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**Title:** Adaptive techniques in e-Learning for transnational programs

**Year:** 2019

**Version:** Accepted version (Final draft)

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**Please cite the original version:**

Subirats, L., Fort, S., Martín, Á., Huion, P., Peltonen, M., Nousiainen, T., Miakush, I., Vesisenaho, M., & Sacha, G. M. (2019). Adaptive techniques in e-Learning for transnational programs. In M. Á. Conde González, F. J. Rodríguez Sedano, C. Fernández Llamas, & F. J. García-Peñalvo (Eds.), TEEM'19 : Proceedings of the Seventh International Conference on Technological Ecosystems for Enhancing Multiculturality (pp. 879-884). ACM. <https://doi.org/10.1145/3362789.3362907>

# Adaptive techniques in e-Learning for transnational programs

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## ABSTRACT

In this article we present a set of methods and models to help the inclusion of information and communication technologies (ICTs) in transnational programs. The material that we are presenting takes advantage of several adaptive models that automatically react to students' activity. These models are extremely useful in environments where a huge number of very different students (such as those found in transnational programs) are enrolled in the courses or where the distance is a problem for face-to-face activities. We present the theoretical background, the gamification and adaptive techniques included in the model and the platform where the courses are implemented.

## KEYWORDS

e-learning, gamification, adaptive environments, transnational programs.

### ACM Reference format:

Laia Subirats, Santiago Fort, Álvaro Martín, Patricia Huion, Marika Peltonen, Tuula Nousiainen, Iryna Miakush, Mikko Vesisenaho, G.M. Sacha. 2019. Adaptive techniques in e-Learning for transnational programs. In *Proceedings of Seventh International Conference on Technological Ecosystems for Enhancing Multiculturality (TEEM'19)*. León, Spain, 6 pages.

## 1 Introduction

One of the challenges university teachers are facing nowadays is evaluating and teaching students in wide scenarios such as transnational programs within the European Union or even including third parties. In this state, the use of information and communication technologies (ICTs) are becoming extremely relevant [1,2]. It is also necessary to coordinate the classroom activities with distance and autonomous learning, becoming any

new learning and teaching paradigm a non-divisible model that must include any activity within the whole learning process [3,4]. In this scenario, developing learning activities that can be easily monitored and give accurate information about students' performance is a task that must be developed carefully. A very good candidate is Computer Adaptive Testing (CAT) because of their ability to adapt the content presented to learners as a function of their responses [5], which is an extremely useful characteristic in this heterogeneous context. CAT has been used previously in a wide variety of subjects such as language [6], identification of learning styles [7] or programming [8]. However, the advantages of using CATs in learning implies also a deep knowledge of the theoretical models to correctly calibrate the system [9].

In this context, FRESH START (Horizon 2020, DG Grow) modeled an integration learning path for refugees through entrepreneurship. We have formulated therefore a design challenge: empowering highly-qualified refugees as co-creators of a network of welcome hosts for refugees. Entrepreneurship was defined as either starting up a business, finding your own path in the receiving society and creating value for others/other refugees through social entrepreneurship. The challenge was approached as a wicked problem as defined by Rittel: 'a class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values and where the ramifications in the whole system are thoroughly confusing' [10].

Wicked problems are indeterminate and having filled one set of details of the basic hypothesis leads to the discovery of other aspects of the problem. So far, we have designed solutions following the principles of citizen science, involving academics, agencies of entrepreneurship and integration, educators and refugees themselves in four rounds [11]:

- connect refugees and intermediaries, create fluid time schedules, bolster the refugee/co-designer identity;

- share national entrepreneurship mores, link to language courses, and explain the pedagogical approach
- organize story-gathering sessions, define location as a sign of respect, and communicate the link to the EntreComp framework, the EU policy on migrant entrepreneurship, the Oxford model of integration levels, Unesco's SDGs;
- open the debate on the differences in work ethics, society's negative perceptions of refugees and society's intercultural vulnerability.

This paper deals with the fifth round of aspects that need to be developed to have this network of welcome hosts: empower highly-qualified refugees to become coaches for all refugees into entrepreneurship.

In this article, we present several techniques that will be useful for including information and communication technologies (ICTs) in the classrooms by using different adaptive formats. These formats take advantage of the potential automatization of evaluation and self-evaluation by computers, making them adequate for many different scenarios and potential users. We opted for an online adaptive learning environment because of limited educational resources, an enormous diversity in beginner's level, the busy refugee time-schedules but also the expertise in the FRESH START refugee community. Some refugees have a financial background, others were entrepreneurs in their country of origin while others are marketeers, fiscalists, teachers, lawyers, gender experts, journalists, IT-specialists or architects.

In section 2 we describe the course in general terms. In section 3 we describe the gamification techniques that can be included to increase motivation. In section 4 we describe the platform where the course will be implemented and section 5 shows the conclusions.

## 2 Description of the course

We combined Bloom's taxonomy, Csikszentmihalyi's flow theory and Kapp and O'Driscoll's network learning to create an immersive learning environment.

Kapp and O'Driscoll envision a work/learn culture where learning is perceived as optimizing networks. These learning networks provide context to the content and migrate from productive learning to nurturing generative learning: "enabling human capital to develop ideas and concepts that grow revenue" [12].

Flow is the state of complete absorption when completing a task. You are no longer aware of hunger, thirst nor sleep. Time flies by and you experience a deep sense of joy and satisfaction. To achieve flow, you need intrinsic motivation, a challenging task and the skills to perform it, and an active and engaging task defined by clear factors of success [13].

Bloom's taxonomy categorizes and orders thinking skills. We use Lorin Anderson's revised Bloom's taxonomy starting from

remembering, understanding, applying, analyzing, evaluating to creating [14].

Our model looks as shown in figure 1. All four chapters- Well-Being (2), Starting up a business (4), Legal (2) and Financial issues (4)- are defined by challenges per Bloom's category: 6 for remember, 5 for understand, 4 for apply, 3 for analysis, 2 for evaluate and 1 for create (ordered from left to right in figure 1). Per category the questions are organized from facets to the major task which is the number 1 in the model. All learners start from the first chapter of the course, Well-Being, finding their own pitch for the future. From 'apply' onwards learners are asked to find answers between the entrepreneurial culture of their country of origin and of their host country. Thus, we create intrinsic motivation as it is about their own passions within their own contexts.

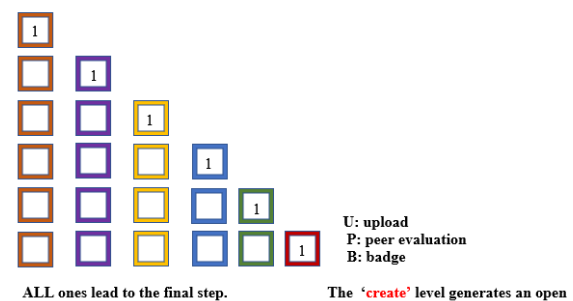


Figure 1: Schematic representation of the course

Learner A starts from the final task (task 1). Should he fail he has to answer two facets of this category before he can get to the next category. If he does not fail, however, he has a fast trajectory from category to category to the final task in 'create'.

Learner B can follow a more linear path building up to the main challenge per category from the bottom up. He does all the tasks moving from the easier questions to the final task (task 1).

In this way, we ensure the tasks are challenging and they have the skills to be doing them.

With the exception of the remember-category, all final tasks involve designing and sharing a file about their own business. These files are given feedback by their peers and by the external experts from the refugee community. Rubrics are given as a link to guide this feedback. As such, the program guarantees active and engaging tasks with clear factors of success.

The continuous feedback from peers and external refugees creates a generative learning culture resulting either in a plan for a future career, a business plan as a social or a traditional entrepreneur.

For each chapter, learners get an open badge but how to validate this and perhaps how this will be appreciated by the community and the host country, will be our next feature of creating a network of welcoming refugees integrating new refugees through entrepreneurship through citizen science.

### 3 Applying Gamification

One of our aims is to apply gamification in e-learning platforms, which is a huge improvement in the particular case of the course described in this article. So far, there are rather few accounts on previous efforts to apply gamification in the context of immigrant and refugee integration (see e.g. [15,16]). However, as gamification – especially from the point of view of emotional immersion – has been found to support dialogic learning [17], it can be seen as having significant potential for an entrepreneurship course for refugees.

Gamification refers to using game design elements in non-game contexts [18]. We want to examine the ways in which gamification could respond to certain challenges related to users' behavior when using these platforms, for example in terms of enhancing users' focus on the tasks and the regular use of the e-learning system throughout the course [19].

The use of games and game elements, such as badges, has potential for enhancing learners' motivation, time-on-task as well as timely and careful completion of exercises [20,21]. However, previous research suggests that the meaningful implementation of gamification is a complex process where there is usually no one-size-fits-all solution. Specific game elements can have a different impact on different individuals' motivation and performance (see e.g., [22,23,24]). Furthermore, while a specific game element fulfills a certain function, the overall experience is a result of a complex interplay of these elements [25].

To meet the needs and preferences of different players, a model of player types can be applied. The best known of them is Bartle's (1996) [26] taxonomy that classifies players into "killers", "achievers", "socializers" and "explorers" based on their main motivations and playing styles. Bartle's taxonomy has since been modified and further developed by many researchers. In their meta-synthesis of studies pertaining to the topic, Hamari and Tuunanen [27] identified five prominent dimensions of player orientations: achievement, exploration, sociability, domination, and immersion. Yee [28], on the other hand, has presented a model where the orientations are seen in terms of three main components: achievement, sociability and immersion. Thus, most of these models share the same core concepts, with some variation in their foci.

The e-learning platform to be used in this course is Moodle; the implementation makes use of the standard features of Moodle enhanced with specifically designed gamification elements as shown in the following section.

We had some specific starting premises regarding the game elements and tasks to be implemented. Firstly, from the pedagogical point of view, the features should aim to encourage the users 1) to focus on the tasks instead of going through them only cursorily and 2) to use the e-learning platform regularly instead of doing most of the work during the final days and weeks of the course. Secondly, they should provide motivating aspects to a heterogeneous group of users and respond to the needs of particular user groups (such as refugees in this case). To this end, building on previous research [29], we adopted a three-component approach to

player orientations: achievement (including competition), sociability and immersion (including exploration).

From the FRESH START design days, we know that newly arrived refugees are feeling very lonely and traumatized. They quite often live in the past, processing what has happened to them. Finding a community, recreating their story and developing a possible continuation are signs of 'healing' and their future-readiness – which suggest the importance of the *immersion* aspect. We also experienced that many refugees have a fluid time concept and plenty of obligations. Thirdly, there is no such thing as a beginner's level for refugees. Thus, from the *achievement* point of view, we designed this online learning environment in such a way as to motivate refugees to focus on the tasks and on regular participation while offering a choice so they can personalize their journey to their needs. In terms of the *sociability* aspect, the course asks them quite often to connect to other participants and to involve outsiders. The welcome hosts' role is not only to guide them with the competence tasks but also to start conversations with them.

The gamification approach consists of the elements presented in Table 1. We will examine the effect of the gamified approach both based on the participants' subjective experience and usage data provided by the platform. Regarding the avatar, users cannot continue if they have not answered or uploaded tasks, the Avatar then fades when they have been absent for a while, they can create a sense of belonging and they can select chapters for a tailor-made course. However, if they want to become a welcoming host they need to have all content badges and a special one. Therefore, they need to have worked through all chapters.

**Table 1: Gamification elements of the Fresh Start course**

Element	Description
Storytelling	The platform has a backstory where participants become the expert-entrepreneur and joins the network of hosts for new refugees. They tell and upload their digital arrival story, their pitch, their marketing strategy, how they will address 'the pains' in the receiving country through social entrepreneurship, their business lean canvas, the reasons why they chose a particular legal and financial constructions. All 'create' activities combined design the personal story of the refugee's integration path. Owning his own story, he can become the coach/wizard for newcomers. From the feedback of the face-to-face participants of the FRESH START course, we learnt that finding your story in the receiving society is bewildering and this step-by-step approach is an intense and much appreciated guide. This element especially taps into the <i>immersion</i> and <i>sociability</i> orientations.
Avatar	Avatars allow refugees to participate in a personalized mode without having to reveal their identity. They create a starting avatar from their arrival story and further personalize

	it through their learning trajectory in this learning environment. Other participants can read from the avatar whether a specific participant is a fast tracker or somebody who builds up their knowledge through all steps. The avatar also reveals the special open badge the refugee is aiming at. The avatar especially addresses the <i>achievement</i> orientation (through making progress visible) and the <i>immersion</i> orientation (through the fantasy element).
Task types	Refugees have different backgrounds. Yet most course providers seem to be oblivious to this. From their feedback, we learnt that recognizing their prior expertise is vital for their engagement. Thus, we give participants a choice per chapter. They can either start from the easy questions empowering them to be able to do the final task or they can choose to start with this final task. If they have overestimated their expertise they can go back, answer two questions correctly and start with the final task again. Thus, a lawyer can fast track through the legal chapter doing only the 'create' assignment. Furthermore, at the levels of 'apply', 'analyse' and 'evaluate' participants are required to seek partners to discuss and compare their answers. The collaborative tasks address the <i>sociability</i> orientation, and the freedom of choice is expected to motivate especially the <i>immersion</i> -oriented participants who want to be able to explore the learning environment.
Points and leaderboards	The leaderboards are motivating in two ways. On a personal level, it allows refugees to keep track of their progress and to make time for the course within their many obligations. On a group level, the progress of one encourages the other to continue. It also helps them to find colleagues who are working on the same chapter so that they can team up for the collaborative tasks. Wizards need to have all five content open badges: well-being, networking, setting up a business, legal forms of a company and financial resources. Points and leaderboards are expected to motivate <i>achievement</i> -oriented participants in particular.
Badges	Badges are awarded for a variety of achievements and purposes, catering for <i>all player orientations</i> : community builder for those who give a lot of very good peer feedback; innovator for those whose stories show great originality; bridger for those who share an in-depth view of the differences

	between the receiving countries and countries of origin; adapter for those who found a diverse path from the one in his country of origin. In order to become a wizard, five badges and a special final challenge badge are required.
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## 4 Learning platform

Fresh start course is created using Moodle Learning Management System (LMS). In Figure 2 a fragment of the Fresh start Course can be seen. The questionnaires have been designed using the questionnaire functionality of Moodle, which enables the restriction of questions according to the results of other questions.

Many other reasons have led us to choose Moodle as the most appropriate platform to implement this project. Firstly, it is the most used e-learning platform in the world, which demonstrates its reliability and sustainability, which are both very important factors for this project. It is an open source environment, and this allows us to adapt it to our needs in an optimal way and implement a completely customized graphic and structural configuration, even having the possibility of easily adding new features. Furthermore, a large community of Moodle developers accompany users throughout the entire process, and that has driven a great evolution of the platform, offering plenty of options that allow users to create a great variety of online training environments. In addition, the platform is specially used as a training tool for diverse social groups, such as universities, public organisations, NGOs and other non-commercial operations.

Thanks to this, it offers many possibilities focused on boosting the motivation of the participants. Consequently, we can create the necessary adaptive itineraries and personalized training paths in order to reach the pedagogical objectives.

Moodle is also specially prepared for the configuration of collaborative environments, among the participants themselves and with the tutors or advisors who participate in the student's training course. Moreover, it allows the implementation of gamification strategies based on rubrics related to objectives and / or in the personalized evolution of the participant's avatar.

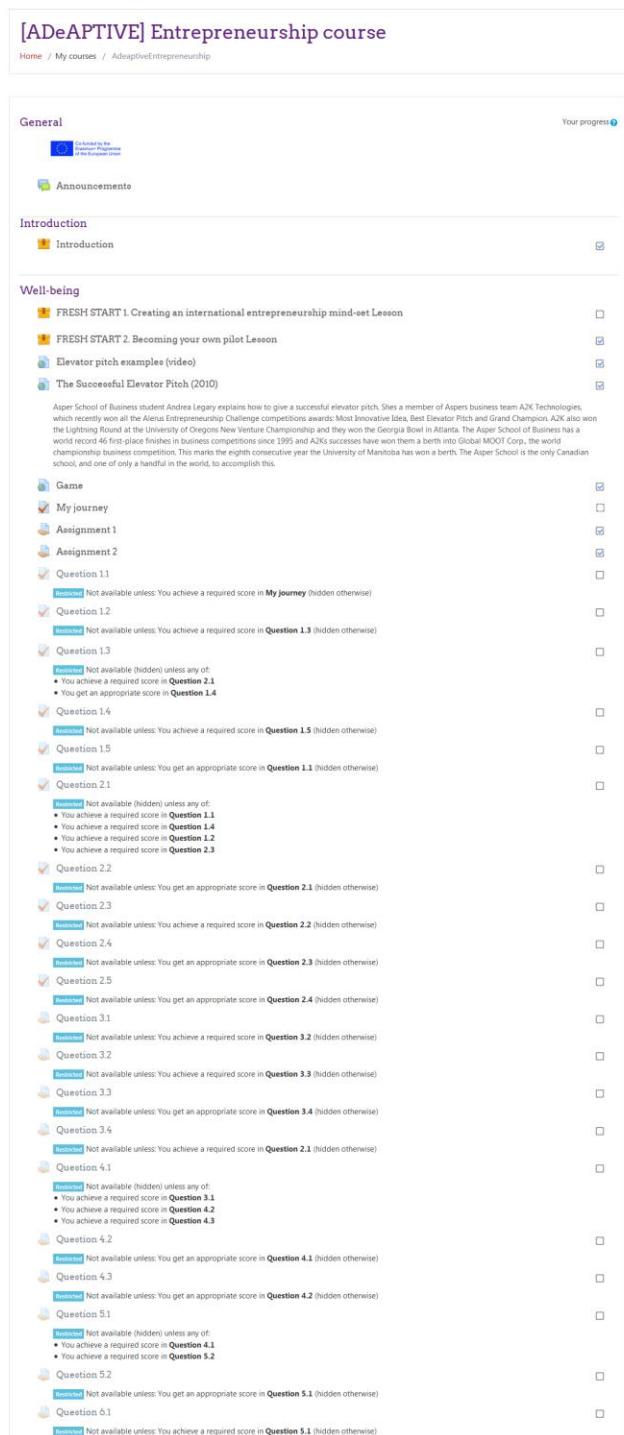


Figure 2: Fresh start Course

## 5 Conclusions

In this paper we have described a course that implies a kind of students that are very different in origin, education, culture and background. For preparing a course in this scenario, we must

include adaptive and gamification techniques in order to be sure that all students fit and are motivated to finish their tasks.

We have described the adaptive model that will be implemented and include tasks based on Bloom's taxonomy: remembering, understanding, applying, analyzing, evaluating to creating. We have also created an environment for including gamification techniques in the course in order to improve users' motivation. Without using adaptive models, we cannot guarantee the correct guidance of this heterogeneous group, and without including gamification, we are in danger of not having a good ratio of students finishing the course. Finally, we have described the platform where the course has been implemented, including the whole adaptive model and gamification techniques.

## ACKNOWLEDGMENTS

The work reported in this paper has been carried out as part of the ADePTIVE (Advanced Design of e-Learning Applications Personalizing Teaching to Improve Virtual Education) project with the support of the Erasmus+ programme of the European Union (grant number 2017-1-ES01-KA203-038266).

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