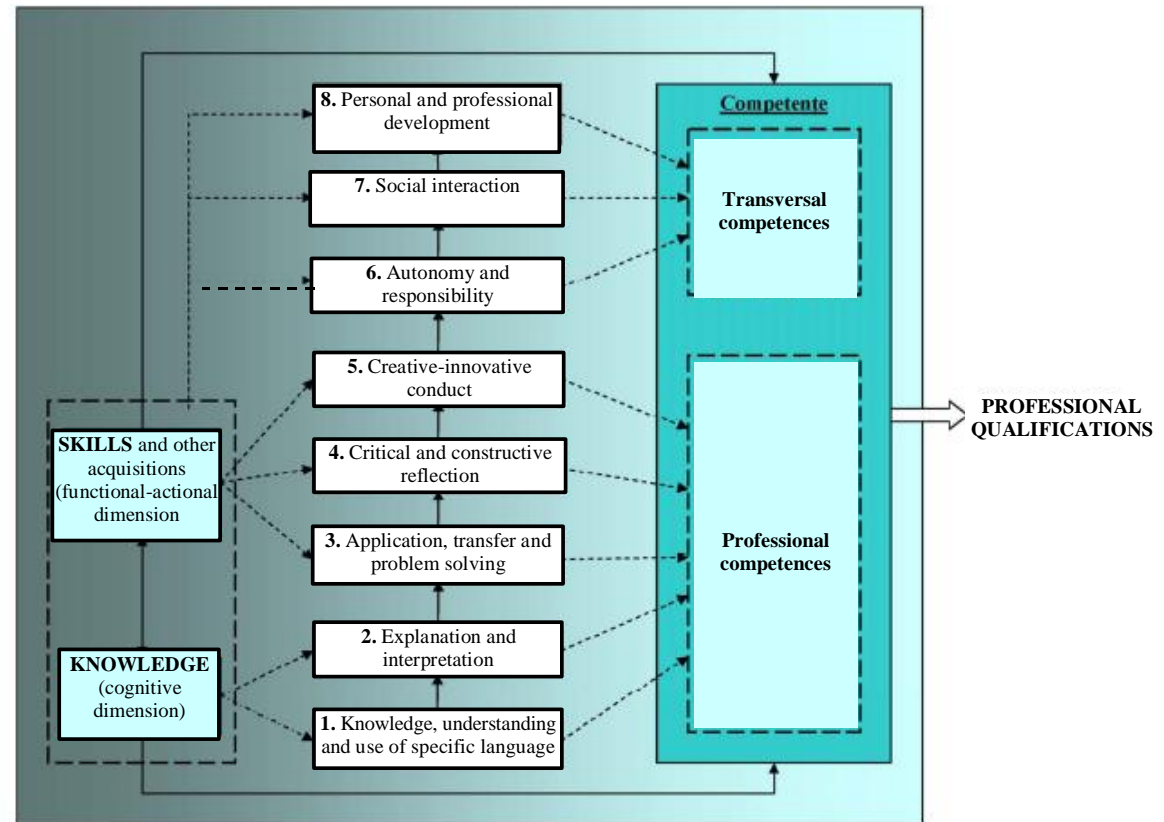


CREATIVITY ROLE IN TRAINING SKILLS AND IN QUALITY ASSURANCE IN HIGHER EDUCATION

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1. CREATIVITY ROLE IN GRADUATES TRAINING SKILLS

The methodology of achieving the **National Qualifications Framework in Higher Education** [1], approved by Minister Order [2] defines the qualifications and competence and also classified competencies in two big categories, respectively **professional competences** and **transversal competences** (fig. 1)



On this basis, in methodology are detailed creativity levels and innovation in all three levels of higher education according to Bologna Process, respectively **License**, **Master** and **Doctoral Studies**, according to those presented in table. 1

Table 1. The descriptor "creativity and innovation" for the three levels of study [1, 2]

	License	Master	Doctoral Studies
Creativity and Innovation	Developing Professional Projects using well-known principles and methods within the field	Developing Professional and/or Research Projects using a wide range of innovative quantitative and qualitative methods in an innovative manner	Designing and conducting original research, based on advanced methods that lead to the development of scientific knowledge, technological and/or research methodologies

2. ANALYSIS OF INNOVATION LEVELS BASED ON TRIZ METHODOLOGY

An essential element of the TRIZ innovation methodology is the **five levels** of innovation set by G. Altshuller.

- **Level one:** *routine problems* solved by methods well known in the field. In this case, no invention is required, and about 32% of solutions are found at this level.
- **Level two:** *minor improvements* to the existing system, by methods known within industry and that usually are solved with the help of some compromises. Approximately 45% of solutions corresponds to this level.
- **Level three:** *fundamental improvements* to the existing system through known methods, taken from other areas. In this case the contradictions are solved, and, about. 18% of solutions are found in this category.
- **Level four:** *a new generation which uses new principles* in order to reaches the main functions of the system. At this level, solutions are found more in science than in technology, and about. 4% of solutions are part from this category.
- **Level five:** *a rare scientific discovery*, in essence a new system. In this category is found about 1% of solutions.

Also, Altshuller concluded after his study, that every level used for finding solutions needs more knowledge and it is necessary to consider more options or attempts, before finding the ideal solution.

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Table 2. Levels of inventiveness [3, 4]

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Level	Degree of inventiveness	% of solutions	Source of information	No. Of options needed to find the solution
I	Seemingly solutions	32%	Personal knowledge	10
II	Minor improvements	45%	Knowledge from the company	100
III	Major improvements	18%	Knowledge from the area of expertise	1000
IV	New concept	4%	Knowledge out of the area of expertise	100.000
V	Findings	1%	General Knowledge	1.000.000

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An essential element of the TRIZ innovation methodology is the five levels of innovation set by G. Altshuller.

Each creative achievement can be comprised in one of the five levels. These five levels have been determined by degree of inventiveness, number of options or attempts needed to find the solution and by the source of the solution, comparing the system after concluding the invention with the previous one, before finding the inventive solution.

In establishing these five levels, it's important to determine the number of attempts made by the specialist or the ones before him or by his contemporaries, needed to find the inventive solution. Based on the experience it is estimated a **small number** of attempts necessary for the **first level**. For the **second level**, a **few dozens** of attempts are needed. For the **third level** are needed, maybe, **hundreds** of attempts. For the **fourth level**, finding the solution means years or research and thousands or tens of **thousands** of attempts. And finally, the **fifth level**, usually takes the efforts of many generations of researchers and

hundreds of **thousands or millions** of attempts.

Another criterion for establishing these levels is source of inspiration for finding solutions.

In case of **level I** this source comes from the own knowledge of the researcher in various fields.

At the **level II** the solutions come from the **scientific field** in which the researcher operates.

At the **level III** the solutions must be searched and in **other related fields**.

At **level IV** of inventivity the solutions come from **clarification of effects** and phenomena in physics, chemistry or geometry, less understood until that time.

At the **level V** is need to overcome the known **borders of science**.

Currently, it considers that with the help of TRIZ methodology it can be found inventive solutions at levels I, II and III in just few days.

Also, TRIZ methodology seeks to improve concepts at levels III and IV, where the direct application of practice does not lead to obtain acceptable results.

Based on research achieved, Altshuller postulated that *over 90% of the problems that specialists are facing have been solved once before*. If specialists could follow a path to ideal solution, beginning with the lowest level, using personal knowledge and experience, most of the solutions can be derived from already existing knowledge in the company, in the industrial field in which is

working or in another technical-scientific field.

3. PROPOSALS REGARDING SETTING LEVELS OF CREATIVITY FOR HIGHER EDUCATION GRADUATES

Based on the submissions, this paper proposes a correlation between levels of creativity and innovation established by Altshuller and study levels according to the Bologna Process, as presented in table 3.

Table 3: Inventiveness levels for each level of study¶

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Levels	Degree of inventiveness	Source of information	Study level
I	Seemingly solutions	Personal knowledge	Graduated licensing
II	Minor improvements	Company knowledge	License graduate with minimum 5 years experience¶ Graduated Master
III	Major improvements	Knowledge in the field	Master graduate with minimum 5 years experience¶ PhD graduate (PhD)
IV	New concept	Knowledge outside the field	PhD graduate (PhD) with minimum 5 years experience
V	Rare scientific discovery	Everything is known	Dedicated scholar

Correspondence presented in table 3 may be a useful tool in formulating graduates competences as well as in establishment indicators regarding the quality and implementation of the curricula according to GD 1418/2006 (ARACIS Methodology) [5]

4. CONCLUSION

Based on the submission in the paper can be established that the degree of creativity of higher education graduates (BA, MA, PhD) can be appreciated based on the five levels of creativity made by G. Altshuller. This structure of creativity degree may be useful in the establishment of graduates competences as well as in quality assessment through specific indicators, according to GD 1418/2006 (ARACIS methodology).

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Thank you for your attention!