# TAILORED COURSES FOR PROFESSIONAL LIFE

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**Abstract:** *The article designs a method of eLearning courses which are customized with regard to the future professional lives of students. The method is based on the disaggregation of the branch of study to single semantic learning objects. Semantic learning objects are interconnected by prerequisites and they contain metadata about the importance of learning objects for mastering specific professions. At the beginning of his/her study each student takes a test to determine which profession could be potentially suitable for him/her and the individual's graduate profile is developed. According to the individual's graduate profile the Learning Management System (LMS) automatically generates a proposal for the optimal study path. For each student the semantic learning objects which are the most important regarding to his/her future profession are selected.*

**Keywords:** learning management system (LMS), professional life, semantic learning object, tailored eLearning course

## INTRODUCTION

A common problem for young people is that they have only a vague idea about their future profession, not only in the choice of field of study at university, but also at the end of their university studies. Many of them then start working in a different field than the one studied, so money, time and effort is largely wasted.

This article describes a solution that could partially alleviate this problem. From the beginning, a customized graduate profile would be developed for each individual student with respect to the profession which would be the most appropriate for him/her. On the basis of this profile, Learning Management System (LMS) will generate an individual study plan for the student with regard to the requirements of the possible future profession. From the beginning of his/her studies the student will have both a clearer goal and path towards this goal. This proposal may be one of the forms of a future LMS.

# 1. SEMANTIC LEARNING OBJECTS

According to modern standards, degree courses at universities consist of individual subjects or individual eLearning courses. The sequence of individual courses is determined each semester usually according to required prerequisites or co-requisites.

In the opinion of the author, degree courses which are composed of relatively isolated subjects are fragmented and sometimes can resemble a mosaic that is indeed composed of beautiful colour tiles (sophisticated individual courses), but in general it just dulls the senses. This vague structure of the field of study does not allow the student to choose the objectives, strategy, and study methods and it is certainly not based on any kind of customized profile of the graduate. The author therefore proposes to disaggregate the entire field of study into various semantic learning objects with clearly designated links (prerequisites of the learning objects) and to regregerate these learning objects at the level of the field of study rather than the individual courses. This is shown in Figure 1 where the circles represent the learning objects (LO) and arrows the prerequisites.

The author assumes that the semantic training modules by themselves create clusters of content-related learning objects. Conversely, individual clusters will be isolated from each other. This can be illustrated in the fields of physics. One can assume that learning objects relating, for example, to mechanics create a cluster because one of the learning objects of mechanics may be a prerequisite of the other. Conversely, a cluster of learning objects of mechanics will be isolate from the learning objects of optics, because, for example, the learning object "inclined plane" will apparently never be a prerequisite of the learning object “convex lens”.

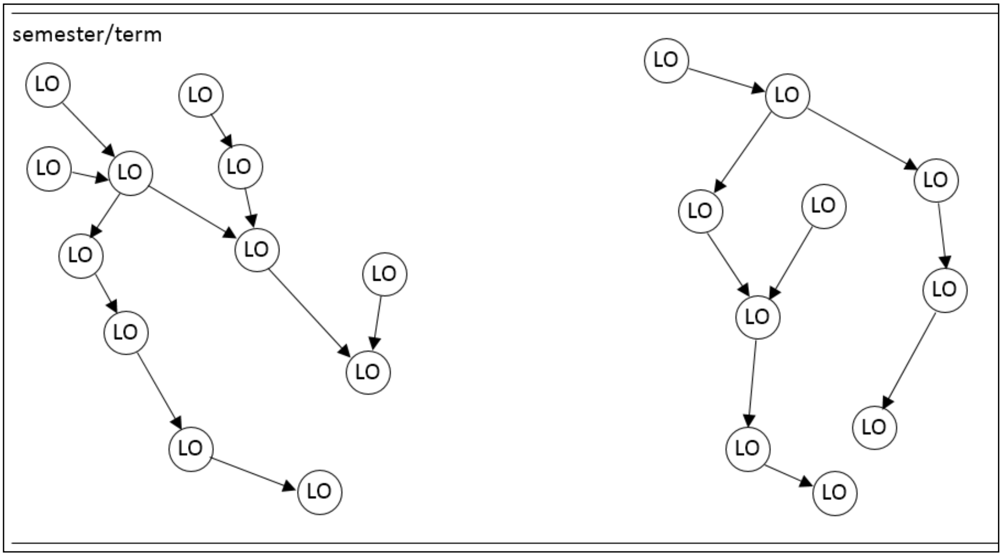


**Figure 1: Structure of the field of study composed of semantic learning objects**

*Source: Own work*

Disaggregation of the subject matter of a field of study into a set of further indivisible semantic learning objects brings out another characteristic of the potential future LMS. This system will not only be an authoring tool for the creation of individual courses, but it will be a strategic tool for creating entire fields of study. In the author's opinion, it is sufficient to disaggregate the subject matter of a field of study into semantic learning objects and the individual subjects of the field of study will sort of “emerge as if by themselves” in the form of clusters of learning objects.

Semantic learning objects have to carry such information which will determine whether a certain learning object is a prerequisite of another one. In other words, a learning object has to be embedded with metadata that describes the content of the learning object. As seen in Figure 1, learning objects interconnected by prerequisites create semantic (associative) networks (Lukasová et al., 2010), where each node represents a learning object and each edge represents the predicate “is a prerequisite”. The nonlinear language of semantic networks can be converted into a linear language, the so-called framework. The metadata format of the semantic learning objects can therefore be based on the syntax of the frameworks. A general registry of semantic learning object metadata with prerequisites is shown in Figure 2.

```
A framework of semantic learning objectives
Framework identifier: learning_object
Slots
Type: definition
Time: hours:minutes
Prerequisite 1: learning_object_prerequisite_1
Prerequisite 2: learning_object_prerequisite_2
…
Prerequisite n: learning_object_prerequisite_n
```

**Figure 2: A general framework of semantic learning object with prerequisites**

*Source: Own work*

It is possible to illustrate this with a specific example of a semantic learning object “convex lens”. This object has the form of a real lens which the teacher can demonstrate to his/her students and the instruction takes about nine minutes. The objects have only one prerequisite, and that is the semantic learning object “refraction”. The entry of the semantic learning object “convex lens” is shown in Figure 3.

Interconnection of a semantic learning object with its prerequisites is only the first step towards LMS, which automatically generates the optimal path through his/her studies for each individual student. As described in the next chapter, in order to create a personalized LMS, the metadata of semantic learning objects need to be expanded.

```
The framework of the semantic learning object “convex lens”
Framework identifier: convex_lens
Slots
Type: real_object
Time: 00:09
Prerequisite: refraction
```

**Figure 3: The framework of the semantic learning object “convex lens”**

*Source: Own work*

## 2. CUSTOMIZED GRADUATE PROFILE

As already indicated, the possible future LMS for each student generates a customized path through his/her studies in such a way as to saturate the student's educational, professional and personal needs to the maximum. At the beginning of his/her studies, a student, with a help of a teacher, psychologist and career consultant, creates his/her own customized graduate profile. From the student's perspective, this profile will express the rate of suitability of professions that the student might pursue after graduation. “Suitability” refers to how attractive a particular profession seems to a student as well as the extent of the student's study and personal skills regarding this profession which will be diagnosed by specialists (teacher, psychologist and career consultant).

```
Framework of a customized graduate profile
Framework identifier: field_of_study&student
Slots
Suitability of profession 1: profession_1=suitability_rate_1
Suitability of profession 2: profession_2=suitability_rate_2
…
Suitability of profession n: profession_n=suitability_rate_n
```

**Figure 4: General framework of a customized graduate profile**

*Source: Own work*

The general format of a customized graduate profile is shown in Figure 4. The entry “profile” refers to a general profile of a graduate and entries “professions_n” refer to professions which the graduate, given his/her specialization, can perform after graduation if he/she stays in the field. The rate of suitability of a profession for a graduate continuously takes values from 0 (totally unsuitable profession) to 1 (completely suitable profession).

For a better idea, Figure 5 shows a customized graduate profile for a student named Radim Bendr who is studying the field of Optics. As an example, three possible professions are named that the student of this field could hold and also the suitability rates of these professions for the specific future graduate are given.

```
Framework of the graduate profile for Radim Bendr studying the field of Optics

Framework identifier: optics&radim_bendr

Slots

Suitability of profession 1: measurement_technician=0,65

Suitability of profession 2: optometrist=0,87

Suitability of profession 3: reseacher=0,25
```

**Figure 5: Framework of the customized graduate profile for Radim Bendr studying the field of Optics**

*Source: Own work*

```
Framework of semantic learning object

Framework identifier: learning_object

Slots

Type: definition

Time: hours:minutes

Prerequisite 1: learning_object_prerequisite_1

Prerequisite 2: learning_object_prerequisite_2

…

Prerequisite n: name_of_the_object_prerequisite_n

Importance 1: profession_1=rate_of_importance_1

Importance 2: profession_2=rate_of_importance_2

…

Importance n: profession_n=rate_of_importance_n
```

**Figure 6: General framework of semantic learning object with prerequisites and rates of importance for different professions**

*Source: Own work*

As shown in Figure 6, for further progress, it is necessary that the semantic metadata for learning objects in Figure 2 (general framework of semantic learning object with prerequisites) are extended with information as to what extent the completion of this training module is important for the performance in different professions. The degree of importance ranges from 0 (the learning object can be entirely disregarded) to 1 (this learning object is absolutely necessary).

To have a better idea, Figure 7 shows the framework of semantic learning object “convex lens”, which is given in Figure 3 (the framework of semantic learning object “convex lens”). In this Figure the frame is extended with rates of importance of completing this learning object for carrying out the future professions which are given in the Figure 5 (the framework of graduate's customized profile for Radim Bendr studying the field of Optics).

```
The framework of semantic learning objects "convex lens"
Framework identifier: convex_lens
Slots
Type: real_object
Time: 00:09
Prerequisite: refraction
Importance 1: measurement_technician=0,71
Importance 2: optometrist=0,95
Importance 3: researcher=0,83
```

**Figure 7: The framework of semantic learning object “convex lens” with prerequisites and rates of importance for carrying out different professions**

*Source: Own work*

Now we have a customized profile of a graduate that contains a list of professions with rates of suitability for this student. Furthermore, there is a set of all learning objects for a field of study which contains metadata about the rate of importance for completing specific learning objects to carry out specific professions.

Using the above examples, the rate of suitability of the profession of measurement technician for the student Radim Bendr assumes a value of 0.65. The rate of importance of completing the module “convex lens” for carrying out the profession measurement technician is 0.71. When assembling an individual study plan for the student Radim Bendr in terms of carrying out the profession of measurement technician, the inclusion of the learning object “convex lens” will have a rate of priority $0.65\times0.71=0.4615$. In the same way we can calculate the rate of priority of the learning object “convex lens” for the student Radim Bendr in terms of carrying out the optometrist profession. The rate of priority in this case will be $0.87\times0.95=0.8265$. The rate of priority of the learning object “convex lens” for the student Radim Bendr in terms of carrying out the profession of a researcher then will be $0.25\times0.83=0.2075$. The overall rate of priority of the learning object “convex lens" for the student Radim Bendr is given by the average of the individual priorities (0.4615+0.8265+0.2075)/3=0.4985. In this way the overall rates of priorities of all the learning objects for all the students of the given field of study will be calculated and these values will be entered into a database.

## 3. OPTIMAL STUDY PATH

The framework algorithm in Figure 8 shows the process of creating a list of learning objects that should be completed by the student. In the first step the LMS selects a learning object from a database that has the highest overall priority for the student and that the student did not yet enroll in and includes it in the list. Then the LMS will continue to work in cycles putting other learning objects on the list that are a prerequisite of the learning object put on the list in the previous step. When the last included learning object does not have a prerequisite, the LMS will check whether the time required to complete all learning objects on the list does not exceed the time allocated for the study (overall, in one year, in one semester or one subject). If the allocated time is not exceeded, the LMS will again select a learning object with the highest priority which has not been enrolled in and repeat the whole process again. If the allocated time is exceeded, the LMS will direct the student towards an evaluation of his/her knowledge of subject matter presented at the completed learning modules. If the student evaluation is satisfactory, another cluster of semantic learning objects interconnected by prerequisites will follow for him/her to study.

After the compilation of a list of learning objects to be completed by the student within the allocated time, the LMS will suggest the optimum study path through the field of study with respect to the future profession. The set of interconnected semantic learning objects can be viewed as a directed graph, where the vertices represent semantic learning objects and oriented edges represent prerequisites. In such a case, tasks from graph theory can be applied (Milková 2013). The LMS will try to find a path that would connect the start and the end point of the study and that would pass through each vertex (learning object from the student's list) just once. In the event that some vertices of the graph will not be connected by an edge (prerequisite), the LMS will add an auxiliary edge to the graph. The final optimal study path is shown in Figure 9. The black circles (LO) represent learning objects from the student's list, the other circles (LO) which are grey, are not included on his/her list. The solid arrows represent prerequisites and the black colour (not grey) signifies the stages of student's study path. The black dashed arrows indicate the auxiliary edges which were added to the graph in order to create a seamless path without recurrence.

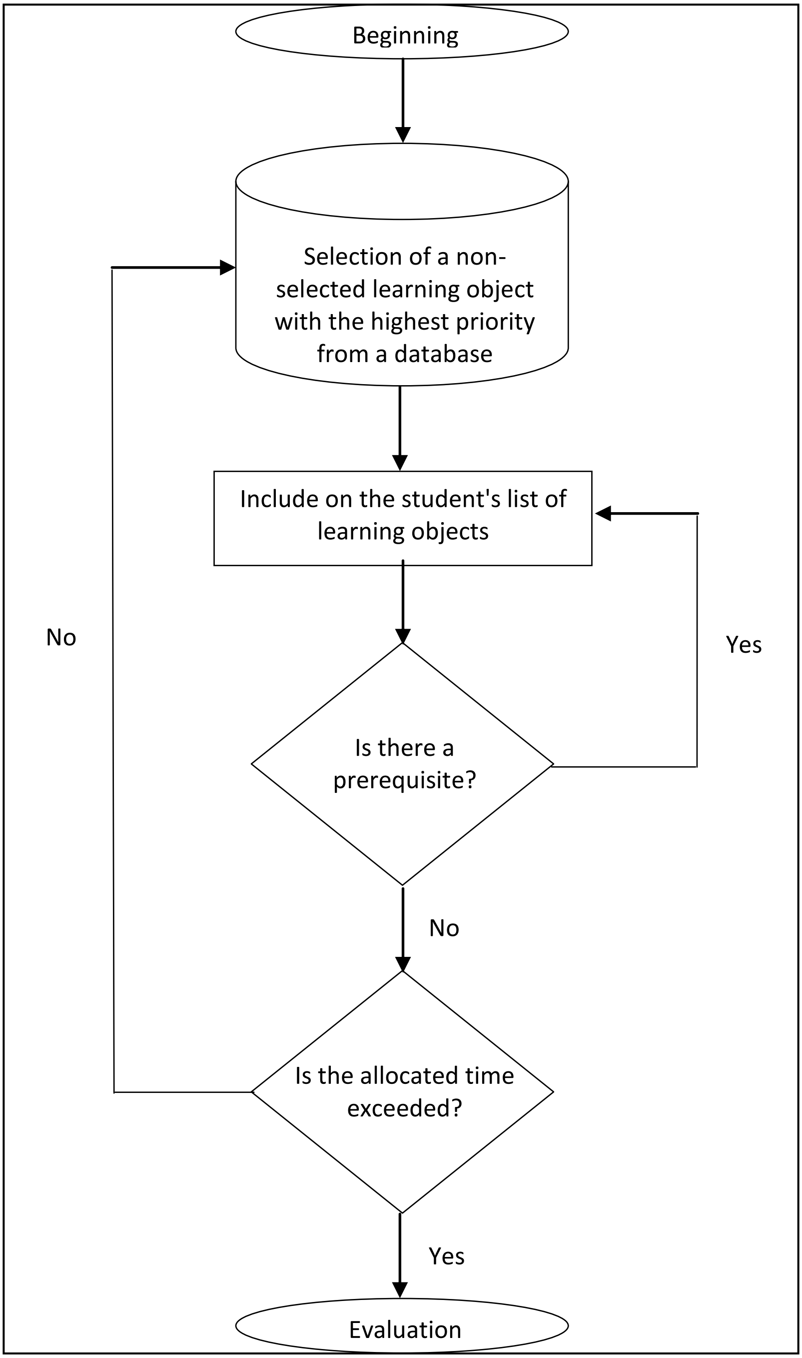


**Figure 8: The creation of a list of learning objects to be completed by the student**

*Source: Own work*

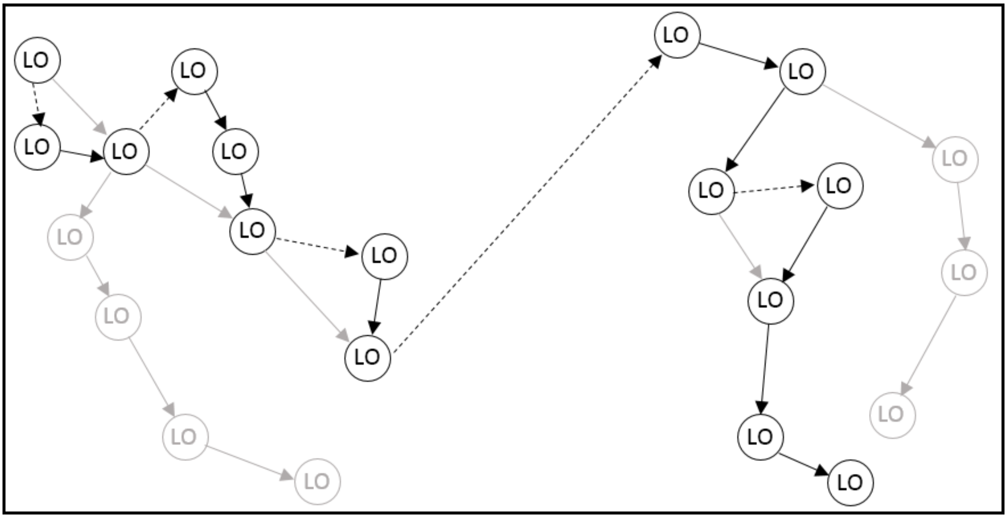


**Figure 9: The student's optimal study trajectory through the field of study**

*Source: Own work*

These proposals can be summarized by saying that our goal is to align a customized graduate profile with the available semantic learning objects. The LMS tries to find the greatest harmony between the suitability of the possible professions for the given student and the importance of the completion of the learning objects for carrying out these professions. In the end the LMS will offer the student an optimal study path through his field of study.

## CONCLUSION

The author is aware that a disaggregation of a whole field of study into learning objects and their description using metadata in frameworks is very demanding. The first step could be to describe only required and required elective subjects with metadata containing information about prerequisites and rates of importance for the given profession. Based on his/her customized graduate profile, the student would receive a list of suitable subjects for him/her, which should be completed with regard to his/her professional goals.

Although better decision making by young people regarding their future and a more goal-oriented preparation of students for their professional life is an arduous and long-term problem, it needs to be solved by all appropriate means. This is evidenced by various studies on employability of university graduates (Gottvald et al., 2008). There are professions where suitable graduates are scarce, while there are other fields of study that have practically zero market application. This problem affects not only society but also the individual because it leads to suboptimal use of individual skills, lack of self-fulfilment and a low sense of professional and personal satisfaction.

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