. J. 2009: 10):

- (1) Choose a meaningful problem or authentic situation as a reference for your content, so that the learners can apply what they have learned and that transfers takes place.
- (2) Outline the learning objectives clearly and set them appropriate to the target group. Consider the learners previous knowledge and existing competencies.

- (3) Organize the learning contents in a conceptual framework that is oriented on the learning objectives - particularly when several Micro Units build up one on another.
- (4) Take reflection and de-contextualisation phases into account. Provide the learners with structures they can reflect what they have learned on.
- (5) Create an assessment for the evaluation of the learning processes. Not for marking the learners, but to support them in their self-evaluation processes.

2.2 Andragogy

A specialty of the OPALESCE project is its target group of Europe's senior citizens and elderly people, particularly in the field of e-learning and the development of a learning application for mobile devices. This, however, makes it necessary to have a closer look on the so called Andragogy – “the art and science of helping adults learn” (Knowles, M. S. 1980: 43). The Andragogy outlines fundamental assumptions about how adults learn, by seeing learners as individuals that develop on the following spectrums (cf. Knowles, M. S. 1980: 43-45; Zmeyov, S. I. 1998: 105-106):

- (1) The learner's self-concepts develops 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) The orientation of learning changes as the individuals mature from a “postponed application of knowledge” to an “immediacy of application” (Zmeyov, S. I. 1998: 106). Adults want to learn something that will have a direct effect on their competencies, so that they can exploit their potential.

These assumptions do already reveal many information about how learning content should be prepared, and furthermore they leave enough space for one's own interpretation. Besides this, KNOWLES outlined practical implication based on these and three more assumptions about how adults learn. The central and for our purpose most relevant implications are the following (cf. Knowles, M. S. 1980):

- (1) Arrange the learning-setting informally and with respect to the special needs of adults, seniors, and elderly like a declining sensitivity.
- (2) Provide the learners with the opportunity to find out their learning needs and with a measure of their competency-level. Do not tell them what they have to learn.
- (3) Enable the learners to plan their own learning process to engage them.

(4) As a teacher or co-learner you should act as a catalyst or co-inquirer of the learning process.

2.3 Cognitive Theory of Multimedia Learning

The Cognitive Theory of Multimedia Learning from MAYER (cf. 2005, 2011) is based on three so called 'sciences' which are divided into several assumptions each. Here, we cannot have an encompassing look onto these sciences, but we will convey a basic understanding of them. The three different sciences and their foci are the following:⁴

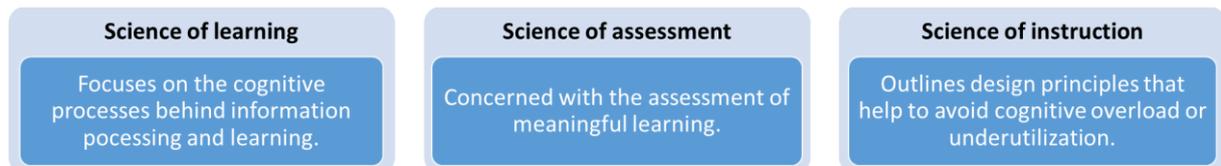


Figure 3: Sciences of learning, assessment, and instruction (MAYER, 2005)

The *science of learning* is based on the assumption that people do have two different cognitive channels to process either auditory or visual information. Each of these channels can process only a limited amount of information, otherwise cognitive overload will occur which hinders meaningful, sustainable learning. Furthermore, MAYER states that meaningful learning is based on active cognitive processing by which it is meant that learners seek to make sense of multimedia presentations. The limited cognitive capacity requires people to judge about the relevance of information and to select it, so that this information can be connected and be used to create simple, coherent mental representations in the working memory. The different verbal and pictorial models that are created will be brought together into an integrated representation which also contains information about the relations of the different models and stays in the long-term memory. These processes can be visualized as follows:

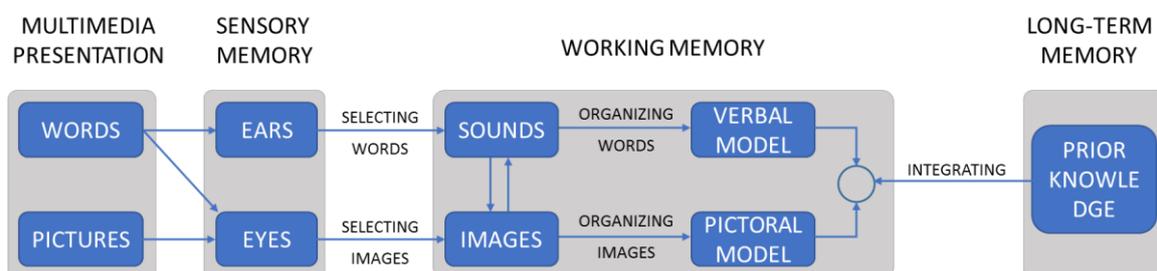


Figure 4: Cognitive Theory of Multimedia Learning according to MAYER (cf. 2011: 81)

Learning contents and materials should be prepared to support these processes. Therefore, knowledge about the science of instruction is inevitable.

⁴ For further information please have a look into the Learning Concept Design & Interactive Task System.

The *science of assessment* focusses the learning outcomes, the instructional effectiveness of a system, and individual differences in learning. However, according to MAYER there are three types of learning outcomes that can be assessed either via a retention test or transfer test:

Learning Outcome	Description
No learning	The learners fails to select, organize, or integrate new information to the long-term memory. Only a poor performance can be measured on either retention or transfer tests.
Rote learning	The learners selects and organized new information and he builds mental models, but he do not integrate it into prior structures. The learners only memorizes facts which is why the performance might be good on retention but bad on transfer tests.
Meaningful learning	The learners runs the five cognitive processes in a coordinated way. He selects, organizes, and integrates information into the long-term memory. He makes sense of what he has learned, and shows good performance on both retention and transfer tests.

Table 1: Learning Outcomes according to MAYER

The *science of instruction*, which is often referenced under the term ‘design principles’, is based on the assumption that learners experience extraneous, essential, and generative processing whilst learning in multimedia environments. These different processes effect the learning outcomes in several ways. Due to the limited cognitive capacity of the learners, these processes can lead either to extraneous or essential overload, or to generative underutilization. To avoid these three types of ‘instructional scenarios’, different design principles should be adhered to foster learning best. The following table will provide you with a concise overview:

Principle	Descriptions	Scenario
Coherence principle	Extraneous information should be excluded.	Extraneous overload
Signalling Principle	Cues related to the organisation of essential material should be highlighted.	Extraneous overload
Redundancy Principle	Information should not be presented twice. “People learn better from animation and narration than from animation, narration, and on-screen text.” (p. 90).	Extraneous overload
Spatial Contiguity	Corresponding information (word/ pictures) should be placed near to each other.	Extraneous overload

Principle		
Temporal Contiguity Principle	Corresponding information (word/ pictures) should be presented simultaneously.	Extraneous overload
Segmenting Principle	Learning material should be presented in user-paced units – not as a single one.	Essential overload
Pretraining Principle	People learn better, when they do already have knowledge about basics.	Essential overload
Modality Principle	Animation and narration is better than animation and on-screen text.	Essential overload
Multimedia Principle	Words and pictures are better than words alone.	Generative underutilization
Generation Principle	Learners are asked to create own materials based on what they have learned.	Generative underutilization
Personalization Principle	Words should be in a conversational rather than in a formal style.	Generative underutilization
Voice Principle	Text should be spoken in a friendly human voice, not in a machine voice.	Generative underutilization

Table 2: Multimedia Design Principles according to MAYER

During the conceptualization phase of the Elements (→ 3.2), the Learning Support Functions (→ **Erro! A origem da referência não foi encontrada.**), and the Guideline for the creation of Micro Units (→ 0) we had the different approaches and principles mentioned above in mind and are confident that they will really help future Micro Units creators to adhere them in their last preparations as well and thus to create valuable learning resources.

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3 Micro Units

The idea behind the Micro Units derived from the claim to create an easy to use Distance Learning System for senior citizens that harnesses the opportunities offered by mobile touchscreen-devices for learning purposes. Therefore, we oriented to some extent on the learning nugget-approach from BAILEY et al. They focus on nuggets as a representation of “stand-alone learning activities that would vary in size and scope. [...] Nuggets are primarily comprised of tasks that learners will undertake in a particular context in order to attain

specific learning outcomes.” (Bailey, C./ Zalfan, M. T. / Davis, H. C. / Fill, K. / Conole, G. 2006: 113)

What makes OPALESCE unique is that the Micro Units are part of informal learning processes and that the resource creators are typically not educators, pedagogues, or other professionals in the field of the design and creation of learning resources. Therefore, we created a blueprint for the structure of the learning resources resp. the Micro Units, and a guideline that helps creators to develop such resources as well. Following, we want to introduce you into the concept behind the Micro Units and we will illustrate the guidelines based on an example.

3.1 Structure

We have already mentioned that Micro Units do have a pre-defined structure that should be adhered by the resources creators. This structure divides a single Micro Unit into different phases, which are the following: Activating beginning, Explanation, Tasks, Assessment, and Final Information (→ Table 3: Phases of a Micro Unit). Each Micro Unit should not exceed a duration of 15 minutes. Within these 15 or less minutes all phases should find consideration, but it is possible for the resource creator to set a focus or to emphasize on one phase, e.g. the tasks-phase, in particular if it seems appropriate. Anyway, the following graphic will provide a suggested time-structure for the different phases:

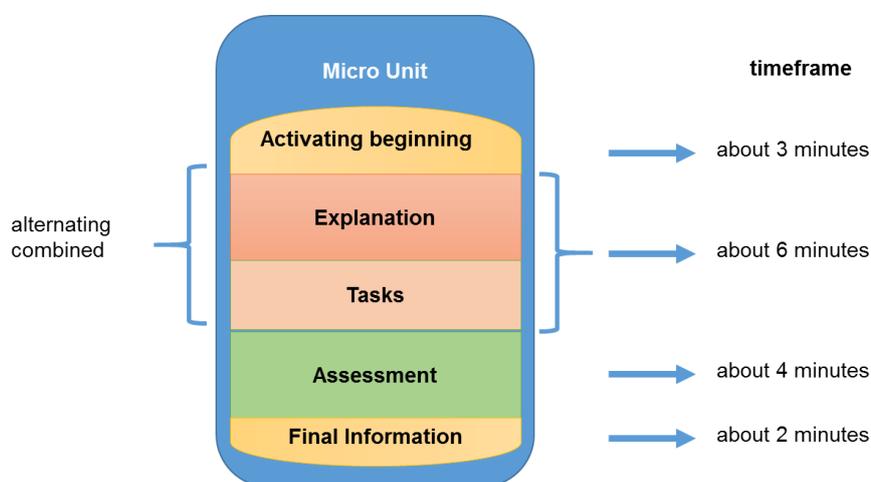


Figure 5: Structure of an OPALESCE core Micro Unit

Apparently, the Micro Unit shown above is based on an approximated duration of 15 minutes. Thus, the time allocated to each of the phases varies as the overall duration does. Anyway, the relation of the time allocated to the different phases should be kept the same, even when having a Micro Unit with an approximated duration of, e.g., only 10 minutes. Anyway, the idea behind the different phases is described in the following table:

Phase	Description
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Activating beginning	In this phase the learner will be informed about the aims of the Micro Units and its importance for real life situations. Furthermore, the learner will get a rough impression of the contents structure.
Explanation	The Explanations phase is concerned with providing the actual information and learning content in a way that motivates and engages the learners and suits the target group best.
Tasks	In the Tasks phase the learner will get tasks or he will be provided with exercises he should do and work-out so that, at best, the learning content can be transferred and applied in real-life.
Assessment	The assessment is concerned with measuring the learning outcomes of the learners to help them with the self-diagnosis of their learning needs and accomplishments.
Final information	In the final information phase the learners might be provided with a reflection of the content, recommendations for further topics and themes, etc.

Table 3: Phases of a Micro Unit

As a maximum of 15 minutes is only a very limited amount of time to convey information, Micro Units can be arranged in a curriculum-like Microteaching Setting. Such a Microteaching Setting consists of Micro Units that refer one to another, and it can be visualized as follows:

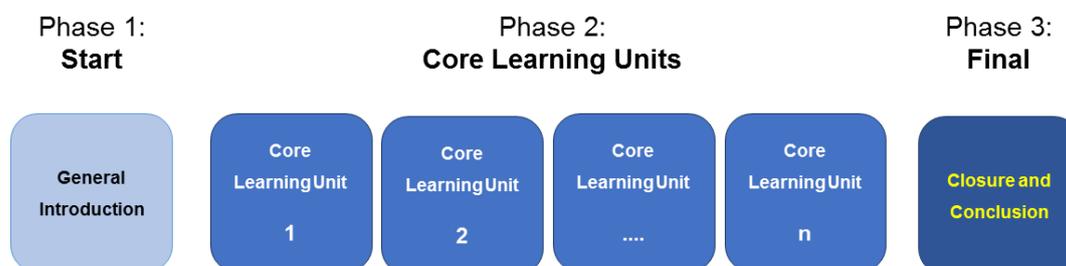


Figure 6: Structure of the OPALESCE Microteaching Setting

The creation of a Microteaching Setting is particularly recommended either for encompassing or difficult topics and problems. This makes it possible to provide the learners with focused Micro Units that concentrate on one sub-topic or one step of a problem-solving process only. Furthermore, it helps to create some kind of a spiral-curriculum like content structure and to have a balance between theory and practicing. As the Core Learning Units should definitely adhere the proposed structure, the Micro Units related to Phase 1 & 3 might (~5 minutes each) vary starkly as they are concerned more with the activation of the learners or the assessment of their learning accomplishments. However, the different phases can be described as follows:

Phase	Description
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. 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.
Core Learning Units	The Core Learning Units are Micro Units divided with regard to the different sub-topics. Here, the actual learning content is provided. Each of the Micro Units will adhere the mentioned structure.
Closure and conclusion	The closure and conclusion has an approximate duration of 5 minutes and will provide the learner with possibilities for reflection of the whole topic and processes and links to adequate discussions. This final part also comes up with hints to additional information and offers a summarizing View (📖 Glossary) to help the learner with the contextualization of the whole Microteaching Setting.

Table 4: Phases of a Microteaching Setting

Anyhow, it must be stressed that this structure is some kind of general recommendation and it should be, at best, adhered. But dependent from the specific content or the way how the content interrelates some adjustments might become reasonable. Therefore, adaptations and adjustments are part of the design process as well.

3.2 Elements and their Learning Support Functions

To have a very basis for the conceptualization and development of Micro Units we decided to rely on something we have named *Elements* (📖 Glossary), which are, generally spoken, different ways to prepare learning content. The different Elements, however, can be combined as it seems to be appropriate considering the content and target group. Nevertheless, during our evaluations seniors mentioned their preferences for graphic, audio, and especially video elements. Furthermore they have stressed that too many different types of Elements in one Micro Unit might distract and confuse them. Please consider this information during your resource creation process. The following table gives an overview about the different Elements:

Text Element	Graphic Element	Audio Element	Video Element
Explanation	Simple Graphic	Audio	Video
Definition	Animated Graphic		

Text Source	Interactive Graphic
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Table 5: Elements available for the Micro Units

A specialty of the Elements and an innovative aspect of the OPALESCE Distance Learning System as well are the so called *Learning Support Functions* (📖 Glossary). Following, we are going to describe both, the different Elements and their Learning Support Functions as well.

3.2.1 Text Elements

A text element conveys information through written text. There are three types of text elements which have special functionality to support the learning process.

Explanation

An explanation is a short text which describes an idea, a concept, or a situation very briefly. When designing an explanation as a content element remember to focus on one thought. A rough guideline is that an explanation should be no more than three sentences long. Longer texts should be grouped into main aspects and spread over several explanation content elements.

★ *Learning Support Function*

With a simple gesture the learner will be able to compress the explanation to only a few keywords. The keywords become bold and larger as the rest of the text fades into the background. This will allow the learner to memorize the essential words more easily. Repeating the gesture returns the text to normal.

Definition

A definition is a text element that the learner should memorize as is. By nature definitions should be short and to the point and are often quoted from other sources. Definitions are marked as such so that the learner immediately recognized them for what they are.

★ *Learning Support Function*

With a simple gesture the learner will be able to hear the definition spoken. The written definition will stay visible during the spoken definition.

Text Source

A text source is a longer text that can be used if a source needs to be quoted. Text sources can be longer and they are the only text element that scrolls down. Since longer texts take a lot longer to read these content elements should be used infrequently. However, there are certain situations in which it is important for the learner to see an original text source.

★ *Learning Support Function*

With a simple gesture the learner will be able to compress the text into a brief summary. Applying the gesture again returns the full source text.

3.2.2 *Graphic Element*

Graphic elements are essentially pictures (such as drawings, diagrams, photos, etc.) that convey information or concepts. There are three types of graphic elements:

Simple Graphic

The simple graphic element is a static picture that can be displayed. It could be a photo (especially when showing a historic person or a place or when a location or an atmosphere needs to be presented), a diagram (especially when explaining a concept or for statistics), a flowchart (when explaining processes), a drawing (especially when illustrating concepts), etc. Simple graphics can have words integrated into them but they should never mix pictures with whole sentences (in that case use a simple graphic followed by a text element or the other way around).

★ *Learning Support Function*

A simple gesture will give the learner a picture overlay that could point to something in the picture, put words on the picture, highlight an area or fade out parts of the picture. Applying the gesture again removes the overlay and returns the normal picture display.

Animated Graphic

The animated graphic element is mostly used for diagrams and flowcharts that change in several steps. These graphics consist of several images arranged in a chronological order. They are automatically animated so that the view cycles through the different steps and then starts again at the beginning.

★ *Learning Support Function*

With a special gesture the learner will be able to stop the animation and go through the animated graphic picture by picture. Applying the gesture again returns the auto play status.

Interactive Graphic

The interactive graphic is a content element that displays a picture which lets the learner interact with. That means the learner will be able to touch certain elements of the picture and the picture changes accordingly. An example would be displaying a motor and when the learner touches a certain part it will be displayed more prominently. Another example would

be an information graphic of a production system and when the learner touches a section it will animate the processes in that section.

★ *Learning Support Function*

With a special gesture the learner can briefly display the “hotspots” on the graphic (the areas to interact with). After highlighting the hotspots the view will automatically go back to normal in approximately 3 seconds.

3.2.3 Audio Element

An audio element is a short content element that the learner can listen to. It should not be longer than a few seconds. There is only one type of audio element.

The audio content element can be used to share original audio sources or to convey information that is best shared this way (such as getting an atmosphere across or when teaching something that focuses on audio impressions, such as music or the different sounds of birds). Don't use the audio element for a definition.

★ *Learning Support Function*

With a special gesture the learner will be able to see the written text of what can be heard. If the audio provides no text a simple explanation of what can be heard will be displayed. Applying the gesture again hides the text.

3.2.4 Video Element

A video element is a short film, either with or without audio. There is only one video element. The video content element can be used to embed a short video. The video should be very short (less than a minute, if possible) because a view should always focus on one idea or aspect only. Videos are versatile elements with the inherent danger of putting the learner into the role of a passive consumer. The learner will be able to pause the video and to forward and rewind it.

★ *Learning Support Function*

With a simple gesture the learner can stop the video and display a summary of the video as a text overlay. Applying the gesture again hides the text and returns the view to the video.

3.3 Assessment

The assessment and evaluation of learning outcomes and processes is an integral part of every formal learning process, but of informal ones as well. In the OPALESCE project the assessment is designed primarily to support the learners in their self-evaluation and to foster sustainable learning – not to mark learners. Therefore, we have designed different

assessment formats that are bespoke to the target group and designed in an interactive, engaging, and motivating way. The following table might provide you with some short insights (see Learning Concept Design & Interactive Task System for more information):

Assessment format:	Short description:
Single-/ Multiple-Choice Tests	Single-/ Multiple-Choice tests are particularly appropriate to test the recognition of facts or theories, but when designed right deep understanding of a matter can be assessed as well. The advantage of this format is its simplicity regarding its creation. The idea is to provide the learners with a more or less complex but short question and four potentially correct answers. After giving answers, the learner will be provided with a feedback.
Matching Tests	<p>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. Therefore different formats can be used:</p> <ul style="list-style-type: none"> • <i>Drawing connections:</i> Words or graphics from different lists need to be linked with a line. • <i>Assigning descriptions:</i> The learners needs to assign descriptions to corresponding parts on a graphic/ process. • <i>Gap texts:</i> Learners are provided with a list of words that must be assigned to the correct gap in a written text.
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 and swiped away from the screen. The learner will receive a short feedback if and why his answer was correct – or not.
Puzzles	The learners get provided with different slices of a graphic/ pattern he has seen before in the Micro Unit. He is required to put these slices back into the correct order by arranging them on a canvas via drag-and-drop. The learner will be provided with a short explanation of the graphic once he was successful.
Arrange-the-Sequence	The learners are asked to put different parts of a process or logical sequence back in the right order. Therefore, they

	get an empty process-scheme and a selection of pictures/ images that need to be put onto the right place by drag-and-drop gestures. The learner will receive a short feedback.
What's to do next?	The learners are provide with a problem related to the examined content, and a selection of possible solutions. Now, he is required to choose the correct solution. Once he was successful he gets provided with an explanation of why the solution was the correct one. This really fosters a sustainable learning and assess the learners understanding.

Table 6: Overview about the assessment formats

3.4 Bibliographic Information

In 2009, the *Schweizerische Fachstelle für Informationstechnologien im Bildungswesen* (Swiss Department for Information Technologies in Educational Contexts; SFIB) outlined quality criteria for electronic teaching and learning resources, which are seen, based on their definition of such resources, as valid for Micro Units as well. However, besides a check on the validity and correctness of the communicated contents, the SFIB divided the description of the learning resources into a bibliographic and a pedagogical field. Here, we are going to focus on the bibliographic information only, because the didactical criteria have been outlined previously. Anyway, the bibliographic information may help to find the Micro Units within the Distance Learning System and provide important information. According to the SFIB, the following metadata is necessary to describe a learning resource (cf. SFIB 2009: 7-8).

Metadata	Description
Unique Identification	Learning resources need unique identification codes.
Title	The resources should have a clear title, which provides an impression of what will be addressed in the resource.
Short description	As short description provides the reader with an overview and describes the main aspects of the learning resource in a few words or sentences.
Key words	The displayed content should be described based on fixed or free key words to facilitate search processes.
Language	If a resource is available in different languages, than each of the resources should have an own bibliographic description and could provide a hint to the other languages available.
Responsibility	The creator of the learning resource should be identifiable.

Author	It is mandatory to have information about the author.
License	It is important to provide information how the author has licensed his resource (for example based on creative commons).
Target group	A short description of the target group offers the opportunity for the users / learners to select micro-units in an easier way according to their needs and interests.
Funding	If there is any funding for the creation of the resources, this funding and funding source should be mentioned as well.

Table 7: Bibliographic Information of Learning Resources (modified by Beutner/ Teine)

4 Guidelines for the creation of Micro Units

- 1 Definition of the problem-context**
In either case your first step should be to identify, concretize and define the theoretical or practical problem-context as the basis of your learning resource and the learning activities.
- 2 Description of your target-group**
Create a short-description of the characteristics of your target-group. This encompasses general information about the targeted persons but their interests or required previous-knowledge.
- 3 Description of the learning objectives**
Outline the intended learning objectives by describing the theoretical knowledge and facts the learners will know afterwards and the practical skills that will be acquired. Be conscious of your target-group here.
- 4 Bibliographic and resource information**
Describe the meta-information of your learning-resource. Its title, a short-description, keywords, a unique identifier in the portal, link it to resources for more- or less-advanced learners and outline its author and license.
- 5 Chosing the elements or resource template**
Chose the Elements or pre-defined resource formats fitting best to your content and the target-group described. Your choice should be dependent from your learning objectives and the kind of planned interactivity.
- 6 Preparation of the learning content**
Prepare and design your learning content in a way appropriate to the content and target-group. Motivate the learners to participate actively and try to foster learning under consideration of design principles.
- 7 Think about exercises and assessment**
Design excercises and assessments to engage the learners to repeat the learning contents and to abstract and transfer what they have learned to other contexts. This will foster sustainable learning.

Figure 7: Guideline for the design of Micro Units

Step 1: Definition of the problem-context

The first step of your resource-creation process should be to identify, concretize and define either a theoretical or practical authentic problem-context. This problem-context should be, at best, relevant to the target group member's daily-life's. Your aim should be to teach knowledge or to help the learners acquire skills that can be applied to a certain real-life problem immediately. For clarification: The value of a Micro Unit is not directly related to the complexity of the problem-context examined. It is about having a problem relevant to the target group and providing them with the knowledge and to help them acquire skills to solve this problems. Such authentic problem-contexts and realistic situations are highly valuable for the successful learning process as well. It will help the learners to identify connection in-between the different matters that are represented, it will make learning meaningful, and the learners can reflect their theoretical knowledge on practice et vice versa. Furthermore, showing the relation between theory and practice or, at best, examining theory based on a practical problem-context will support the transfer process of the learners, so that it will be easier for the learners to immediately apply what they have learned. Particularly when focusing on adult learners it is absolutely inevitable to consider this aspect to keep them motivated and engaged into the Micro Unit respectively the learning content. It should be kept in mind that successful learning is based on problems – not subjects.

Summarized, the following sub-steps might be necessary for a resource creator to complete this step:

1. Identify either a theoretical or practical problem-context that is relevant to the daily-life's of your target group's members. Write down, why it is relevant to some group of persons.
2. Concretize your problem, reduce it, and write down its core aspect that should be the basis for your Micro Unit. Often, it is not necessary to provide the learner with every detail. Keep it as simple as possible and provide the learners only with those information that really are necessary for the learning process/ to understand the problem. Consider, that the learners will create reduced mental models of what they learn. Help them to make this creation process easier and more effective.
3. If you would like to teach theory, look for a practical problem or situation that can be used to examine the content based on an example. If you would like to show a problem-solving process, research its theoretical basis to provide the learners with reasons why your actions help to successfully solve a problem.

 *Example: Chopping onions*

Presumably every person knows the terrifying feeling when you have to cry whilst cutting onions into small, similar cubes. It is not only extremely annoying to wipe away the tears but it is also dangerous as well because the tears might blur your vision and you will cut yourself. Therefore, this Micro Unit will provide the learners with the theoretical background about why they have to cry when cutting onions and how to avoid to do so. Furthermore, the author will showcase a technique of cutting onions into perfectly similar cubes without having to cry. Here, theory and practice will be brought together.

Step 2: Description of your target group

It is inevitable to have a detailed picture of the target group of one's Micro Unit as this will affect the way of how the content needs to be prepared and presented. The members of your target group might differ in aspects like their previous knowledge regarding a certain topic, their educational level, their preferences regarding interactivity, their fields of interest, and many more. Therefore, it is necessary to describe the targeted learners at least in relation to the following characteristics: Fields of interest, previous knowledge, educational level (might affect the complexity of content), and the estimated learning needs (What is their problem?). Additionally, characteristics like special needs of the target group (disabilities), their aspirations, their experiences, or their preferred learning styles (cf. e.g. Kolb, A. Y./ Kolb, D. A. 2005) could be part of the description as well.

Consider: Neither is it necessary to describe your target group related to every characteristic possible nor is this table to understand as all-embracing. Describe the targeted learners in a way that allows you and others to have a clear understanding about how you can design a Micro Unit that suits their needs and preferences best.

 *Example: Chopping onions*

Description of the target group

This Micro Unit addresses every person that would like to learn how onions could be cut into small and similar cubes in a fast way without crying and without cutting yourself. The resource will be designed so that the transfer into practice can take place immediately.

Fields of interest:	Cooking
Experiences:	The learners should know how to handle a sharp knife safely.
Learning style:	Physical; practically oriented
Miscellaneous:	The learners should have a sharp chef-knife and an anti-slip

	chopping board. Furthermore, two onions will be required for practicing purposes.
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 *Example: Consumption engines and exhaust turbochargers*

Description of the target group

This learning resource addresses people that would like to change to acquire a general understanding of how consumption engines work and that would like to diagnose problems with their engine or charger-system to undertake minor repairs by themselves.

For teaching purposes, we will have a focus on 6-cylinder v-type engines with an exhaust turbocharger system.

Fields of interest:	Tinkering on cars; mechanics; technics/ engines
Previous knowledge:	General understanding of the functionality of consumption engines; understanding of the differences between v-type and in-line engines; understanding of the differences between turbochargers and compressors.
Experiences:	The learners should have gathered first practical experiences with tinkering on cars.
Miscellaneous:	This resource addresses learners that are keen to transfer what they have learned into practice. Therefore, they should have, at best, a small garage and tools to apply what they have learned.

Step 3: Description of learning objectives

When designing a learning resource it is necessary to describe the learning objectives and intended learning outcomes of the resource in detail. Such descriptions are necessary to help the learner to identify if the resource is relevant and interesting to them. Which is particularly important when focusing on self-directed and self-paced learning and the requirement of an opportunity for a self-diagnosis of the learner's learning-needs. Here, we want to stress again that it is necessary to set the learning objectives appropriate to the target group.

This step focuses primarily on two major questions that need to be answered in the description of the learning objectives:

1. Which theoretical knowledge will the learners master after the completion of the Micro Unit?

2. What are the practical skills that will be acquired respectively which practical problem can be solved by the learners when they have used the resource?

The following example shall give an impression of how a description of the learning objectives could look like.

 *Example: Chopping onions*

Theoretical knowledge:

After the completion of the Micro Units the learners will have acquired the following theoretical knowledge:

- The learners will know about the general structure of onions and their cells.
- The learners will be familiar with the basic information about amino-acid Isoalliin and the enzyme Alliinase.
- The learners will know that Alliinase breaks down Isoalliin and that this process creates a gas that makes people cry as it gets in contact with their eyes.

Practical skills:

After the completion of the Micro Units the learners will master the following things:

- The learners will be able to operate and use a chef-knife correctly and safely.
- The learners will be able to chop an onion into small, similar cubes by applying the technique examined within the Micro Unit.

Step 4: Bibliographic and resource information

As the Micro Units are developed for the Distance Learning System respectively as multimedia learning resources that can be accessed via an online platform, there is the special need to line out its bibliographic and basic information. Such description are necessary to catalogue and manage the resources but to help the learners find the contents and resources they are looking for as well. Therefore, information like the title, a short description, keywords, a unique identifier, and some more information as outline in Table 7: Bibliographic Information of Learning Resources (modified by Beutner/ Teine) are absolutely inevitable. One's resource should also be linked to other ones that aim at learners on a less-advanced or more-advanced level. This will help the learners to find content relevant to them and to orient within a resource suite. Linking the resources one to another will also create something like a quasi-curriculum for the learners, so that they can plan their individual learning process in a self-directed way. Moreover, it will support the learner's self-evaluation regarding their learning progress and future needs. Additionally we want to say that if a Microteaching Setting is designed, the whole series should be described in this way.

 *Example: Chopping onions*

Bibliographic information	
Unique Identification:	OPA2015-6-215
Title:	Chopping onions without crying
Short description:	In this resource, the users will learn about the theoretical facts why people cry when they are chopping onions and they will learn how they can avoid crying by using a certain chopping technique.
Key words:	Chef, cooking, kitchen, vegetables, onions
Language:	German, English, French
Responsibility:	Matthias Teine
Author:	Matthias Teine
License:	CC BY (Creative Commons)
Target group:	This learning resource addresses people that would like to change to acquire a general understanding of how consumption engines work and that would like to diagnose problems with their engine or charger-system to undertake minor repairs by themselves.
Funding:	Not funded.

Step 5: Choose the elements or resource template

The preferred resource format should be chosen based on the content that shall be provided, the intended learning outcomes, and the appropriateness to the target group. As a Micro Unit needs to adhere a given structure, we have defined several elements with Learning Support Functions that will make it easy to create valuable learning resources of different kind and in various ways. These elements can be combined as it seems to be appropriate under consideration of the intended learning outcomes, the target group, and the concrete content that shall be provided and examined. To make it easier to create a Micro Unit and to provide future resource creators with ideas, hints, and something like a blueprint we have furthermore outlined four different pre-defined resource templates (see Table 5: Elements available for the Micro Units and **Erro! A origem da referência não foi encontrada.**).

Generally spoken it can be said that the resources should be built based on your knowledge about pedagogy and didactics in general but the principles outlined in the Cognitive Theory

on Multimedia Learning as well. Studying these chapters will help to get a deep understanding of how the different available elements could be combined to foster learning processes best, strongly dependent from the content.

Based on the pre-defined resource formats we would suggest the following combinations:

- (a) If basic knowledge, theoretical facts or processes and mechanisms shall be visualized and taught, the following formats might fit well: Information-reduced insights or point-and-click-information graphics.
- (b) If the purpose of the Micro Unit is to showcase how a certain problem can be handled or solved in a step-by-step approach, then these formats suit best: Moderated Tutorial, Indexed animation and videos, or a Photo Story. These formats will make it easier for the learners to apply what they get taught immediately, and they can compare their learning outcomes directly to the intended state.

The following example shall describe based on an exemplary problem-context how the decision about a certain element can be made. Consider: We decided to combine elements freely without adhering to any of the resource templates outlined before.

 *Example: Chopping onions*

Elements and resource formats	
Element:	Purpose/ Reason:
Simple Graphics	<p>Simple graphics will be used to visualize the cells of the onion and its components as they allow to have a schematic view on them. The following pictures/ scratches will be used:</p> <ul style="list-style-type: none"> • Schema of a cut-in-half-onion and its layers. • Visualization of the cell-structure of the onions with a focus on the inside of the cell and its outer cell-layer to localize the amino-acids and enzymes.
Animated Graphics	<p>Animated graphics are used to visualize the cell the schema of the chemical process when the Alliinase breaks down the Isoalliin. Therefore, the animation should show the following things:</p> <ul style="list-style-type: none"> • The nuclear-structure of the acid • The nuclear-structure of the enzyme. • The process of reaction. • The way how the gas that makes people cry is built.

	<ul style="list-style-type: none"> The reaction of the gas with the eye. <p>The animation will be supported with a spoken explanations of the different steps that are visualized in the animation.</p>
Video	<p>Video elements will be used to visualize the chopping technique as it is necessary to be accurate here. The learners will see how it is done correctly and they will have the opportunity to repeat the video as often as they want to, to focus on details etc. The following views shall be realized via videos:</p> <ul style="list-style-type: none"> Showing how to place the fingers on the onions correctly and how to operate a chef-knife correctly to avoid cutting oneself (max. 30 sec.) Showing the chopping process from different angles and perspectives and showcasing the result (max. 45 sec.)
Text	The exercise will be a short written statement.

Step 6: Preparation of the learning content

The learning content should be designed in a way that is appropriate to the target group and that engages the learner to participate as actively as possible. The aim should be on the one hand to keep the learner motivated and, on the other hand, to avoid/ reduce cognitive (over)load. Therefore, the resource creator must be, besides the aforementioned steps, concerned with the adherence Design Principles in Multimedia Environments (cf. Mayer) which have been outlines earlier in this document. The design of the learning content is strongly dependent from the chosen elements and their Learning Support Functions.

In the below-standing example we want to show examples of slides of a fictional Micro Unit to show how the mentioned design principles can be applied in practice. Here, it needs to be considered that the preparation is primarily practically oriented and often the resource creator runs several steps in loops to have a view fitting with his expectations and adhering the design principles.

Example: Chopping onions

Simple graphics:

In this view it is planned to have a schematic and simplified view on the structure of one single cell of the peel of an onion. The learner will see the overall elements of a cell like, e.g., the inner and outer cell wall with the middle lamella, the localization of the nucleus and the cytoplasm, the plasma membrane and the cell sap. Additionally, the localization of

the Isoalliin and Alliinase will be visualized. It is planned to show only the very basic elements of the cell structure. We have planned to have this as a stand-alone view besides the schema of the cut-in-half onion to adhere the Segmenting Principle.

The view will be structured as follows:

In the middle of the view there is the schematic and simplified view of the structure of the cell. The different names of the parts of the cell will be written near to the corresponding part and linked to it with an arrow (Spatial Contiguity Principle). There will be no voice in the off that repeats the names (Redundancy Principle). Thus, extraneous overload will be reduced. The combination of words and the picture was chosen to avoid Generative underutilization.

Animated graphics:

In this view the learner will be made familiar with the nuclear-structure of the amino-acid Isoalliin and the enzyme Alliinase. Therefore, graphics that visualize the structural formula will be shown. Additionally, the structural formula of the products Propionaldehyd and Dipropyl-disulfid will be shown. In the animation, these simple graphics will be displayed one after another on the view so that the content will be presented step-by-step. Due to the Learning Support Function of the animation, the learner will have the opportunity to focus on each of the steps as often as he wants to. There will be no extra text given to explain the graphics. In this combination, the views will adhere the Redundancy Principle, the Modality Principle, the Temporal Contiguity Principle, and the Segmenting Principle. The audio explanations will be spoken by the Micro Unit creator in a friendly voice to adhere the Voice Principle.

The view will be structured as follows:

- At first the structural formula of Isoalliin will fade on the view and the learner will get an audio-explanation of this amino-acid (e.g. that it is an amino-acid based on sulfur, etc.).
- After that the structural formula of Alliinase will fade in to be placed besides the structural formula of Isoalliin and the learner will get an information about some general aspects of enzymes and their role for breaking Isoallin down.
- The third graphic that will fade into the view and will be placed below the structural formulas. In-between the graphics of the amino-acids and the enzymes an arrow will indicate that the Alliinase has broken down the Isoalliin now. Via the audio part, the learners will be informed about how the chemical process of breaking down the amino-acid works and why Propionaldehyd and Dipropyl-disulfid are the results of this process. Here, the learners will also get a spoken explanation of why people

have to cry when their eyes get irritated by e.g. Propionaldehyd.

Video:

The idea here is to show the learners how they can place their fingers and finger-tips on a cut-in-half onion safely so that they will not cut themselves when chopping the onion fast. Furthermore, the chopping process itself will be shown out of different perspectives. The videos will follow a step-by-step approach. The different steps will be shown one after another and the explanation of the different steps will be given right in time. As it might be necessary sometimes to show a single cut from different perspectives, some cuts might be shown repeatedly. The explanation will not be repeated again but maybe some additional information will be given that states something that can only be seen from this special angle, for example. Thus, the Temporal Contiguity Principle will be adhered. Due to the Learning Support Function of the video, the learner will have the opportunity to tap on the screen to see the explanation written down. Thus, two more principles are adhered: The Coherence Principle and the Spatial Contiguity Principle.

Step 7: Think about exercises and assessment

Exercises and tasks should be implemented due to different reasons. The two main ideas behind exercises and tests are the following:

1. The learners shall be provided with the opportunity to repeat the content, to apply what they have learned, to decontextualize, and thus, to learn sustainably.
2. The learners shall be assessed. Here, it is not our concern to mark them but to give them the opportunity to see how well they have performed. Thus, the assessment here is primarily for self-evaluation purposes.

The assessment is of high importance as it is concerned with the evaluation of the learners understanding of the learning material and their success of transferring their knowledge and what they have learned into other context or practice. Therefore, the learners should be provided with exercises and tasks similar to the initial problem. The outcome of the exercise could then be evaluated by the group, because it is not possible to automate this kind of feedback. Furthermore, it will engage the learners because they can practice and apply their knowledge immediately. Retention tests like e.g. multiple-choice questions, matching tasks, or similar approaches can assess rote learning only. It is nearly impossible to see if the learners can transfer their knowledge in this way, but the tasks can be evaluated in an automated way. Therefore, both kind of assessment are valuable in our project (see Table 6: Overview about the assessment formats)

Consider: do not make it too easy. The aim of an assessment is to distinguish between those who understood the content and those who did not in a valid and reliable way.

To showcase how such an assessment of a fictional Micro Unit could look like, we have designed some examples and described why we designed it the way we did.

Example: Chopping onions

Exercises:

As the Micro Unit is primarily conceptualized to help the learners acquire practical skills that can be applied to their daily life immediately and because there is only a few theoretical background information, we will focus on exercises and not assessment tests. Thus, the learners will have to repeatedly practice what they have learned to get routine and thus, to reach mastery. Due to the aspect that the chopping technique can be applied to other vegetables as well, the exercises of the learners will be the following:

- Examine the chopping technique on at least three more onions. Therefore, cut them in half first. This will help you to get the routine.
- Examine the chopping technique on at least three tomatoes. This will help you to get a feeling of your knife and due to the consistence of tomatoes it will require you to apply the technique carefully. This helps you to enhance your technique.
- Examine the chopping technique on at least three apples. The roughness of the apples will help you to learn to handle your knife and the cuts very fast.

Assessment:

Due to the extensive exercise and practicing part mentioned in this step but also because of the practical insights that will be given in the resource, we will not focus on the assessment of the chopping technique. Here, we will focus on the assessment of the theoretical knowledge and background information provided within the learning resource. Because of the fact, that there is no need to master the theoretical knowledge to master the chopping technique, we will only have one assessment task that is concerned with the chemical processes that are responsible for making people cry.

In this case we have decided to create a “Catch the fake”-task (see **Erro! A origem da referência não foi encontrada.**). This is not only an assessment-format appropriate to test the knowledge of the learners but it will bring interactivity into the learning process as well. We decided to provide the learners with the following statements that can either be true or false:

Statement	True	False
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The enzyme Alliinase is located in the outer layer of the cells.		X
The amino-acid Iso-Alliin is located in the outer layer of the cells.	X	
Alliinase breaks down Iso-Alliin.	X	
When Alliinase breaks down Iso-Alliin a gas comes up which irritates the eyes – We have to cry.	X	
The reason why we are crying is to wash out the gas-particles from the eye.	X	

We have to mention here that the user will receive a feedback on his answers. Thus, he will be provided with the correct answers in the end either way. This will show him if he really understood what was examined in the Micro Unit.

5 Annex

5.1 Micro Unit Examples

Following, we will have a look on the already mentioned and displayed example Micro Unit concept “Chopping onions” again. There idea here is not to provide extra information but some kind of template for the conceptualization of Micro Units. This template is to understand as a recommendation as it is bespoke to our ideas. Nevertheless, each resource designer should feel free to adjust it for its own purposes and how he think it is reasoned and appropriate. In some cases, e.g. when designing a Micro Unit with another assessment format, it is even required to make adjustments and to find a way to have a written concept of this part of the Micro Unit.

Furthermore, we will attach one concept of another Micro Unit which is part of a Microteaching Setting. Its name is “Individualization of one’s profile” and aims to make interested learners familiar with different opportunities to individualize the profile of an account on the social network Facebook. These Micro Units were created as we received the feedback that this network is starkly used even by seniors.

5.1.1 Example 1: Chopping Onions

Example: Chopping onions

Description of the target group

This Micro Unit addresses every person that would like to learn how onions could be cut into small and similar cubes in a fast way without crying and without cutting yourself. The resource will be designed so that the transfer into practice can take place immediately.

Fields of interest:	Cooking
Experiences:	The learners should know how to handle a sharp knife safely.
Learning style:	Physical; practically oriented
Miscellaneous:	The learners should have a sharp chef-knife and an anti-slip chopping board. Furthermore, two onions will be required for practicing purposes.

Example: Consumption engines and exhaust turbochargers

Description of the target group

This learning resource addresses people that would like to change to acquire a general understanding of how consumption engines work and that would like to diagnose problems with their engine or charger-system to undertake minor repairs by themselves.

For teaching purposes, we will have a focus on 6-cylinder v-type engines with an exhaust turbocharger system.	
Fields of interest:	Tinkering on cars; mechanics; technics/ engines
Previous knowledge:	General understanding of the functionality of consumption engines; understanding of the differences between v-type and in-line engines; understanding of the differences between turbochargers and compressors.
Experiences:	The learners should have gathered first practical experiences with tinkering on cars.
Miscellaneous:	This resource addresses learners that are keen to transfer what they have learned into practice. Therefore, they should have, at best, a small garage and tools to apply what they have learned.

 *Example: Chopping onions*

Theoretical knowledge:

After the completion of the Micro Units the learners will have acquired the following theoretical knowledge:

- The learners will know about the general structure of onions and their cells.
- The learners will be familiar with the basic information about amino-acid Isoalliin and the enzyme Alliinase.
- The learners will know that Alliinase breaks down Isoalliin and that this process creates a gas that makes people cry as it gets in contact with their eyes.

Practical skills:

After the completion of the Micro Units the learners will master the following things:

- The learners will be able to operate and use a chef-knife correctly and safely.
- The learners will be able to chop an onion into small, similar cubes by applying the technique examined within the Micro Unit.

 *Example: Chopping onions*

Bibliographic information

Unique Identification: OPA2015-6-215

Title:	Chopping onions without crying
Short description:	In this resource, the users will learn about the theoretical facts why people cry when they are chopping onions and they will learn how they can avoid crying by using a certain chopping technique.
Key words:	Chef, cooking, kitchen, vegetables, onions
Language:	German, English, French
Responsibility:	Matthias Teine
Author:	Matthias Teine
License:	CC BY (Creative Commons)
Target group:	This learning resource addresses people that would like to change to acquire a general understanding of how consumption engines work and that would like to diagnose problems with their engine or charger-system to undertake minor repairs by themselves.
Funding:	Not funded.



Example: Chopping onions

Elements and resource formats

Element:	Purpose/ Reason:
Simple Graphics	<p>Simple graphics will be used to visualize the cells of the onion and its components as they allow to have a schematic view on them. The following pictures/ scratches will be used:</p> <ul style="list-style-type: none"> • Schema of a cut-in-half-onion and its layers. • Visualization of the cell-structure of the onions with a focus on the inside of the cell and its outer cell-layer to localize the amino-acids and enzymes.
Animated Graphics	<p>Animated graphics are used to visualize the cell the schema of the chemical process when the Alliinase breaks down the Isoalliin. Therefore, the animation should show the following things:</p>

	<ul style="list-style-type: none"> • The nuclear-structure of the acid • The nuclear-structure of the enzyme. • The process of reaction. • The way how the gas that makes people cry is built. • The reaction of the gas with the eye. <p>The animation will be supported with a spoken explanations of the different steps that are visualized in the animation.</p>
Video	<p>Video elements will be used to visualize the chopping technique as it is necessary to be accurate here. The learners will see how it is done correctly and they will have the opportunity to repeat the video as often as they want to, to focus on details etc. The following views shall be realized via videos:</p> <ul style="list-style-type: none"> • Showing how to place the fingers on the onions correctly and how to operate a chef-knife correctly to avoid cutting oneself (max. 30 sec.) • Showing the chopping process from different angles and perspectives and showcasing the result (max. 45 sec.)
Text	The exercise will be a short written statement.

Example: Chopping onions

Simple graphics:

In this view it is planned to have a schematic and simplified view on the structure of one single cell of the peel of an onion. The learner will see the overall elements of a cell like, e.g., the inner and outer cell wall with the middle lamella, the localization of the nucleus and the cytoplasm, the plasma membrane and the cell sap. Additionally, the localization of the Isoalliin and Alliinase will be visualized. It is planned to show only the very basic elements of the cell structure. We have planned to have this as a stand-alone view besides the schema of the cut-in-half onion to adhere the Segmenting Principle.

The view will be structured as follows:

In the middle of the view there is the schematic and simplified view of the structure of the cell. The different names of the parts of the cell will be written near to the corresponding part and linked to it with an arrow (Spatial Contiguity Principle). There will be no voice in the off that repeats the names (Redundancy Principle). Thus, extraneous overload will be

reduced. The combination of words and the picture was chosen to avoid Generative underutilization.

Animated graphics:

In this view the learner will be made familiar with the nuclear-structure of the amino-acid Isoalliin and the enzyme Alliinase. Therefore, graphics that visualize the structural formula will be shown. Additionally, the structural formula of the products Propionaldehyd and Dipropyl-disulfid will be shown. In the animation, these simple graphics will be displayed one after another on the view so that the content will be presented step-by-step. Due to the Learning Support Function of the animation, the learner will have the opportunity to focus on each of the steps as often as he wants to. There will be no extra text given to explain the graphics. In this combination, the views will adhere the Redundancy Principle, the Modality Principle, the Temporal Contiguity Principle, and the Segmenting Principle. The audio explanations will be spoken by the Micro Unit creator in a friendly voice to adhere the Voice Principle.

The view will be structured as follows:

- At first the structural formula of Isoalliin will fade on the view and the learner will get an audio-explanation of this amino-acid (e.g. that it is an amino-acid based on sulfur, etc.).
- After that the structural formula of Alliinase will fade in to be placed besides the structural formula of Isoalliin and the learner will get an information about some general aspects of enzymes and their role for breaking Isoalliin down.
- The third graphic that will fade into the view and will be placed below the structural formulas. In-between the graphics of the amino-acids and the enzymes an arrow will indicate that the Alliinase has broken down the Isoalliin now. Via the audio part, the learners will be informed about how the chemical process of breaking down the amino-acid works and why Propionaldehyd and Dipropyl-disulfid are the results of this process. Here, the learners will also get a spoken explanation of why people have to cry when their eyes get irritated by e.g. Propionaldehyd.

Video:

The idea here is to show the learners how they can place their fingers and finger-tips on a cut-in-half onion safely so that they will not cut themselves when chopping the onion fast. Furthermore, the chopping process itself will be shown out of different perspectives. The videos will follow a step-by-step approach. The different steps will be shown one after another and the explanation of the different steps will be given right in time. As it might be necessary sometimes to show a single cut from different perspectives, some cuts might be

shown repeatedly. The explanation will not be repeated again but maybe some additional information will be given that states something that can only be seen from this special angle, for example. Thus, the Temporal Contiguity Principle will be adhered. Due to the Learning Support Function of the video, the learner will have the opportunity to tap on the screen to see the explanation written down. Thus, two more principles are adhered: The Coherence Principle and the Spatial Contiguity Principle.

Example: Chopping onions

Exercises:

As the Micro Unit is primarily conceptualized to help the learners acquire practical skills that can be applied to their daily life immediately and because there is only a few theoretical background information, we will focus on exercises and not assessment tests. Thus, the learners will have to repeatedly practice what they have learned to get routine and thus, to reach mastery. Due to the aspect that the chopping technique can be applied to other vegetables as well, the exercises of the learners will be the following:

- Examine the chopping technique on at least three more onions. Therefore, cut them in half first. This will help you to get the routine.
- Examine the chopping technique on at least three tomatoes. This will help you to get a feeling of your knife and due to the consistence of tomatoes it will require you to apply the technique carefully. This helps you to enhance your technique.
- Examine the chopping technique on at least three apples. The roughness of the apples will help you to learn to handle your knife and the cuts very fast.

Assessment:

Due to the extensive exercise and practicing part mentioned in this step but also because of the practical insights that will be given in the resource, we will not focus on the assessment of the chopping technique. Here, we will focus on the assessment of the theoretical knowledge and background information provided within the learning resource. Because of the fact, that there is no need to master the theoretical knowledge to master the chopping technique, we will only have one assessment task that is concerned with the chemical processes that are responsible for making people cry.

In this case we have decided to create a “Catch the fake”-task (see **Erro! A origem da referência não foi encontrada.**). This is not only an assessment-format appropriate to test the knowledge of the learners but it will bring interactivity into the learning process as well. We decided to provide the learners with the following statements that can either be

true or false:

Statement	True	False
The enzyme Alliinase is located in the outer layer of the cells.		X
The amino-acid Iso-Alliin is located in the outer layer of the cells.	X	
Alliinase breaks down Iso-Alliin.	X	
When Alliinase breaks down Iso-Alliin a gas comes up which irritates the eyes – We have to cry.	X	
The reason why we are crying is to wash out the gas-particles from the eye.	X	

We have to mention here that the user will receive a feedback on his answers. Thus, he will be provided with the correct answers in the end either way. This will show him if he really understood what was examined in the Micro Unit.

5.1.2 Example 2: Individualization of one's own profile

Step 1: Definition of the problem-context:

When a person joined a social network, often, the next step is to create a user profile/ a profile of one self which represent the person. Dependent from the purpose of the social networks the opportunities to individualize the profile or the data requested/ displayed on the profiles do often vary hardly.

The focus of this Micro Unit will be to show the individualization opportunities of the users regarding their own profile on the social network Facebook. Therefore, the learners will be made familiar with the opportunity to change their profile picture, their header picture, to give basic information about their person, to show their interests in various fields (interests in general, books, films, ...), and sites they like.

All of the mentioned functionalities will be showcased in some kind of tutorial approach. This will help the learners to transfer what they have learned later to their own profiles. For this purpose, exemplary pictures will be uploaded, etc. As in the previous Micro Units as well, data security issues will be emphasized. Thus, to a later points, the learners will be able to reflect their ideas to individualize their profiles against the background of data security issues related to showing personal data in the internet.

Step 2: Description of the target group

The targeted learners resp. users of this Micro Unit are those that would like to know how they can individualize their personal profile on Facebook. The knowledge and competencies acquired here may also help learners that have registered on another social network as the actions are reflected against the background of data security issues that are valid and important on a general level.

Fields of Interests:	No special field of interest.
Experience:	Some first experiences with using Facebook.
Previous knowledge:	Only what is examined in the preceding Micro Units.

Step 3: Description of the learning objectives

After the completion of this Micro Unit the learners will have acquired the following theoretical knowledge and practical skills:

Theoretical knowledge:

- The users will know that profiles in social networks that focus on the same purpose or target group do often have similar opportunities to individualize their user profiles as well.
- The users will know that there are several data security issues that need to be taken into account when publishing personal data on the internet.

Practical skills:

- The users will be able to create and individualize their own user profile on Facebook and they are able to do so under consideration of data security issues they can reflect on.

Step 4: Bibliographic information

Unique Identification:	OPA2015-623-S173-3
Title:	Individualization of one's own profile.
Short description:	The users will learn to individualize their Facebook profile particularly against the background of data security issues that are also transferable to other contexts resp. other social networks or websites.
Key words:	Social networks, Facebook, Data security

Language:	English
Responsibility:	Matthias Teine
Author(s):	Matthias Teine
License:	CC BY (Creative Commons)
Target group:	Users that would like to learn how they can individualize their profile on Facebook without the danger to publish sensitive data. Furthermore, every social network user is addressed as issues related to the handling of sensitive data will be examined as well.
Linked resources:	<i>Previous:</i> General Information in Social Networks; How to register on Facebook and personal data options. <i>Following:</i> The user's chronic and finding friends; Joining and leaving groups on Facebook; Assessment of skills necessary to use Facebook.
Funding:	Not funded.

Step 5: Choosing the resource template

Element:	Purpose:
Animated Graphic	<i>Second view:</i> In the second view it is the idea to show the learners how they can get to the "edit" page of their profile. After clicking it will be shown how the "edit" page looks like.
Explanation	<i>First view:</i> Here, the learners will be provided with an enumeration that shows them the structure of the content that is going to be examined and they will be provided with the description of the Micro Units purpose. <i>Fifth view:</i> In this view it is planned to have a reflective overview on the contents that have been examined. Furthermore, it will be stressed that e.g. data security is a topic of concern and that the similar structures can be found in other networks or websites as well, so that the acquired skills can be transferred easily. <i>Sixth view:</i> The last views shows a written exercise that aims to let the learners repeat the contents by individualizing their profiles so that they get routine and become confident with using

	Facebook.
Video	<p><i>Third view:</i> In the third view the learners will learn to change their profile picture by using the “camera-icon”. It is planned to have a detailed look on the upload-interface and an exemplary picture will be uploaded to show the process.</p> <p><i>Fourth view:</i> In the fourth view the resource creator will show how the header picture can be changed. Therefore the “camera-icon” will be used and the drop-down menu will be explained. An exemplary picture will be uploaded to show the whole process.</p>

Step 6: Preparation of the learning content

Animated Graphic:

Second view: For the second view I decided to use an animated graphic as this illustrates best what is to do by the learners. The starting point for the animated graphic will be a screenshot of the-front page of Facebook. As the “edit profile” option is located as a link in the left upper-corner right beneath the persons small profile picture, a circle and an arrow that indicate the position of the link will come up next. Following, a mouse-cursor clicking on the symbol will displayed and the screenshot will change, to one of the overview page the link refers to.

All of the different steps and screenshots will be shown between five to ten seconds so that the learners can follow the different steps easily. The circles, arrows, and words written on the screenshots that indicate something are written on a slight white overlay and in a signal-color so that the learners can realize their existence and read them easily.

Explanation:

First view: The first view will be designed as an explanation to show the learners the contents respectively the Micro Units structure so that they have a short introduction and can prepare the following learning and exercising process. The structure they will get shown is the following:

“In this Micro Unit we will examine content that is concerned with the following questions and topics.

1. How to get to the editing options of your own profile.
2. How to change your profile picture.

3. How to change your header picture.
4. Summarizing reflection of the content.
5. Exercise and learning transfer.

These different topics will be focused in detail now.”

As the structure will be reduced to its very basic structure even in the normal view it is not planned to use the Learning Support Function as the text cannot be/ should not be reduced any further.

Fifth view: For the fifth view it is planned to have a text-based view which provides the learners with a basis to reflect the contents that were provided previously on. The idea is to have a short summarizing repetition of the contents before so that the learners can keep them in mind easier.

The view will be designed just as a short enumeration that lists the different contents examined and that emphasized, again, one the point that it is necessary to always be concerned about several data security questions and aspects.

Sixth view: The sixth view will be kept very simple as well. It will consist of a short introducing sentence and some bullet points that describe the exercise shortly only. The concrete exercise is mentioned in Step 7.

Video:

Third view: The video of the third view will be designed as a recording of the resource creators' screen. Thus, it shows how he is browsing through Facebook. The starting point of the video will be the page that comes up after clicking of the “edit profile”-link so that the learners can see that the video starts where the last view ended.

In an appropriately paced and sonorous voice the resource creator will explain what he sees and he mentioned that he is going to change the profile picture, which is the small picture shown right aside to the users name. The following steps will be made in the video:

1. Hovering the profile picture and mentioning that the camera icon changes and shows us that we can change the profile picture here.
2. Clicking on the camera and explaining the interface that comes up. Here, the focus will be to explain the “upload photo”, “make photo” and the edit option (the pencil-icon). This explanation will be held comparatively general because they are explained in detail in the following steps.

3. The “upload photo” option will be showcased. Therefore, an example-picture will be uploaded. When choosing the photo, the resource creator explain the reasons for his choice (no others are on the photo, no private situation, etc.) as well.
4. The “make photo” option will be use. Here, again, the different steps will be examined and an exemplary picture will be made with the webcam of the resource creators’ webcam.
5. The editing option will be showcased in the same exemplary way.
6. It will be shown how the users can delete their profile pictures by clicking on the picture, using the “option” menu and clicking on “delete this photo”. When having the “options”-menu open the resource creator will also give short explanations on the option the users have to edit and/or change their profile picture now.

It is important to mention that all of the different steps will be examined in an appropriately paced way and that each of the steps will be explained. This allows the learners to follow the different steps easily. To avoid confusion it is important to use the same terms for the whole video when referring to particular elements of the website.

The Learning Support Function will be used in the way that the different steps that are also mentioned above will be shown as a list/ enumeration in the overlay. This provides them with the opportunity to have a fast insight without the necessity to watch the whole video again e.g. when they would like to have information on this part a second or third time. Additionally, it might help the learners to have a structure of the content they can rely on when they are watching the video for the first time.

Fourth view: The fourth view is based on the same idea as the third view, but here it is planned to show the learners based on an example how they can change their header picture respectively the bigger picture that builds the head-area of their profile. The starting point of this picture will be, again, the page the user gets when he clicked on “edit profile”.

The audio-elements of the video will be spoken in an easy-to-follow pace that gives the learners the opportunity to understand the actions of the resource creator and the reactions of the website. It is highly important that the user gets the different actions of the resource creator explained, only then, it is possible for him to follow the actions and to do them on his own. E.g. when clicking a certain icon/ button/ area it will be mentioned, that this element will be clicked with a certain aim.

Anyway, the video will be structured as follows:

1. At first, the resource creator will hover over the camera icon in the upper left corner of the header picture/ title picture to show the learners that the option to change the picture comes up then.

2. In the next step, the upcoming drop-down menu will be shown and the options behind the different navigation points will be explained in theory to show the exact functionalities in the next steps one after another.
3. The “upload photo”-option will be examined first because it is necessary for some of the other options to already have some pictures uploaded. Therefore, a picture will be uploaded and it will be shown how it can be positioned. Furthermore, the “data security” options (in the lower right corner) will be highlighted.
4. Following, the “choose from my gallery” option will be examined. Therefore, it will be mentioned that there were already other pictures uploaded and the new one from step three as well. Another picture will be chosen and the positioning and data security options will be shown again.
5. The “synchronized pictures” option will be skipped and the focus will be on the “delete” link, as the positioning which stands above is something the learners are already familiar with because of the former steps. The deleting process will be ran.

Summarizing it can be said that after watching this video the learners should be able to administrate their profile- and title-/ header pictures confidently.

Step 7: Think about exercises and assessment

In this Micro Unit both is combined theoretical knowledge and the idea to focus on practicing as well. The approach was particularly to help the learners acquire the practical skills whilst reflecting their actions against their theoretical background especially related to data security. Due to the practical focus it is planned to have this focus in this part as well, but it is also planned to have a short assessment of the theoretical part which is primarily designed as a repetition of the contents of the former Micro Units as this one builds up on them.

Exercise:

To support the learners in their transfer process, they are asked to do the following exercises. They will act as some kind of initial profile-individualization process but as an exercise that helps fostering the practical skills as well:

(Hint: Please do the following exercise by adapting your theoretical knowledge about data security particularly when it comes to sensitive data like those that could be given on social networks.)

1. Upload both a profile picture and a header picture for your website as well.
2. Fill in the general data part of your profile that focuses on information related to your work, relationships, and family.
3. Like a page or a person on Facebook.

Assessment:

There is comparatively few theoretical knowledge or information that is party of this or even the former Micro Units that could be assessed. Nevertheless, we already stressed that we think that it is important that the learners are aware of data security issues and that they are concerned with some questions in this regard so that they can reflect their actions against this background. Therefore, it is our concern in the assessment to provide the learners with the opportunity to do this reflections and to raise their awareness again. It is not the idea to have something like perfect tasks that let us distinguish between the “high”- and “low”-performers, therefore some of the answers are written in a way to show that the described behavior is such a no-no. Anyway, here, we decided to use single- and multiple choice tests to do so:

First Question/ Task:

Imagine the following situation: It is the first time you joined a social network and you are individualizing your profile. The next step you want to do is to change your profile- or header picture. Please mark those answers that are correct in this context:

Statement	True	False
It is totally fine to upload picture that show me in private or even intimate situation as the pictures are stored on a save server and there is nothing to worry about.		X
There is no problem with uploading picture that show me and my family and there is need to be considered about data security issues.		X
When uploading picture of myself I should use those picture that do show me in daily, non-private/ non-intimate situations.	X	
When I upload a picture that shows other persons than me as well, I need to make sure, that the other persons give their permission that I upload this picture.	X	

Second Question/ Task:

Imagine the following situation: You are about to change the personal information changed on your profile (e.g. you would like to add a new job, change the status of your relationship, or something similar). Please mark those answers that are correct in this context:

Statement	True	False
I should think twice about publishing certain information about me, particularly because I may make it available even to strangers when I forgot to adjust the security options.	X	
The information I publish will be used by the social network to show me personalized advertisement, to suggest groups, etc.	X	
I should be very careful in regard to my personal data as it is stored on servers in the USA or other countries and the laws to gather and process those data are different to those in my own country.	X	
There is no need to be worried about the only very small possibility that the sensitive data I have published about myself is used in an abusive way.		X

Third Question/ Task:

Imagine the following situation: You are about to “like” some interesting pages, persons, books, movies or similar on Facebook. Furthermore, you are on a journey and would like to share your destination/ the place where you currently are with your friends. Please mark those answers that are correct in this context:

Statement	True	False
It is totally fine to make information about my political, sexual, or religious orientation available on the internet.		X
It is some kind of dangerous to publish information that there is recently and for some more days/ weeks no one in my flat/ house.	X	
In general, there is no need to be worried about showing my interests in certain books, movies, or the places I have travelled to.	X	
I should always be careful with publishing information about me	X	

and my interests.

5.2 Glossary

Distance Learning System: The creation of the so called Distance Learning System is the overall aim of the OPALESCE project. The system is a free and open to anyone system that runs on mobile touch-screen devices such as tablets and smartphones. By using the system the learners can access the different learning resources, the Micro Units. It will be optimized by senior citizens and its use can be learned in less than 1 hour even if one has no previous computer experience.

Elements: Elements build the very basis of Micro Unit. They describe different ways and formats of how learning content can be prepared best for and communicated to learners. Elements are, e.g., Different ways of Texts, but graphics and videos as well.

Learning Support Functions: Learning Support Functions are an integral part of Elements. They describe how learners can interact with the different views dependent from the elements chosen to present the content. Each if the elements has one Learning Support Function that should help to foster the learning progress and to make learning more sustainable.

Microteaching Setting: A Microteaching Setting is to understand as an arrangement or a sequence of Micro Units that build up one on another. Framed by an introducing and a closing Micro Unit here several so called Core Learning Units convey information. The advantage of such an arrangement is that complex topics or problems can be divided into different sub-topics or –problems. Each Core Learning Unit focuses on one of such sub-topics/ -problems then. This gives the learners the opportunity to have a very focused learning process.

Micro Units: Micro Units are 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.

View: A view is what the learners get displayed on their mobile touch-screen devices when using a Micro Unit. Thus it is to understand as a single screen or, talking under reference to presentation-software, as a slide. Learners browse through the different views of a Micro Unit either by swiping to the left or to the right on their screen.

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