

ADAPTIVITY IN MOODLE BEYOND THE LIMITS OF ADAPTIVITY IN MOODLE

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Keywords: Technology enhanced learning, e-Learning, Didactics, Learning management systems, Moodle, Adaptivity.

Abstract: Learning management systems (LMS, for short) have meanwhile gained an enormous practical relevance. Nevertheless, the quality of service offered is, at least in some respect, astonishingly behind the state of the art. Adaptivity of system behavior is such a field in which we confine ourselves to much less than we can afford. The authors develop an original approach, demonstrate an implementation, and discuss the benefits for learning of an adaptivity approach which is integrated into the LMS moodle although it apparently goes beyond the limits of moodle. The approach is sufficiently generic to be carried over to other LMSs.

1 INTRODUCTION

As early as in 1957, Cronbach has directed the attention of educators to adaptivity in setting the goal “not to fit the average person, but to fit groups of students with particular aptitude patterns” (Cronbach, 1957).

In harsh contrast, half a century later the state of affair in technology enhanced learning is still rather unsatisfactory.

Beyond the horizons of contemporary computer-supported education, the personalization of products and services is a quite obvious tendency permeating nearly all domains of the modern industrial society.

For already a few decades we all are used to the configurability of products and services. When you buy a new car, for instance, you are facing almost uncountably many decisions about details you can configure according to your wishes and desires. When you book your holiday trip, e.g., you can change and expand the program in numerous ways. This type of configuration is usually decided about quite a long time before you get your product or service. As soon as the product or service, respectively, relies on some computerized system at your fingertips, usually, you can set up details immediately prior to usage. Setting the level of difficulty when playing a digital game or choosing your seat when checking in online or at a self-checkin terminal in the airport are just two almost trivial examples of adaptability. But we all know that we can go even further—computerized systems bear the potentials of doing the adaptation for us. Instead

of tuning a system according to our needs and desires, a computerized system can tune itself, i.e. be adaptive.

Adaptivity is an established field of research and applications in Artificial intelligence (AI).

So far, what the authors have been summarizing above applies to products and to services, in general. And what about technology enhanced learning . . . ?

In proprietary e-learning systems such as the data mining tutor DaMiT which has been implemented and used around the turn of the millennium—adaptivity is well established and has been proven to be effective (Jantke et al., 2004a; Jantke et al., 2004b).

But as soon as we must rely on standardized and widely used platforms such as the LMS moodle, e.g., our dreams about adaptivity and personalization rarely come true. Those systems are much too rigid.

There are a few obvious reasons for the current state of affair. Adaptivity requires a finer granularity of learning objects, a larger number of variants, and suitable object annotations (Memmel et al., 2007). To say it briefly, adaptivity is demanding and costly.

These difficulties have been recognized and, in response, elaborate endeavors such as the GRAPPLE project¹ have been launched. In contrast, the present paper is aiming at a generic light-weight approach.

¹<http://www.grapple-project.org>

2 EXPECTATIONS OF ADAPTIVE SYSTEM BEHAVIOR

The authors expect the whole CSEDU audience to be knowledgeable in the problem area of adaptivity and personalization. Consequently, the introduction may be kept short.

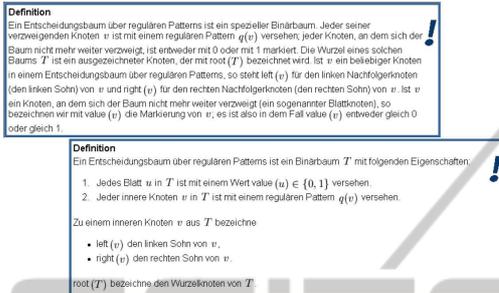


Figure 1: Two alternative variants of a definition as they are in use in the data mining tutor DaMiT (Jantke et al., 2004a).

The two frames on display in figure 1 show two variants of defining the quite involved concept of a “decision tree on regular patterns” within the data mining tutoring system DaMiT—a proprietary system for technology enhanced learning that does not rely on any prefabricated platform software.

The upper variant of the definition is seen as the *informal* one which is quite wordy and contains only those formal symbols that are inevitable.

The other variant is seen as the *more formal* one which offers more concise definitions and abandons the appearance of continual text.

The expectation of an adaptive system in the field of technology enhanced learning is to present the one or the other variant autonomously in accordance to a human learner’s needs, desires, and wishes.

An implementation of adaptivity requires, at least, three things:

- the acquisition of knowledge, i.e. modeling², about the peculiarities of an individual human learner (see (Brusilovsky, 2001), in particular),
- content which is prepared for varying system behavior as described in (Mommel et al., 2007), e.g.,
- functionalities implementing adaptivity.

The authors support the trend from proprietary systems such as DaMiT (see above) toward standardized systems used world-wide such as moodle, e.g. This perspective has been motivating their research and development reported in this paper.

²There is a whole journal named “User Modeling and User-Adapted Interaction” providing paramount sources: <http://www.springer.com/computer/hci/journal/11257>

3 NEEDS IN THE LMS MOODLE

The authors are employing the LMS moodle for courses on Theoretical Computer Science (TCS) and on Artificial Intelligence (AI).

These particular courses have the peculiarity of incorporating rather new and advanced technologies such as so-called Webbles as described and discussed in recent publications such as (Fujima et al., 2010) and (Jantke and Fujima, 2010).

In the TCS course, webbles are used to model rules of formal language grammars (“rubble” is short for rule webble). The derivations of formal language expressions are realized by plugging webbles together as shown in figure 2. When webbles are plugged together, they perform the derivation by themselves.

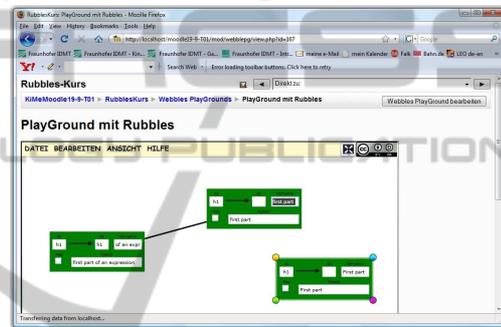


Figure 2: Screenshot of moodle at work; rubbles are used as building blocks for formal grammars à la Noam Chomsky.

			id	groupid	userid	timeadded
<input type="checkbox"/>			1	1	3	1284455150
<input type="checkbox"/>			2	4	5	1284990089
<input type="checkbox"/>			3	3	4	1284990113
<input type="checkbox"/>			4	2	3	1284990122
<input type="checkbox"/>			12	13	2	1285161588
<input type="checkbox"/>			11	12	3	1285137639
<input checked="" type="checkbox"/>			10	13	5	1285137639
<input type="checkbox"/>			9	12	4	1285137639

Figure 3: Cutout of a particular moodle group database.

To novice learners, Webble technology, in general, and rubbles, in particular, are unfamiliar. There is a need to enrich moodle content by guiding texts which explain how to operate the objects on the screen.

However, guiding text next to the work space has also several, at least, potential disadvantages such as

- occupying space which is always scarce,
- extending the cognitive load on the learner,
- diverting the learner’s attention, and

id	course	module	instance	section	idnumber	added	score	indent	visible	visibleold	groupmode	groupingid	groupmembersonly
60	6	16	2	19	1265946248	0	0	0	1	1	0	0	0
61	6	12	1	20	1265949376	0	0	0	1	1	0	0	0
62	6	12	2	20	1265965920	0	0	0	0	1	0	0	0
63	6	13	12	20	1265968011	0	0	0	1	1	0	0	0
64	6	13	13	20	1265968227	0	0	0	0	1	0	0	0

id	course	module	instance	section	idnumber	added	score	indent	visible	visibleold	groupmode	groupingid	groupmembersonly
60	6	16	2	19	1265946248	0	0	0	1	1	0	0	0
61	6	12	1	20	1265949376	0	0	0	1	1	0	0	0
62	6	12	2	20	1265965920	0	0	0	0	1	0	0	0
63	6	13	12	20	1265968011	0	0	0	1	1	0	0	0
64	6	13	13	20	1265968227	0	0	0	1	1	0	0	0

Figure 4: Change of the visibility attribute (see last row in every table) in response to a learner’s interaction with the system.

- hindering the learners to memorize essentials.

It is ultimately desirable to interact with a work space as in figure 2 where text is suppressed as much as possible (for a debate, see (Kirschner et al., 2006) and (Kuhn, 2007)).

The two authors’ didactic approach is as follows. Guiding text shall be available as long as necessary and appreciated by the learner. As soon as the learners can manage to complete their tasks without looking for and at the guiding text, the text shall be dropped. If necessary lateron, learners shall get guidance back.

But unfortunately, such a dynamic, i.e. adaptive, behavior is far beyond the limits of moodle.

4 ADAPTIVITY IN MOODLE

The authors have been pondering ways of going with moodle beyond the limits of moodle. The title of the paper shall shade some light at the intended quality: to provide adaptivity by means of moodle which goes beyond what moodle has been designed for.

Different from the ambitious GRAPPLE approach (Abel et al., 2009; van der Sluijs and Höver, 2009), the authors aim at a light-weight solution which may be realized by means of a few lines of code.

A first idea is to use the grouping functionalities of the LMS moodle to implement adaptivity (fig. 3).

In detail, this works as follows. In dependence on a learner’s activities when using the system, a script writes into the group database and changes the learner’s group membership dynamically.

The underlying didactic principle is quite obvious. One assumes that, at least for the concrete course and for the audience under consideration, it makes sense to determine learner stereotypes. One may follow David A. Kolb’s learner types, for instance, (consult (Kolb and Fry, 1975) and (Kolb, 1984)).

Under the assumption that some learner model has been chosen, one may group the content variants for every stereotype appropriately. Learners who belong to a particular group get content provided in a related form assumed to be suitable for this learner type.

The art of adaptivity is now to reassign learners to groups in response to their individual behavior and success in the course of learning. This is the authors’ first approach to adaptivity introduced in the present paper.

The second idea is to change the content available to particular learners or learner groups dynamically. For this purpose, visibility attributes are set as shown in figure 4.

Seen from a more general point of view, the two authors’ idea is to slightly expand the operational interpretation of some learner activities in different ways. Basically, particular activities of the human learner trigger scripts that write into the one or the other databases of the moodle system as visualized in the figures 3 and 4. PHP scripts such as the one on display in figure 5 are invoked to update database entries such as group membership attributes or visibility attributes of learning objects, e.g.

```

require_once($CONFIG->dirroot.'/config.php');
require_once($CFG->dirroot.'/course/lib.php');
require_once($CFG->dirroot.'/mod/forum/lib.php');

global $CFG, $USER, $DB;

foreach ($USER->groupmember[$COURSEid] as $key => $group)
{
    if (($USER->groupmember[$COURSEid][$key] == GROUPO1)
        || ($USER->groupmember[$COURSEid][$key] == GROUPO2))
    {
        //get GroupRecord from db
        $groupRecord = get_record_select('groups_members',
            "groupid = '". $USER->groupmember[$COURSEid][$key].
            "' AND userid = '". $USER->id. "'");

        //set new Group value
        $groupRecord->groupid = $toGroup;

        //update database entry
        update_record('groups_members', $groupRecord);
        //update globals

        unset($USER->groupmember[$COURSEid][$key]);
        $USER->groupmember[$COURSEid][$toGroup] = $toGroup;
    }
}

```

Figure 5: Cutout of a PHP script to implement adaptivity.

The reader may imagine some link which in response to a learner’s click does not only, as before, opens a new page or loads some file, but sets some attribute in a certain database, additionally. The script

syntax is quite lucid and uniform, thus, being generic.

Based on those simple ideas, even the extremely rigid moodle system can be made to appear adaptive.

5 SUMMARY & CONCLUSIONS

According to Cronbach (Cronbach, 1957), it is old hat that good didactics necessarily include efforts of adaptation to the human learners' peculiarities (see also (Salomon, 1972)). This is sound with numerous contemporary insights into technology enhanced learning and its foundations (see, e.g., (Davis et al., 2000), (Flechsigt, 1996), and (Jank and Meyer, 2002)).

But the opinions about the appropriate degree of learner guidance—and, thus, of adaptation—are divided (Kirschner et al., 2006; Sweller et al., 2006).

ACKNOWLEDGEMENTS

The Webbles in use within the authors' courses on TCS and AI, respectively, have been provided by their colleague and friend Jun Fujima.

The underlying Webble technology is a certain contemporary version of Meme Media as introduced and developed by Yuzuru Tanaka (Tanaka, 2003).

This work has been supported by the Thuringian Ministry for Education, Science, and Culture within the project iCycle under contract PE-004-2-1.

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