ABSTRACT

Our society is currently facing significant changes in the labor market. The changes are brought by the trends from Industry 4.0. The assumption is that higher-skilled positions will gradually come to the forefront of interest: employees who hold specialized positions requiring deeper knowledge and skills, staff with the ability to solve complex problems. The system including knowledge, skills and also to some context values and attitudes is called 21st Century Skills. These skills must be also incorporated and reflected in education, including science education. Science education needs to take into account the above-mentioned as this has direct impact and implications not only on scientific knowledge but also on skills such as critical and analytical thinking, the ability to do research, problem solving or decision-making processes. The system of such key knowledge, abilities and skills is included in the concept of scientific thinking and reasoning. For this reason, the curriculum of schools, including universities, requires development of thinking and reasoning, which would enable them to find a good job on the labor market. Furthermore, relationships between universities and employers are gradually being built, which catalyzes the adoption of universities' curriculum according to the needs of labor market. There is a need to communicate which concrete skills and knowledge will be developed by the university students, in a narrative that both parties understand (companies on one side, teachers and university students on the other side).

Therefore, the research conducted in this dissertation thesis aims to create a framework of Scientific Thinking and Reasoning (STAR) for companies focused on research and development (R&D), manufacturing and services in the field of natural sciences. Based on STAR is to create complementary assessment framework of scientific thinking and reasoning for selected positions in companies focused on research and development (R&D), manufacturing and services in the field of natural sciences. While the STAR framework makes it possible to communicate important aspects of scientific thinking and reasoning between stakeholders (employers, universities and students, or their parents), the complementary assessment framework can serve as an evaluation tool for employers, university teachers and also as a self-evaluation tool for students - graduates.

Qualitative research methods were used to create the STAR framework. The research was based specifically on theoretical research methods - analysis of existing approaches to the definition of scientific thinking and reasoning and semi-structured interviews with representatives from selected companies. The companies have helped create the final form of the STAR framework and define its components. The evaluation framework was developed using mixed research methods. The content and face validity of the tasks of the evaluation framework was based on qualitative research - expert assessment. Last but not least, construct validity was based on quantitative research on a limited number of respondents.

The result of the work is a comprehensive framework of scientific thinking and reasoning STAR accompanied by an evaluation framework composed of tasks. These will allow employers to easily identify and communicate the knowledge, skills and abilities that they require from employees in various positions. At the same time, it is a tool for communication between universities that are preparing students for their future careers in science as well as companies that will later on hire these students. The evaluation framework can then serve as an evaluation tool for companies or universities, but also as a self-evaluation tool for students.