



INDIVIDUAL LEARNING PATH IN GAMIFIED ENVIRONMENT

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Summary

The purpose of the paper is to present the preliminary findings of a research project aimed at individualization in Technology Enhanced Learning. In the first section we are going to present a brief context of the research explaining what are the differences between personalization, individualization and differentiation and what is meant by the individualized approach in our research. Also some other research works related to the scope of the project will be indicated. In the second section the concept of a project and its main phases will be described, followed by the presentation of the current stage of work. Further works, both with regard to the nearest future and to a longer period of time will be introduced briefly. The paper will finish with some conclusions and observations concerning the results already achieved and the steps completed up to now.

Introduction

Although information and communication technology (ICT) is commonly used in education for a couple of decades there is still a lot of discussion about the way it should be used in order to improve the teaching and learning results. One of the frequently raised issues is the usefulness of ICT for personalizing learners' experience. A number of different approaches can be observed during the recent years but they could be divided into two main categories. The solutions developed by those who believe technology can "replace" the teacher and play a role of an intelligent tutor. The main stream of that approach is represented by AHS (Adaptive Hypermedia Systems) or Intelligent Tutorial Systems. Such systems are frequently associated with the research of Peter Brusilovsky, professor from the University of Pittsburgh and a chair of the School of Information Science, whose works appeared first in mid-nineties of the previous century. Brusilovsky's (1996) solutions are based on the use of Artificial Intelligence methods and techniques and represent the technical approach to personalization. Along with the increased presence of multimedia and mobile technologies in education another trend in personalization appeared, which can be generally described as the freedom for adapting the application interface and changing the settings in a way that it suits the learner best. But again, this is only technology and although personalized desktop or interface can establish more friendly or intuitive environment it does not change the way one learns and acquires new skills. In recent years the concept of big data and learning analytics are frequently used in the context of personalization. Big "educational players" like Pearson

Education¹ or Khan Academy claim they provide personalized learning based on the analysis of huge amounts of data describing the way how learners work and solve the problems they are given while learning. Such different interpretations of a word “personalization” have led to the attempts of distinguishing among various types of usage of that term and in consequence two other words are being used in parallel: individualization and differentiation. Barbara Bray and Kathleen McClaskey known from their research on personalized learning (2011-2014) elaborated a chart² which role is *to clarify the differences in these terms*. They define personalization as a process that learner-centred while differentiation and individualization are teacher-centred. In personalized learning *the learner is driving their learning and actively participates in the design of their learning*, while in differentiation *the teacher adjusts learning needs for groups of learners and designs instruction based on the learning needs of different groups of learners*. The teacher also plays a key role in individualization where (s)he *accommodates learning needs for the individual learner and customizes instruction based on the learning needs of the individual learner*. According to this classification the research project described in the following sections is aimed at individualization of learning, with some prospects of being extended to more personalized learning in the future, what will be discussed as the possible direction of future works. The model of individualized online course, which could be created by the use of the tools described in this paper has two other features that distinguish it from the other similar solutions:

1. Some elements of gamification are applied;
2. The course design includes activities which are aimed at developing soft competences like: leadership, collaboration skills, organizational skills, time management and others.

It is worth to be stressed that both aspects correspond well with contemporary trends in education, which include supporting the learners in acquiring the skills that are highly valued on the labour market and preparing them for lifelong learning (and the main area where gamification is being used are corporate trainings).

Project aims and scope

The main objective of the project is to elaborate the methodology of designing the individualized courses and of implementing them into online and blended learning. The project has been financed by The Polish-Norwegian Research Fund within the scope of so called Small Grant Scheme aimed at women doing research in technical sciences³. Although originally the scope of the project was placed in computer science there is no doubt that pedagogical aspects of the issue are equally important. The pedagogical and technological aspects influence each other, which means that the conceptual work and software solutions

¹ The adaptive learning platform built by Pearson is called Knewton – detail available at: <http://www.knewton.com/> [retrieved 2.09.2014]

² The recent version of the chart can be viewed on the website: <http://www.personalizelearning.com/2013/03/new-personalization-vs-differentiation.html> or on the Slideshare at: <http://www.slideshare.net/barbarabray1/pdi-v3-2> [retrieved 30.08.2014]

³ INDIPATH, Formal description of individual learning path in Technology Enhanced Learning, project ref. No Pol-Nor/205110/12/2013

are well settled in teaching practice which is not often the case when talking about adaptive learning systems. Therefore the necessary steps of the project could be outlined as follows:

1. To establish the context for individualization – how is it understood and realized in practice;
2. To identify as many as possible different forms of engaging the learners and increasing their motivation for learning (this was done by analysing good practices both accessible as online courses and described in the literature);
3. To elaborate a system of identifying different types of course components and activities with the aim of assigning diversified activities to the different learners' profiles they correspond with;
4. To prepare a sample individualized course and to implement it in a chosen learning environment;
5. To run a course, evaluate its workflow and improve the system based on evaluation results.

The project started in September 2013 and now it is at the step 4, that will be implemented in the autumn semester 2014/2015.

At the beginning it was planned that the project will end with the definition of a dedicated language (based on XML) that would allow the authors of the courses enhanced by the use of technology to design their structure and their content with focus on individualized approach to the learners needs and preferences. At the current stage (almost a halfway of the whole project) we are convinced that the language itself is not enough and that elaboration of the necessary tools that create an environment for individualization is necessary. Some of them will hopefully be ready at the end of the project whereas some others are suggested as the future works.

The overall concept of the system

As far as the technological aspect of the project is concerned the main challenge is to create an algorithm that would be able to adjust the course content to the learners' individual needs. This should be understood that the author of the course that is intended to be delivered in an individualized manner creates its content, which is redundant in some way because it includes various types of tasks corresponding with different learners' profiles. Some course components (incl.: general instructions, course completion requirements, game rules, some units of learning content and even some activities) are common for the whole cohort of learners whereas the others are aimed at particular working teams or individual learners, depending on their preferences and the role they play in a group (and consequently in a whole course). Those preferences are recognized by the appropriate tests, which will be introduced in the following section. In brief – two types of tests are used – the results of the Bartle's test show the individual preferences in a gamified context, while Learning Styles Inventory gives the indications for audio-visual form of learning content contrasted with the verbal (descriptive and explanatory) or graphical (logically structured and concise) form. The first

part of those data helps the teacher to match the learners with the roles they will play in a course and to create the working groups of them. The heart of the system is the *Selection engine*, which goal is to create individualized version of a course, which will be a subset of the original one. The general overview of the system is presented in Figure 1.

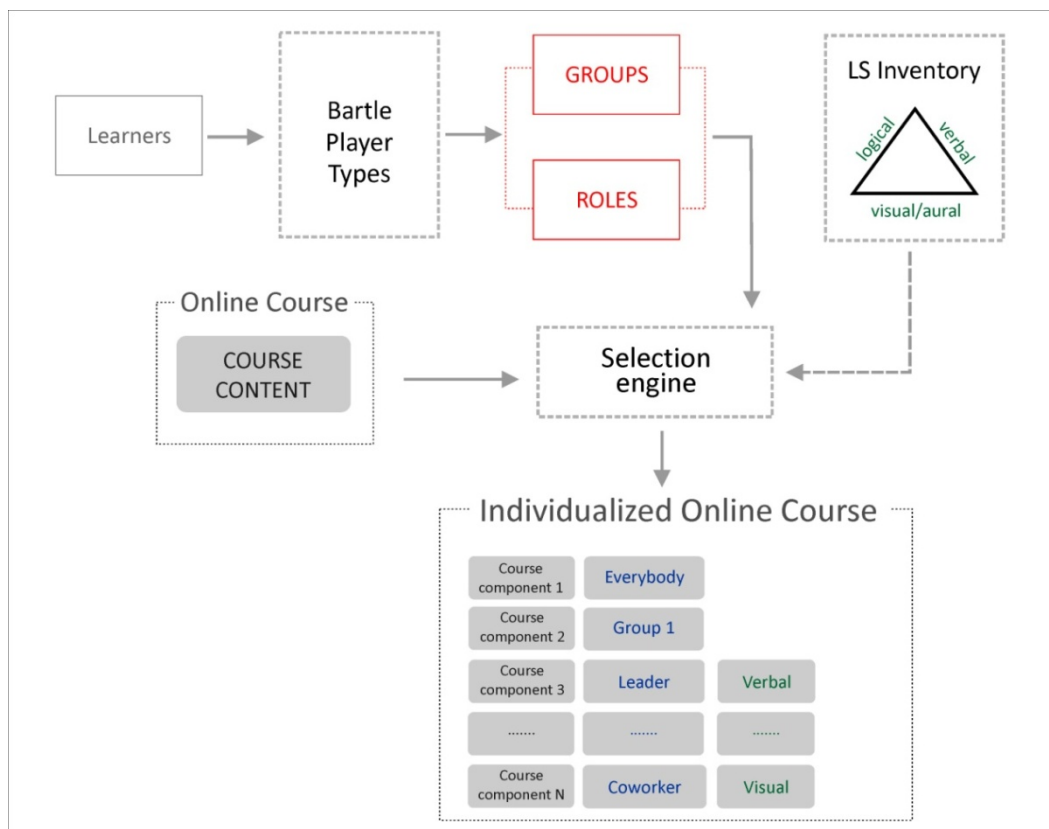


Figure 1. The structure of the individualization system

As far as the pedagogical aspect is concerned the main challenge refers to finding a solution to the problem expressed by the following question:

How should we design the learners' activities in a course that will support achieving the same learning objectives in different ways, depending on the learners' profile or preferences?

The answer to this question can be given only by a human being, namely a teacher. That is why a heuristic approach has been undertaken in the project – two experimental online courses are being created for two university subjects to be realized in the autumn semester 2014/2015 (October 2014 till the end of January 2015). The characteristics of learners' profiles applied in the experiment will constitute the base for creating versatile activities aimed at different types of learners. This combined with the vast experience of the authors in online teaching as well as the analysis of other good practices should result in creating the set of rules to be implemented later on in the selection engine.

How to individualize learning experience

The main issue in the first phase of the project was to define the backgrounds for identifying individual learners needs. Based on the previous research of the authors one of the possibilities taken into account was the concept of learning styles. Despite some controversy that learning styles cause among the researchers and educators the authors have positive experience in that area (Zajac, 2009). The questionnaire already used by them was collocated with Howard Gardner's Multiple Intelligence Theory⁴ and it helped to recognize the extent to what a particular learner has developed each of the seven learning styles corresponding with seven main types of intelligence indicated by Gardner (1983). Four of them – visual, aural, verbal and logical – are addressed in the course directly by different forms of learning content as mentioned above and the other three – kinaesthetic, social and solitary – have to be reflected in adequate activities. Another source of data describing the learners' preferences was the Bartle test of player types (Gamer DNA, 1996). This test indicates four player types called: achiever, explorer, socialiser and killer. As individualization in the project is based on three pillars: gamification, project based learning and collaboration (teamwork) the Bartle's test results have been combined with the Belbin's theory of team roles (2012) and finally four different roles have been defined: leader, researcher, co-worker and player. The advantage of introducing those roles is not only better organization of teamwork but also creating the possibility of assigning dedicated individual tasks to the learners who play particular roles in the team and in the course. There are several possible ways of creating the teams according to identified roles, – starting from the very formal (based on indicated player types) to totally intuitive and heuristic based on the teacher experience and his/her knowledge about their learners, some of them were briefly described by Douglas Kiang in his blogpost (2014). Probably the most common 'algorithm' leads to creating the groups of four learners, in which every person plays a different role, but in some contexts establishing the groups identified by the role i.e. group of leaders, group of researchers will be more justified. Especially when we design the activities that are aimed at improving soft skills like for instance team management or critical thinking. Table 1 illustrates one of the possible divisions of 16 learners cohort into four teams. The algorithm used here was partly "statistical" and partly heuristic – this should be understood that all learners got access to the results of test (stored in a Google form) and they were allowed to create the teams of four on their own, but with the requirement that everyone should take on a different role and that role must correspond with the profiles indicated by the Bartle's test. The experiment took place in previous semester (February till June 2014) and the groups worked in partly gamified context but not in individualized manner (every group was given the same tasks) – it was a part of the pilot stage aimed at verifying the usefulness of Bartle's test for the arrangement of group work. Observation of their work has shown that the learners created the teams based on various types of informal relations among them, not really on the Bartle's test indications and that more strict rules

⁴ The original LSI, adapted by the authors to the Polish educational conditions is called Memletics Learning Styles Questionnaire and is available online at: <http://www.learning-styles-online.com/inventory/questions.php> [retrieved at 30.08.2014]

must be introduced in the future if the learner's roles are expected to influence their work and type of activity.

Table 1: Division into groups based on the Bartle's test results

		Bartle's test results				KS-TIW results								team
No	name	achiev.	expl.	socialize	killer	VIS	AUR	VERB	LOG	PHYS	SOC	SOL		
1	Piotr	80%	53%	53%	80%	9	12	10	14	12	14	5	Z1	
2	Mateusz	87%	75%	40%	73%	11	13	12	12	9	17	10	Z1	
3	Jarek	60%	53%	27%	73%	10	8	9	18	7	12	12	Z1	
4	Arek	33%	80%	40%	67%	15	12	10	14	16	12	9	Z1	
5	Mateusz2	27%	60%	47%	67%	8	8	5	17	5	5	15	Z2	
6	Maciej	53%	27%	67%	53%	9	9	9	11	12	11	11	Z2	
7	Mateusz3	73%	67%	47%	13%	9	10	6	13	9	12	6	Z2	
8	Jakub	0%	67%	60%	80%	7	13	5	8	11	14	7	Z2	
9	Filip	47%	53%	13%	93%	9	12	14	11	10	13	14	Z3	
11	Kamil	40%	47%	33%	67%	15	11	10	15	12	10	15	Z3	
12	Mateusz4	73%	73%	40%	27%	9	10	6	12	12	11	13	Z3	
14	Bartek	47%	73%	53%	27%	7	10	9	15	9	14	9	Z3	
13	Przemek	53%	100%	60%	13%	9	11	9	15	7	10	14	Z4	
14	Anita	60%	73%	87%	27%	10	11	6	18	6	10	15	Z4	
15	Szymon	53%	47%	40%	60%	14	15	8	13	13	14	11	Z4	
16	Tadeusz	27%	93%	60%	33%	11	16	15	18	9	13	10	Z4	

Implementation of the project

At the experimental phase all the tools and solutions i.e. grouping algorithm, selection engine are tested on the Moodle platform. The users data are stored in the Moodle files extended by additional tags and the algorithm that transforms that data and creates the groups is written in Python. The course structure including the indications for particular roles and groups must be written in EDL, which is a dedicated language based on XML syntax with its own structure stored in associated XML Schema file. It is planned that in the next step a dedicated EDL-editor will be implemented with the aim of supporting the design process of the individualized course.

Future works

There are a couple of things that could be done in order to further develop the already described concept. One of them could be a move towards personalization of learning, which is step 2 in Bray and McClaskey chart. While step 1 (already achieved) represents *adjusting the learning process to what the teacher thinks will most suitable for a particular learner*, in step 2 the learner *has voice and choice* – which in this context means that the learner can decide which activities are more engaging for them and shape the course in collaboration with teacher. This could be an interesting direction of further development.

As it was already mentioned at the experimental stage the system is implemented on the Moodle platform therefore the other piece of work which should be done in the future is to consider its implementation also on the other learning platforms.

It would also be necessary to evaluate the effectiveness of teaching and learning processes based on individualised courses.

Another area of further works relates to the game rules and maybe game mechanics – what have been already done in this area within the scope of the project is only the beginning.

Conclusions

One may ask what is the purpose of creating such concept of individualization if a lot of work still remains “in the hands” of the teacher. Two advantages can be indicated – first: the presented approach can be used for designing the online courses – once the course is designed using the EDL mechanism the only thing that the teacher must provide for a new group of students is the list of their results from the Bartle’s test and a KS-TIW (for Polish learners) or other equivalent MI based questionnaire. Dedicated algorithm will help then to create the working teams and rearrange the cohort into smaller groups (usually having 4 members) and the selection engine (SE) will generate for each learner an individualized version of a course. Secondly EDL can also be applied in blended learning not only because those parts of a course, which are delivered online could be individualized in the same way but also because the necessity to think off and to create diversified tasks and activities according to students profiles could stimulate the teacher to search for new didactic solutions and in consequence support achieving better learning outcomes.

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