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**CREATIVITY THROUGH TECHNOLOGICAL EDUCATION FOR
FUTURE SOCIAL AND ECONOMIC DEVELOPMENT**

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Abstract

The world we live in is changing faster than ever and facing unparalleled challenges. It is almost impossible to predict the way the future will look like and what this complexity of individual and social needs will consist of. As the world is transforming at a very high speed, all types of organizations and institutions from everywhere affirm they need people who think creatively, communicate efficiently, are team players, flexible and capable of adapting quickly to any situation. This paper constitutes a research of "Technological Education and practical applications" manuals for gymnasium (fifth to eighth grade) available in school years 2005 – 2018, in Romania. This article's goal is to demonstrate that the subject of study "Technological Education and Practical Applications" that is taught in Romania in middle school is aimed at cultivating and developing the students' creative abilities. These students are the future carriers of the labor offer and entrepreneurs in a new economic system – the circular economy which aims to ensure the future socio-economic development. By studying these disciplines, students acquire knowledge and skills that will enable them to become a creative, flexible human resource, capable of finding innovative solutions to cope with a challenging complex environment characterized by uncertainty.

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1. Introduction

Human life is influenced by numerous transformations belonging to both economic and social field. These changes are produced by the accelerated evolution of the new technologies. As active participants in the social and economic system, humans must accommodate to it and gain the newest communication means. They must inform themselves, buy goods and services and pay for them, fulfil their professional tasks, socialize, schedule their daily program or the rest and leisure times etc. Although for most part of humanity economic growth means a high standard of living, the results of the consumption based economic growth and mass production in the last decades are very damaging to the natural environment. This reality of the modern society is a challenge that humanity must address in order to slow down or even stop the negative results of this type of linear economic growth that has demonstrated its limits (Jackson, 2017). The solution turns out to be the transition to the circular economy (European Commission, 2014). Circular economy is the new model of economic care that should lead to more sustainable economic and social development. Sustainable development requires broad analysis and several aspects at the same time: economic, environmental, technological and social, as well as an interaction between them (Ghisellini, Cialini, & Ulgiati, 2016). For this purpose, the human resource is, on one hand, the result of the educational system and, on the other hand, represents the essential production factor for attaining a future sustainable economic growth, one that implies a realistic design, production, consumption and waste management. In the present context shaped by the challenges posed by the necessary permanent economic growth and the accelerated rhythm of science and technology development, the human resource needs a creativity oriented education (Robinson, 2011). This kind of education must develop new visions that allow finding solutions that enable the social and economic growth and environment protection to reinforce each other. Economic growth and modern technology development have lead to a higher standard of living that has determined an increased demand for goods and services and, implicitly, an increased consumption of resources. Quality of life, prosperity, welfare and economic growth depend on the rationalized consumption of the available resources. In order to achieve this goal we must change the way of designing, manufacturing, using and managing the byproducts of the consumption, as Figure 01 shows. This change is everyone's responsibility – individuals, households, companies, local and national administrations and the world community (ANPM, 2017, p. 446).

2. Problem Statement

New technologies have an impact on the nature of work by transforming it. The direct consequence of this is the emergence of new forms of work that involve innovation, creativity and an increasing level of specialized knowledge. Faced with the speed of these changes, both states through their governments and the business world around the world recognize that education and professional training are the key to the future and underlines the vital need for the human resource to be trained so as to develop skills in the field of creativity and innovation, because it is very important to find ideas for new products and services capable of preserving competitive advantage on the market. For this, it is important for education to provide flexible and adaptable people to the labor market, able to cope with the demands of a complex and highly unstable market (Obeng, 2012). In view of this context, students are helped to understand the transformations that mark the current increasingly developed and computerized economy and society (Toma, 2004) through the

Technology Education discipline. Also, the subject of "Technological Education and practical applications", through a transdisciplinary approach, familiarizes students with what it means: technologies, technological processes, characteristics of different types of materials, sciences, IT, environment protection, labor protection, consumer protection, Economics, entrepreneurship. These students will be future employees or entrepreneurs who will operate in a world where they will be dependent on technology and in an environment to which they will have to behave with responsibility because only this way ensures sustainable economic development.

3. Research Questions

The questions that will find answers as a result of this research are the following:

- What is the nature of the homework to be done / projects to be prepared in the Technological Education manuals for middle school?
- What category of notions do the students need in order to do their homework and prepare the projects that appear in the Technological Education manuals?
- Do the homework / projects proposed in the Technological Education manuals for middle school develop students' creativity?
- What interests and skills do the practical exercises in manuals cultivate in students?

4. Purpose of the Study

In this paper we intend to clarify the way in which the creative spirit is cultivated in the students during the "Technological Education and practical applications" courses and the necessity of developing this educational side under the present conditions that require a better environment protection in the course of the transition towards a circular economy able to ensure a sustainable economic growth. As shown above, circle economy needs to be closed by: designing, manufacturing, consuming and managing consumer products (see Figure 01) to reduce the virgin materials consumption, reuse and recycling the results of economic activity, in order to increase the economic efficiency.



Figure 01. Circular economy (Ceruti, 2018)

The present paper also proposes to undertake an analysis of general and specific competences acquired by students through the learning activities of textbooks.

5. Research Methods

This research consists of a study of the content, homework and evaluation activities proposed in the current Technological Education manuals for grades fifth to eighth in Romania.

It is important to mention that in Romania the Technological Education manuals have started to be reviewed in 2017, reviewing meaning that they are altered from the point of view of both the content and structure. Thus, if until 2017 the manuals for these four grades had been structured on learning modules, starting with 2017 the new “Technological Education and Practical Applications” manual for the fifth grade is structured on learning units. The new manual for the sixth grade that has been in use starting with this autumn follows the same pattern. In the next two years the new manuals for the seventh and eighth grade will be published.

6. Findings

After the study of the content of the Technological Education manuals for middle school and the approved school curricula on which the manuals were drawn up and certified, we have the following observations:

- The homework and projects proposed in the manuals require practical manufacturing of useful products and / or other creative works for current activities that can be later sold and creation of simple products or models starting from a technological handout, all these realized with the teachers’ support.
- For doing their homework and projects, the students need basic mathematics and science knowledge for efficiently creating a product.
- The homework / projects to be done in the Technological Education manuals for middle school develop students’ creativity. They are encouraged and challenged to participate in activities and create innovative products by dismantling and then reassembling and creatively reusing components of other initial products.
- The interests and skills cultivated in students by the homework and projects in the Technological Education manuals for middle school are useful for occupations / professions and entrepreneurship. The students are challenged to evaluate the qualification they need in order to undertake a certain activity or to obtain a certain type of product. They find themselves in the situation of evaluating the quality of the products they built, selling those products and project the possible benefits obtained as a result of reinvesting the already gained sums.
- The practical applications in the Technological Education manuals help the middle school students to understand a greater modern necessity: the technological environment must one favorable to a sustainable development. This fact implies, on one hand, the importance of knowing and abiding by the rules of job security, fire prevention and fire fighting in the context of different activities, and , on the other hand, finding solutions for eliminating waste, a rational consumption and waste reusing.

After a careful analysis of the “Technological Education and Practical Applications” manuals, we have come to the conclusion that the students acquire general and specific competencies by the following means:

- By practically manufacturing useful products and / or creative works for current activities
 - Manufacturing of simple products / works on the basis of a given technological handout by selecting the raw materials and the appropriate materials / tools / devices / apparatus;
 - Identifying data, sizes, relations, processes and phenomena specific to Mathematics and Sciences and useful for manufacturing a product;
 - Analyzing products based on certain criteria.
- Developing a technological environment favorable to sustainable development by
 - Selecting products and technologies able to keep the quality of environment and health;
 - Explaining the necessity of using hygiene norms, occupational and health measures, fire protection and fire fighting measures applicable to the real work conditions.
- Exploring interests and skills for jobs / professions, professional fields and entrepreneurship in order to help the students choose an educational and professional path by
 - Identifying professional models in the explored fields;
 - Displaying the ability to work both individually and in a team to solve problems.

7. Conclusion

We have come to the conclusion that the homework / projects in the Technological Education and practical applications manuals for grades from fifth to eighth provide the students with the general and specific competencies specified by the school curricula approved by Order of the Ministry of Education nr. 3393 / 28.02.2017. The “Technological Education and practical applications” curriculum focuses on providing the students with entrepreneurial skills and initiative spirit (Manolescu & Manolescu, 2017).

In Romania “Technological Education and practical applications” is a compulsory discipline, component of the curriculum area “Technologies” that teaches the students, in a trans-disciplinary way, notions about technological processes, technologies, materials, sciences, IT, environment protection, consumer protection, Economics, entrepreneurship. The students come into contact, both theoretically and practically, with the above mentioned aspects and are provided with the opportunity of realizing projects that highlight their creative capacity in manufacturing various objects, activity planning, finding and presenting solutions etc. Thus, discipline “Technological Education and Practical Applications” answers the present requirements for an education that generates a creative and innovative labor force, used with the current and future social, economic and technological problems that must be addressed in order to attain a sustainable economic and social growth in the future.

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