

# Authoring of an adaptive group-oriented business English course with AHA!

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**Abstract.** Vocational training is a good application field for adaptive learning environments, as learner pre-knowledge is diverse, learning objectives can be derived from job roles and employers value focusing on most important parts to shorten learning times. An adaptive web based training multimedia course on business English was created with a learning time of about 5 hours. It is used to demonstrate adaptive learning concepts to learners, authors and training providers. It is group-based in the sense of job roles. Learning content is recommended based on competency needs and available knowledge. Presentation media is selected based on display platform (PC, mobile phone). Learning preferences determine the selection of dialogue forms. The authoring of the course with the AHA! adaptive learning environment is also described as well as how AHA! could be extended to better support this kind of adaptive learning.

## 1 Introduction

The GRAPPLE (Generic Responsive Adaptive Personalized Learning Environment) project<sup>1</sup> currently interviews learners, training providers and web based training (WBT) authors about their opinion on the value of adaptation features and technologies. To aid these stakeholders in understanding the possibilities, principles and mechanisms of adaptation, an adaptive WBT on business English has been created. It is presented to them together with a scenario of a fictitious company which has to train its employees in business English to participate in an upcoming conference and fair. Adaptation is group-based in the sense of job roles. Furthermore, it is based on competencies, capabilities and preferences. Employees will receive recommendations for learning units that they need for their job role, but do not know yet. The WBT has rich media, like text, graphics, video and audio and media is selected based on the capabilities of the device (PC, mobile phone). Also personal learner capabilities, as they become evident in language test performance is taken into account by providing additional material when needed. Learners can configure the WBT to show them certain dialogue forms and tests, based on their learning preferences.

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<sup>1</sup> <http://www.grapple-project.org/>



What is adapted?	To which feature?	How?
Menu presentation	previous knowledge	Already known concepts are marked with a happy smiley 😊.
Menu presentation	job role	Recommended concepts to accomplish a job role are annotated with a green bullet ●. Otherwise the learning unit is marked with a cross ✕.
Menu presentation	test results	If a learner has not achieved enough points in a test, a neutral smiley 😐 indicates this status.
Menu presentation	preferred learning activities	Depending on the preferred learning activities a learning unit is annotated with a green bullet ●. If a unit does not match the preferences, it is annotated with a cross ✕.
Learning content	test results	If a learner did not pass an exam she is presented a glossary in addition.
Media selection	user platform	If the course is accessed from a desktop PC, the learner can watch videos. If the learner's device is a mobile phone, the videos are replaced by transcripts.

**Table 1.** Overview of adaptation in the authored adaptive course

will answer a multiple choice test on this diary. The third type presents a spoken dialogue in order to train the listening comprehension of spoken dialogues. Afterwards a test is offered to assess the learner's listening comprehension.

In this scenario three groups of employees will be attending the conference each with different tasks defined by their job role(s). Each job role is assigned to competencies that are necessary for the role's accomplishment. In our example each competency is covered by exactly one learning unit.

Adaptation features as defined in [1] and [2] are divided into user characteristics and environment, which both are used for adaptation by an ALE. The functionality of the adaptive business English course is summarized in table 1. The system adapts to the user characteristics (previous knowledge, job role, test results, preferred learning activities), and the user platform.

Brusilovsky [1, 3] differentiates between two areas of adaptation: adaptive presentation and adaptive navigation support. In this course the icon annotation of the course menu (adaptive navigation support), and the learning content and the presented type of media (adaptive presentation) are adapted.

In the next section the authoring with the AHA! system of the described course is explained.

### 3 The authoring process

As described in section 2 when elucidating the scenario, several features are considered for adaptation in the adaptive business English course. The presentation of adaptation is provided by using different technologies. In the following section we explain the authoring using the Graphical Author tool for AHA! [4]. First we describe the course's structure of the data; afterwards the implementation of adaptation is expounded.

#### 3.1 The course's data structure

Several objects store the user's learning progress, her preferred learning activities, job role(s), and the user platform. These objects are explained in the following sections.

**The learning unit/lesson object** The course is made up of ten learning units each containing six lessons. Each learning unit and its lessons are realised as page concepts in AHA! containing certain learning content stored in XHTML-format. Such a learning unit has several attributes. The most important ones for the realisation of the learning logic are:

**visited** Stores how often a learner has visited this page concept.

**suitability** True, if this concept is recommended for the learner.

**competency** Indicates the percentage of correctly answered questions, which belong to a learning unit and lesson, respectively.

**The test object** Each lesson of a learning unit provides one or two tests the learner can attend. For each single test there is a test object containing two integer attributes: "visited" and "knowledge". The first attribute stores how often a learner has taken the test, the second stores the percentage of correctly answered questions. This percentage is used for giving feedback to the user and to decide if she needs additional learning aid.

**The job role object** A learner can be assigned to several job roles. A job role is assigned to several learning units. Each job role has an attribute "interest" of type boolean. If it is true for a certain job role, then this job role is assigned to the learner. The job role object is an abstract concept in AHA! that means that it does not appear in the menu in contrast to a page concept.

**The preferences object** The preferences object is an abstract concept that indicates which learning activity or activities the learner wants to perform. For each learning activity there is an object with a boolean "interest"-attribute. If it is true, the corresponding learning activity is assigned to the learner.

**The user platform object** An abstract concept “platform” with an boolean attribute “mobile” was also introduced to store the user platform. If this attribute is true, then the learner attends the course using her mobile phone.

### 3.2 The implementation of adaptation

Table 1 provides an overview of adaptation performed in the course. In the following section the adaptation applied in the course is described in more detail.

**Adaptation of menu presentation** As shown in figure 1 and described in table 1 there are several adaptive changes on the menu presentation of the course by annotating links with an icon. The appearance of an icon depends on the state of several learning unit object’s attributes and several rules:

Icon 🟢 is displayed, if complied with:

$$\text{suitability AND visited}==0 \quad (1)$$

Icon ✖ is displayed, if complied with:

$$\text{!suitability AND visited}==0 \quad (2)$$

Icon 😊 is displayed, if complied with:

$$\text{competency} < 51 \text{ AND suitability AND visited} > 0 \quad (3)$$

Icon 😊 is displayed, if complied with:

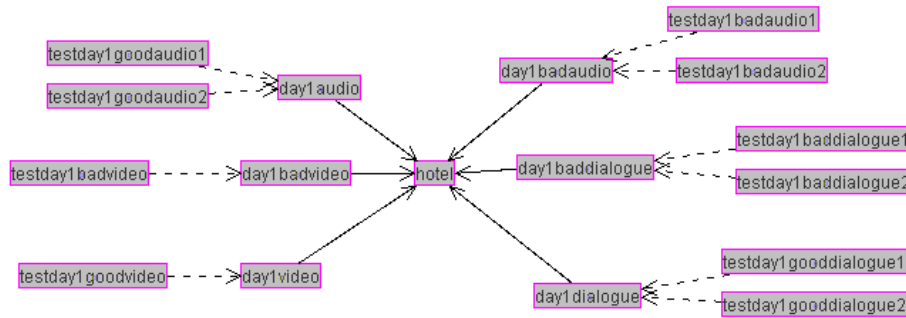
$$\text{competency} > 50 \quad (4)$$

Learning units are recommended for a learner depending on her job role and previous knowledge. If a learning unit (e.g. “Checking into a hotel”) corresponds to a learner’s job role and her previous knowledge is insufficient, then a learning unit is recommended for the learner to bridge it. A relationship “roleprevknow” was created in AHA! to control this behaviour by setting the “suitability” value (cf. eq. (1-3)). The source of the relationship is a job role, the destination a learning unit object. The “suitability”-attribute of a learning unit is true, if the learner’s competency is less than 100 and if the job role is true for the learner.

The learner’s preferred learning activity or activities determine which of the six lessons of a learning unit are recommended for the learner. Thus a learning activity is a prerequisite for a corresponding type of lesson, so to speak.

Furthermore, if a learner visits a learning unit or a lesson the corresponding “visited”-counter increases by one.

Both smiley icons depend on the “competency”-attribute value (eq. (3, 4)). This value is influenced by the percentage of correctly answered questions of a lesson’s test(s). The “knowledge” value of a test object is propagated to the “competency” attribute of the corresponding lesson. If there are two tests belonging to a lesson, both test results are propagated halfway through. The competency propagation is illustrated with arrows (figure 2) which are assigned to rules



**Fig. 2.** The competency propagation for the “Checking into a hotel”-learning unit

controlling the propagation. This competency propagation relationship includes three case differentiations, one for each number of selected learning activities. In general the computation of the competency value for a learning unit is done using the following mathematical expression

$$Competency_{new} = n \cdot \frac{1}{6} \cdot ChangeInTestResult + Competency_{old} \quad , n \in \{1, 1.5, 3\} \quad (5)$$

The change of a lesson’s test result is added to the former competency value of the learning unit. For each learning activity there are 2 lessons. Therefore there are  $2 * 3 = 6$  learning activities for each learning unit altogether. A test result which represents a change in competency therefore pours with  $1/6$  ( $n = 1$ ) for every lesson if the learner chooses all three learning activities. But in the case of the selection of just two or one learning activity, the division by 6 has to be replaced by  $1/4$  ( $n = 1.5$ ) and  $1/2$  ( $n = 3$ ), respectively.

**Adaptation of media selection** If the abstract concept *platform.mobile* (section 3.1) is true then instead of the standard XHTML page another XHTML with mobile content is assigned to the page concept. A corresponding rule was set up with the Graphical Author tool for AHA!

**Adaptation of learning content** If a learner does not achieve enough points in a test, a glossary is provided in addition to support the learner. This adaptive behaviour is set up in a concept page itself by inserting an “if-block” which is interpreted by the AHA! system. In case a test result is below a certain percentage and the learner has taken the test (both values stored in the test object introduced in section 3.1), a glossary is presented to the user.

## 4 Concluding remarks and future work

This paper described how we created an adaptive business English course with the AHA! system. Although AHA! is a very powerful system we had to modify

AHA! to be able to realize our ideas for the adaptive course. We propose to incorporate these changes in future versions of AHA!:

- Read and write access to the user model through a web form (currently only write access; this was changed by us)
- Support for competency hierarchies in the Graphical Author tool. Learning outcomes should be assessed with multiple choice test and a certain percentage of correct answers requested to confirm knowledge (currently reading a page means having learned the concept; test results have to be checked with many manually entered rules).
- Support for tooltips for the status icons at menu entries (possibility to enhance icons with tooltips was added by us)
- Changes to the menu should be updated on the web page immediately (currently only on next click on menu)
- Support for editing of more than one concept at once within the Graphical Author tool to save author's time.
- It should be further possible to store how often a learner has taken a test in the user model as well as to determine which concept is influenced by test results (currently we solved this by counting the number of test result's changes and knowledge propagation).

The authored course can be visited on <http://www.learning-demo.eu/> and is under constant improvement. As mentioned in the introduction section, it is currently used as a supporting tool for a requirement analysis in order to help the interviewees understand the basic concepts and idea of adaptation. The requirement elicitation aims at getting the opinion and expectations of both learner and training provider. The results of the requirement analysis shall be applied for a further implementation of adaptation in the demo business English course as part of the improvement process.

## Acknowledgement

The content of the demo adaptive business English course originates from a BBC world service course<sup>2</sup>.

## References

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<sup>2</sup> <http://www.bbc.co.uk/worldservice/learningenglish/business/tendays/index.shtml>