# Personalization of Foreign Language Education in the LMS Moodle Environment

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**Abstract.** The paper deals with new processes in e-learning to achieve the most effective path through a course for each student. In order to achieve such an ideal path through an e-learning course (here a course of the English language), a new methodology has been developed and special components have been introduced, which enabled to create an individual study plan for each student individually. New components consist of two blocks. A block consisting in finding out student's language knowledge and a block of sensory preferences. These blocks provided input values and information for creating a verification e-course. A great benefit is that the proposed methodology used existing possibilities of a conditional progress through a course while introducing the new components enabled to create individual study plans in an *automated* way. This comprehensive system has been verified on a sample set of students of the bachelor study program Applied Informatics at the Department of Informatics and Computers, Faculty of Science, University of Ostrava, in winter term 2014.

**Keywords:** e-learning · Language learning · LMS · Personalized education

## 1 Introduction

Computer-based learning is very favoured among the users of e-learning, mainly if it concerns languages [1], and as described in paper [2], languages can be taught learnt through e-learning although with limited possibilities and results. Thus, the results often show that e-learning of a foreign language falls behind in areas of flexible feedback and individualized approach [3]. Thus, various systems have been developed in order to overcome this insufficiency. Achieving an individual approach to students, primarily those of distance studies, represents a complicated task and requires a change in the conception of the whole e-learning system. One of the possibilities is to use systems that enable to work with inaccurate information.

Inaccuracy, insufficient definition of these processes respectively, also has its own structure, which enables to use appropriate tools for work with a given type of incompleteness. When analyzing inaccuracies occurring when solving a given decision-making process, it is frequently found out that the given inaccuracy is also insufficient information, thus its cause can lie in student's "inability" to define their knowledge, i.e. what they know or not. Insufficiency is basically represented by describing knowledge


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in all areas of the language in one test – e.g. if a student can use the present continuous tense in two out of its several possible ways of using, does it mean that the student knows the tense or not, or only partially? This blurriness then becomes the ultimate cause why classical mathematics and exact sciences were not able to adequately cope with linguistically-defined situations. The situation has changed in the last decade when a so-called fuzzy mathematics was established, which enables to effectively work with such verbally described situations. Our approach is therefore based on the possibilities of working with a fuzzy logic expert system.

## 2 Adaptivity

Adaptivity of a system mean system's ability to adapt to changing input information, which the system reacts to with an appropriate change. Current LMS systems generally do not offer possibilities of adaptation to the needs of individual users to such an extent which would qualify them to be called adaptive systems. All activities are permanently supervised by a tutor, who guides the student through the course to achieve better results. It is fully up to the tutor to advise a student the most suitable study materials, which might be often difficult as the tutor does not have much personal contact and time to analyze the students. This might result in a very time-consuming or even impossible process.

Research in adaptive systems branches into several, more specific areas. There have been attempts for adaptation in the area of learning styles [4], or testing respecting learning styles [5]. However, they do not lead to adaptive systems as we have defined the term *adaptivity*.

An example of a more advanced adaptive system can be found in work [6] dealing with an adaptive system for proposing a so-called *re-usable adaptive educational e-content* and their prototype system KOD (*Knowledge on Demand*).

Our approach focuses on adaptivity in the area of adapting the learning content of the course according to student's needs not only based on initial information about the student, but based on his later study results as well.

## 3 Proposed Model

A general objective of the research of the authors of this paper is to propose an adaptive model applicable in an e-learning system used for language learning. Its verification has been carried out in LMS Moodle. The model proposal is based on two levels which provide a basis for next processes. The first level represents a pedagogical area aiming at focusing on the student, i.e. gathering information about his learning and absorbing information (i.e. learning preferences) and (http://vark-learn.com/home/) information about his language knowledge. Results of a more detailed research on this area were published in [7]. The second level focuses on using a fuzzy logic expert system LFLC 2000 [8] to assess student's language didactic test. Benefits of using such a system were published in [9].

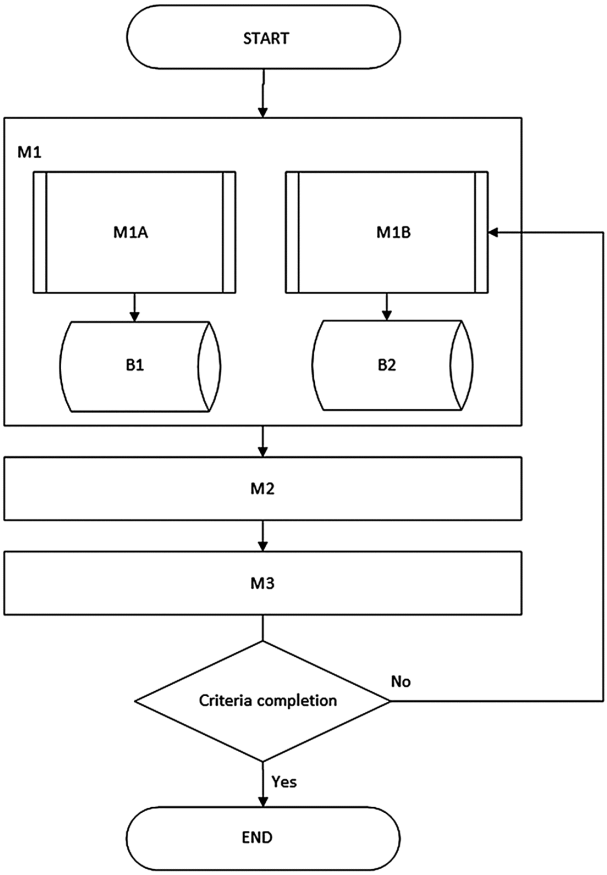


**Fig. 1.** The proposed model of adapting a student's study plan

This paper is closely related to the phase when all student's data has been gathered and stored in a database, or portfolio, consisting of two sub-databases, see Fig. 1. We do not try to design a universal student's model because each student is unique. Thus we do not want to assign a real student a predefined student's model, which would a priori predefine his study plan. Our conception is that each student has his own portfolio.

The proposed model is based on three modules M1 to M3. Module M1 deals with acquiring student's portfolio and consists of two sub-processes M1A and M1B. M1A deals with the issue of mapping student's learning preferences from the point of view absorbing information. The results are stored in Base 1 marked as B1. M1B gathers and evaluates current student's knowledge, which results in assessing his input knowledge of the language. This is stored in Base 2 marked as B2. Module M2 represents a process of managing the educational process itself. It primarily focuses on adapting the content of the e-learning course to student's needs defined in B1 and B2. In this view, the study materials are adapted both in their content and form. A more detailed study of M2 might result in dividing it into parts corresponding to its thematic areas. From the pedagogical

point of view, it is highly important that basic thematic areas form basis for more advanced levels. Thus, managing the educational process does not only focus on adapting the content, but on conditional access to higher thematic levels based on the results from preceding thematic areas. Once processes in module M2 are completed, module M3 takes its turn. M3 focuses on the final diagnostics.

### 3.1 Target Group of the Experiment

The target group for verification of the proposed model, including designing and structuring the didactic test and the e-course, were students of distance and combined form of studies, bachelor study programs Applied Informatics and Informatics at the Department of Informatics and Computers, Faculty of Science, University of Ostrava. The students enrolled for course *English for Specialisation Degree 3* (marked as XANG3) in winter term 2014. The time length of the course was 13 weeks, period September 22 – December 19. The course XANG3 has two preceding optional courses XANG1 and XANG2.

### 3.2 Implementation of Module M1A

Implementation of an adaptive e-learning model has been verified in the LMS Moodle environment using its existing components. The model focuses on student's individuality. This idea was reflected in the implementation, which concentrated on student's profile, primarily on optional fields in user's profile. This profile was extended with 25 new fields. The extension consisted of two groups.

The first group of user's fields served to define learning preferences for study materials. A set of such fields is marked as VARK. This group corresponds to base B1. The fields hold values either yes or *no*, which was obtained from the student by a questionnaire.

VARK methodology of learning preferences was developed by Neil Fleming [10] and extended by Leite in [11]. VARK reveals how people how they ideally acquire information, and how they process and remember the information best. The preferences are divided as follows:

**V**isual – images, diagrams, charts, maps;
**A**ural – lectures, recordings, discussions, repetition of spoken words;
**R**ead/write – texts of all forms;
**K**inaesthetic – movement, learning by doing, touching, active experience.

VARK methodology is very simple, but practical and effective. It is obvious that a student is not clearly defined and assigned to one dimension, but the categories do not exclude each other. They are not opposite poles which one must select from; one always has a certain combination of these preferences.

Suitability of using VARK methodology to analyze student's learning preferences was proved in [7].

The VARK questionnaire was processed in a way to acquire percentage ratio for each student. Generally, it can be 25-25-25-25. However no student achieved such balanced preferences. If any of the preferences fell below 20 %, corresponding materials were not offered, see Table 1.

**Table 1.** Students'learning preferences in XANG3, winter term 2014

| First name | Last name | Profile field V | Profile field A | Profile field R | Profile field K |
|---|---|---|---|---|---|
| Student*1* | Student*1* | YES (29.7) | YES (21.6) | YES (21.6) | YES (27.1) |
| Student*2* | Student*2* | YES (20.3) | YES (33.3) | NO (11.1) | YES (30.3) |
| Student*3* | Student*3* | NO (15.2) | YES (30.4) | YES (27.2) | YES (27.2) |
| Student*x* | Student*x* | YES (33.3) | NO (16.6) | YES (30.1) | YES (20) |

### 3.3 Implementation of Module M1B

The second group of fields, corresponding to base B2, focused on particular thematic areas, therefore let's call it a group of thematic fields. Such fields describe individual grammatical phenomena and specific areas related to English for IT:

– Present tenses, past tenses, present perfect tenses, past perfect tenses, passive voice, adjectives, numerals, modal verbs, verb patterns, future and conditionals, countable nouns, phrasal verbs, databases, networking, network topologies, giving talks.

These fields acquired linguistic values corresponding with individual fuzzy sets characterizing present students' competences in individual thematic areas (categories). Such a linguistic value is acquired as a result of the initial didactic test, which is processed in software LFLC 2000, which enables to work with indefinite information. Individual categories are analyzed to assess the need of further studies of the given category in an e-learning course.

The analysis process considers the following input variables for each category separately:

1. Number of correct answers (V1) – *small, medium, big*
2. Weight of correctly answered questions (V2) – *small, medium, big*
3. Importance of the category for further study (V3) – *very small, small, medium, big, very big*
4. Time spent on questions of the given category (V4) – *small, medium, big*

**Number of Correct Answers (V1).** It means how many correct answer a student has achieved in a given category.

**Weight of Correctly Answered Questions (V2).** It means that some questions are more difficult than others. More difficult questions hold a higher weight.

**Importance of the Category for Further Study (V3).** It means that categories hold weights according to their importance at the point of starting the course. For example, knowledge of Present simple for an advanced user is highly important (strongly required) because the student already learnt it in previous courses. On the other hand, knowledge of Past perfect continuous is not as important (not required) because the student will learn it.

**Time Spent on Questions of the Given Category (V4).** Time allows us to assess student's knowledge in a way that if the student answers quickly (and correctly), it positively influences the output variable, and vice versa.

**Output Variable (V5):**

5. Need of further studies of the given category – *extremely small, very small, small, more or less medium, medium, big, very big, extremely big*.

### 3.4 Implementation of Module M2

The LMS Moodle environment has been extended with a set of rules which open the student the most suitable form of study materials, based on the VARK fields and V5. Altogether, this extension included 25 user fields.

Implementation of this extended version required a new instance of LMS Moodle, which was installed in Linux Debian hosted on the VMWare technology. The Moodle version was 2.7.2+ and is available at http://bradac.osu.cz. The experiment could not be implemented in current Moodle of the University of Ostrava because the extension of user field would affect all existing courses.

When preparing the XANG3 e-learning course, we had to consider the possibility that a student should be able or will have to study the categories from previous courses (XANG1 and XANG2), which regular Moodle at the UO does not allow. Thus, it was necessary to import materials from the preceding courses, but only materials related to grammar, not topics. Having completed the import and extension of user fields, settings how to progress though an e-course had to take place.

### 3.5 Methodology of the Progress Through an e-course

The progress through an e-course had to ensure that it corresponded with the results from M1A and M1B, but there was a need of reflecting student's results during the studies – ideally without any tutor's interference (Table 2).

A general structure of the course was as follows:

**Table 2.** Structure of XANG

| | |
|---|---|
| Unit 1 | Present simple |
| Unit 2 | Present continuous |
| Revision 1 | Cumulative test (Present simple + Present continuous) |
| Unit 3 | Past simple |
| Unit 4 | Past continuous |
| Revision 2 | Cumulative test (Past simple + Past continuous) |
| … | … |

In a standard e-learning course, all students would have accessible all study materials and units. However, the fact that we possess a student's portfolio, we can work the possibilities of adapting it to his needs by, for example, using conditional access.

Limiting access to a whole unit is based on the result from the didactic test (V5). However, we might face a situation when the student can skip a closed unit (based on V5), but fails a compulsory revision Cumulative test, which checks if the student really knows the given area. Now, if the student fails a Cumulative test, a corresponding closed unit opens. The student then has the possibility to study the unit again and come back later to the failed Cumulative test. Let's describe such a conditional access to Unit 1, Unit 2, and Revision 1:

1. V5 is *extremely big, very big,* or *big* neither for Unit 1 nor Unit 2. Both units are closed and the student immediately proceeds to Revision 1.
2. V5 is *extremely big, very big,* or *big* either for Unit 1 or Unit 2. The student has to pass a test from the open unit before proceeding to Revision 1.
3. V5 is *extremely big, very big,* or *big* both for Unit 1 and Unit 2. The student has to pass a test from both open units before proceeding to Revision 1.
4. If Unit 1 or Unit 2 are closed, the closed unit automatically opens based on the result from Revision 1, i.e. if the result fall below a specified threshold.

Once the student passes Revision $x$, he can proceed to next step in the studies, i.e. next available Unit or Revision. The student proceeds the course in this way until he reaches the end. Personalized study plan is achieved by using the information from the initial portfolio, but from the results during his studies as well.

### 3.6 Implementation of Module M3

Diagnostics in module M3 is, once again, adapted to student's need from the form point of view. Diagnostics can be considered normative. The diagnostic phase can be performed repeatedly, although there is a limit in a number of trials for achieving this diagnostics. For our purposes, the number was set to three. It means that the student had tree possibilities to pass Unit $x$ and Revision $x$. If the anticipated normative of knowledge has been achieved, the studies came to its successful end. If not, base B1 has to be redefined in order to find a better form of suitable study materials.

## 4 Conclusions

The paper dealt with new processes in e-learning to achieve the most effective path through a course for each student. A new model has been designed to meet the requirement of e-learning. A methodology related to language learning has been developed and special components have been introduced, which enabled to create an individual study plan for each student individually. New components consist of two blocks. A block consisting in finding out student's language knowledge and a block of sensory preferences. These blocks provided input values and information for creating a verification e-course. A great benefit is that the proposed methodology used existing possibilities of a conditional progress through a course while introducing the new components enabled to create individual study plans in an *automated* way.

The verification on a sample set of students of the bachelor study program Applied Informatics at the Department of Informatics and Computers, Faculty of Science, University of Ostrava, in winter term 2014, proved that it is possible to successfully implement this model into real education using current LMS systems and to make them more adaptive than they are today.

Our research has not reached its end, but in future we want to focus on structuring students' study plan taking into consideration time exigency of individual study materials and the e-course as a whole.

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