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for a LAbor force supported
by trustworthy Artificial Intelligence

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0.1	First draft	Jan Naumann (ITB)
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Reviewers

Name	Organisation
Massimo Curti	CIT
Anna Folso	STAM

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List of Abbreviations

Abbreviation	Description
LMS	Learn management system
DIA	Digital Intelligent Assistant
ADDIE	Analyze-Design-Develop-Implement-Evaluate

Executive Summary

This report covers the main activities of the COALA project carried out from M4 to M12 (January - September 2021) by the ITB of the University of Bremen. The report describes the work accomplished during this period and details the activities and first results achieved in Task 3.4. It also provides an overview of the activities carried out building on findings from the End-users' workplace analyses, surveys and workshops.

The activities presented in this Deliverable 3.3 focussing on the didactic consideration of the prepared data, their evaluation and their derivation. Accordingly, didactic requirements are formulated and first methodological derivations of a work process-oriented further education with COALA Digital Intelligent Assistant (DIA) are specified. The activities were documented and the completion of this deliverable forms the basis for a standardised design, a didactic concept and finally concrete actions for the implementation of learning units in the identified use cases at the project partners.

1 Introduction

This document focuses on a basic didactic concept for the training and further education of the process-integrated language application COALA. The aim is to present a structuring element for implementation in internal training and further education processes, which can be used in the process of the project and adapted to the requirements of the respective use cases. The selected didactic approaches are based on the results of evaluated questionnaires and the evaluation of the data collected during the sprint sessions on typical work situations and actions. The didactic design as well as the resulting methodology consider scientific justifications for learning in and at the work process.

Finally, the result of the D3.3 is to provide an initial conceptual, didactic structure for user training. This structure must on the one hand contain elements for the promotion of vocational and media competences, and on the other hand establish strong references to the identified work scenarios of the use cases. Due to the required efforts to make the learning application as close as possible to the real work processes and the related actions, the learning contents become an integral part of the COALA application.

1.1 Document Structure

This document is subdivided into the following sections:

- **Section 1** gives a brief overview of the deliverable presented. In addition, references to other work packages, tasks and deliverables are pointed out.
- **Section 2** presents the transition of the analysis phase (WP1) and the circumstances to be considered with regard to the skilled work and the competences of the skilled workers.
- **Section 3** concerns the evaluation and the transfer of the data into a comprehensible structure. Furthermore, the instructional design model is presented in this section and the use of this model is justified.
- **Section 4** forms the main part of this document. It describes the transfer of the results from the previous steps. This section is divided into a subject-related description of transfer and the presentation of the implementation approach.

1.2 Relation with other Work Packages and Deliverables

The processes and results presented in this document build on the activities of Task 1.1: Situation analysis and detailing of use cases, Task 1.2: Risk reduction and concretization of use cases, Task 1.3: Assessment of the expected benefits of the use cases as well as the deliverables delivered in M6 entitled D1.1 Common COALA requirements, D1.2 Use cases and scenarios for textile production, D1.3 Use cases and scenarios for white goods production and D1.4 Use cases and scenarios for detergent packaging.

This document also receives input from the D1.1-4, in which the use cases and scenarios were identified and specified.

2 Data Collection

The evaluations of the questionnaires and the collaborative work boards (Klaxoon) from WP1 showed that didactic approaches should be selected in such a way that they promote motivation to use the COALA application and designed as much demand-oriented as possible and in small learning units. The focus of vocational education and training should be placed on the individual development of professional competences for direct application in the respective use case on the one hand and the promotion of competences in dealing with technologies and data on the other (Figure 1).

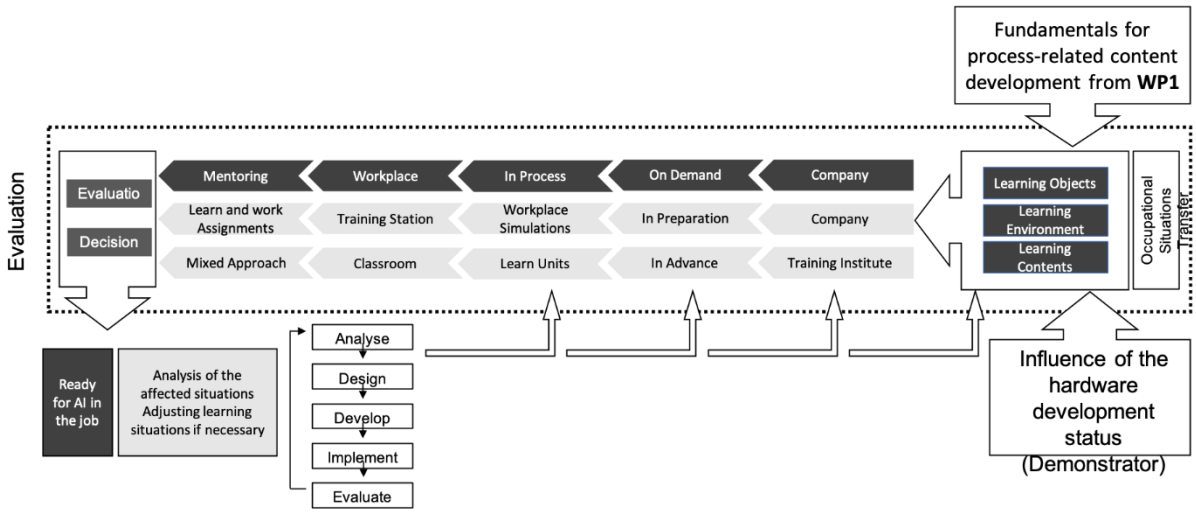

Figure 1: Initiating process-oriented design of teaching-learning arrangements

For this purpose, it is necessary to link the objects of the skilled work including the associated work infrastructure and objects with a learning infrastructure (Dehnbostel 2019). The analyses carried out also made it possible to identify typical vocational action situations in order to prepare them didactically in the later process and to transfer them into learning situations. The ITB used questionnaires to collect data on:

- Use of digital media
- Responsibilities related to the work process
- Activities and actions within the use cases
- Technical training of the users

and processed them in competence matrices for further use (WP 1).

Building on the results of the questionnaires regarding the use of digital media and the needs of the application partners, the work process-oriented didactic concept will be adapted during the further course of the project and further developed as needed. This concept is based on actual contents of the specialized work and considers a competence development of the users through spiral curricular elements.

Finally, the result of D3.3 is to provide a conceptual, didactic structure for user training. On the one hand, this structure must contain elements for the promotion of professional and media competences and, on the other hand, establish strong references to the identified work scenarios of the use cases.

3 Analysis and Evaluation

The structuring of the subject matter covers a whole range of aspects; appropriate design decisions here depend on the knowledge and the analysis of the task. The choice of the level of abstraction (rather overview or in-depth), a more deductive (from the general to the specific) or an inductive (from the individual to the general) presentation, the division into units of different information density (segmentation) and the didactically sensible order in each case (sequencing) influence the learning success just as much as the adaptability or adaptivity of the presentation to learner characteristics (e.g., prior knowledge).

Closely related to the structuring of the content is the development of adequate learning tasks and - in the case of some formats (simulations, explanatory videos, and pictures) - the embedding of a suitable story (narration). This is where the learning scenarios are linked to typical actions and activities of the actual situations in the subject work. Learning tasks reflect familiar processes and work environments on the one hand, and initiate learning processes on the other. For structuring and learning progress, the areas range from simple comprehension tasks for commissioning the learning object to complex diagnostic situations. This subdivision allows learning situations to be used in a competence-supporting way. In order to accomplish learning tasks, learning levels are usually determined and previous learning socialisation is taken into consideration. Observation and reflection of previous learning experiences should allow conclusions to be drawn about the quality of task accomplishment and enable feedbacks. The classification of learning levels is based on the competence matrix created in WP 1. On the one hand, this provides the information for the user-friendly design of the tasks. In addition, the grid also defines objectives which are to be achieved through competence growth.

In view of later implementation of in-house training projects, the ADDIE (Analyze-Design-Develop-Implement-Evaluate) model was chosen as the instructional design model (Figure 2). Other models such as the SAM-model (Successive Approximation Model) DO ID-model (Decision-Oriented Instructional Design Model) were deliberately not used due to their complexity. The content as well as the sequence of processing should be adapted by trainers and teachers in the later course.

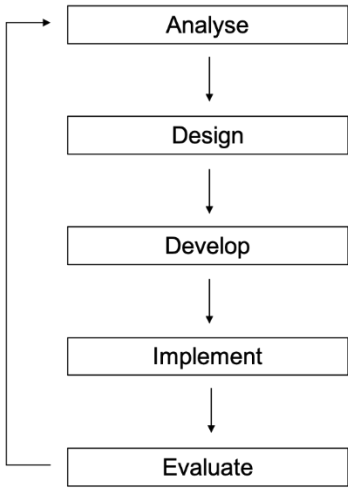

Figure 2: Procedure instructional design according to the ADDIE model

The ADDIE model differentiates between five decision fields, in some of which design and content decisions have to be made in several stages. These decisions are by no means always independent of each other, nor can they be made successively as described linearly in the text. Special features such as access to data, images and information are just as different in the individual use cases as the target groups that have to deal with the different learning objects on the different levels. Only the explanation of the basic functions of the application can be done generically. Here, however, the different languages and learning socializations of the learners must be considered.

Another advantage of the ADDIE model is that it allows for immediate correction of errors in content as well as structural errors through cyclical processes. By adjusting the process, the quality of the final media product is improved.

4 Derived Results

Based on the results of the analysis, learning arrangements were developed with a focus on actual operational actions. The aim is to increase the media competence of the identified skilled workers in the identified application cases through the design as a digital application. In order to promote a good implementation of the didactic concept and learning content on the one hand and the acceptance of electronic learning media on the other hand, different educational science models were considered (Section 3).

An approach based on the ADDIE model was chosen as the instructional design model. One of the reasons for this choice is that it is easy for the user (company trainer) to learn in the context of implementation in internal teaching-learning concepts. Another advantage of the ADDIE model is that it allows for immediate correction of errors in content as well as structural errors through cyclical processes. By adjusting the process, the quality of the final media product is improved.

4.1 Transfer

In order to realize a direct transfer into the subject work, it makes sense that learning contents are not too complex and self-contained (Howe and Berben 2006). The learning material should contain all the necessary facts about a topic and introduce the topic in a self-explanatory, motivating and appealing way (Howe and Berben 2006). The learning material to be produced by the ITB on the basis of the results of the analysis of the subject work is designed in different ways for this purpose. The microlearning units will include:

- Added explanatory hotspots to photos of the COALA application user interface;
- Videos of critical user situations with decision sequences made.
- Quizzes and comprehension questions used as (self-) evaluation tools, and, if necessary, a detailed report of the actions taken

For the creation of learning content in the form of learning nuggets, the use of an open resource solution is currently being examined. First exemplary contents are created with the authoring tool H5P. H5P is a free and open source software for creating interactive (learning) content for the web. However, H5P requires Wordpress or an LMS such as Moodle or Drupal in the background. A technical connection will be examined in the further course of the project. On the one hand, the content could be displayed directly on the COALA application device in a training setting. A link to a server-based LMS would also be conceivable. The authoring tool enables the creation and distribution of learning content in an interactive image-video-text combination. Hotspot content is an example of this. The learner gets a basic picture of a typical work situation. Points, so-called hotspots (Fig.3), are shown on this picture. These can be selected and processed according to the task. The hotspots can contain explanatory videos, texts, quizzes or questions. The learners can work through the entire content in an explorative way. This attractive content design aims to promote active engagement with the content and motivate learners.

Figure 3: Learning nugget in the form of an interactive hotspot image created with H5P

4.2 Implementation

In the project, the learning sequences will consist of micro-learning units for the respective application, explanatory pictures and videos, simulations or documentation of typical actions and tasks with subsequent quizzes for verification and a final report of the students' performances. Checking the learning success directly through integrated quiz elements ensures that skilled workers understand and internalize the content. In addition, small-step learning objectives are defined, allowing to track learning progress. In order to realize a user-side traceability of already completed learning units and quizzes, this data should be stored assigned to a profile and made retrievable by users. This should be done with the lesson management by using a learning management system (LMS). Individually structured learning units that consider the learners' usage behaviour and the learning environment are based on this system. The learners thus receive an individual learning plan that can be continuously adapted, considering the learning status already achieved. The acceptance of dealing with a learning subject is increased (Winkelhake 2017) by the fact that learning can take place independently of time and place but also, if necessary, in the process of working.

The strengths of this type of flexible learning were shown in the brevity of the learning units, which are called learning nuggets (Fig. 4), and the retrievability from anywhere at any time (Winkelhake 2017).

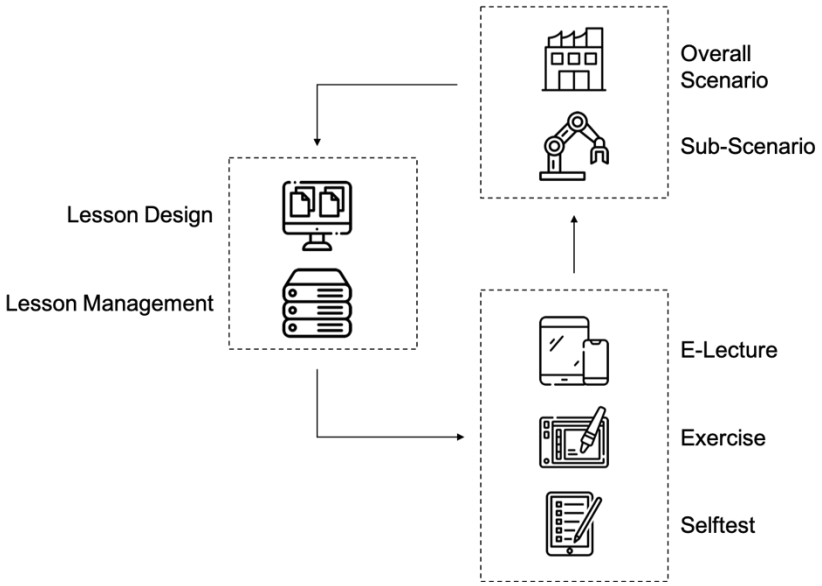

Figure 4: Availability, use and influence of learning nuggets

The learning nuggets take up the findings from the workstation analyses and surveys on relevant topics such as quality assurance, shift handover and troubleshooting and consider the observation that visual stimuli such as photos encourage skilled workers to reflect on work processes. In order to stimulate reflection (Kahnemann 2012), the focus for the design of the learning units will be particularly on the selection of professionally relevant content, images and spoken texts and their transfer into learning nuggets. These small learning units are also easily adaptable to individual learning levels during the course of the project and beyond; each skilled worker can choose which learning nugget interests him or her or what is needed in everyday work and does not necessarily have to complete a time-intensive holistic training separately from the work process. The immediate assessment at the end of the learning unit, e.g., through the quizzes, is also intended to ensure that the knowledge acquired is consolidated and correctly memorized by the learners. In the COALA project, it is planned to combine individual learning nuggets into learning paths (Fig. 4). Each learning path thus combines small learning sequences into a structured learning object (Niegemann 2008).

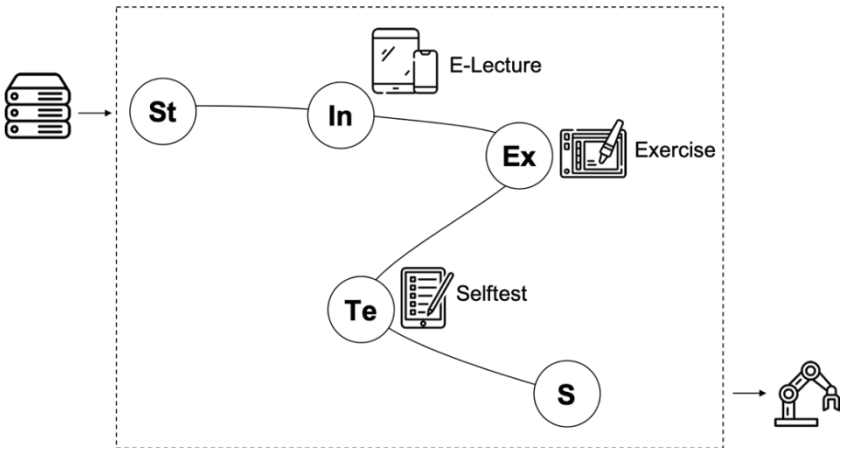

Figure 5: Learning path structure for use in asynchronous learning

It is planned to design the resulting content as microlearning units along multidimensional learning paths. First drafts with concrete learning contents have already been created.

Here a specific example of the transfer of an occupational work situation to a learning situation in COALA is reported:

- **St** – Starting point
  - the initiator of the learning unit
  - ties in with previous learning units
  - forms the entry point
- **In** – Information phase
  - Provides all the information needed to complete the learning unit
  - different formats (video, audio, images, text)
- **Ex** – exercise phase
  - gives learners the opportunity to work on tasks in a self-directed, action-oriented way
  - reflects the actual work process
- **Te** – Test point
  - ensures the learning level in relation to the course unit
- **S** – summarize
  - summarises the learning unit
  - gives an orientation for the following learning units

Along the described points of the learning path, we will start this example with the starting point of a scenario from quality assurance on a final product **(St)**. This is followed by a short introduction to the combined use of the voice assistant with a QR code reader. The processes are explained in a video excerpt that shows the process at the real workplace **(In)**. The video is commented on by the audio track (voice) of the voice assistant. This guides the learner through the entire learning sequence. Following the instruction, the learner can practise independently on prefabricated exercise artefacts (real or simulated) **(Ex)**. This exercise unit is concluded by a short knowledge quiz **(TE)**. At the end of the unit, the sequence is summarized once again and an outlook on subsequent units is given **(S)**. Since the learner uses the object of the assignment - COALA input device - and is in a real working environment, he can directly apply what he has learned in the work process.

5 Conclusion and Outlook

The first developed learning paths with the associated micro-learning units will be tested in close cooperation with Città Studi in the first quarter of 2022. The existing learning environments will be used for this purpose. A special focus is on the acceptance of the use of the voice assistant. For this purpose, users will be guided both from familiar support media such as visual representations and explanations along the learning paths and from media that are unfamiliar to them in the context of professional learning (COALA). The aim is to recognize and use the voice assistant as an integral part of learning in the work process.

The barrier of a generic view and design of possible learning arrangements has already been crossed by concrete contents and transferable occupational work situations. The first learning nuggets have been designed on the foundation of the learning path structure. Nevertheless, technical conditions for implementation must be considered more intensively in close coordination with the development partners. These include at the present time:

- Identification LMS
- Interface LMS and output device
- Integration into the COALA device (tablet)
- Connection to existing training infrastructure (server)

Learning content can already be designed for each possible application. Through this structured preparation, it is possible in the further process of the project to adapt the learning solution accordingly, depending on the application device.

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