ISSN 2719-6550
ISSN 2719-7417 online

JOURNAL OF EDUCATION, TECHNOLOGY AND COMPUTER SCIENCE

No. 1(31)/2020

Journal of Education, Technology and Computer Science is a continuation of "Edukacja – Technika – Informatyka. Education – Technology – Computer Science" Journal.

PUBLISHING OFFICE
UNIVERSITY OF RZESZOW
RZESZOW 2020

JOURNAL OF EDUCATION, TECHNOLOGY AND COMPUTER SCIENCE
No. 1(31)/2020

ADDRESS OF EDITORIAL OFFICE
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ISSN 2719-6550
ISSN 2719-7417 online

DOI: 10.15584/jetacomps

ADDRESS OF PUBLISHER
PUBLISHING OFFICE UR
prof. S. Pigonia 6 Street, 35-959 Rzeszów, tel. 17 872 13 69, tel./faks 17 872 14 26
e-mail: wydaw@ur.edu.pl; http://wydawnictwo.ur.edu.pl
Issue I; size B5; publisher's sheet 6; signature 6,25; editor's contract 99/2020

Printing and binding: Printing house University of Rzeszów

CONTENTS

EDITORIAL

The *Journal of Education, Technology and Computer Science* in 2020 consists of three main thematic parts.

In the first part, entitled *Selected Problems of Professional Lifelong Learning*, we present articles dealing with, among others, considered of the utmost importance these days: the analysis of systemic axiological evaluation of globalisation processes in the aetiology and chronology of the Bologna process; the use of pedagogical advice as a professional activity of specialists in education; the possibilities of educational digitisation in the training of managers in the field of socio-cultural activities and the use of optimisation of vehicle trajectories by means of interpolation and approximation methods in the training of students in technical fields.

The second part, entitled *Selected Environmental Educational Problems*, consists of two researches presenting the directions of exploitation of mineral resources for sustainable development on the example of Poland and the interpenetration of activities in the anthroposphere and mining.

The third part, entitled *Selected Problems of Contemporary Education*, deals with, among others, reflections on a fundamental educational question: how to teach? and is there any effective method for that? We gain an understanding of the opportunities and threats of artificial (non-)intelligence; a critical and creative commentary for the use of ICT in kindergarten; the requirement to introduce new, effective educational programmes, assumed as the necessity of future social development; the deductions based on our own research concerning the didactic significance of modern simulation programmes in vocational education and the reasons for fatigue and health behaviour of the youth from rural and urban areas.

We encourage our readers to critically analyze and prepare polemical texts in relation to various topics of educational research published in the journal.

PART ONE

SELECTED PROBLEMS OF PROFESSIONAL LIFELONG LEARNING

©University Press 2020
ISSN 2719-6550
ISSN 2719-7417 online

„Journal of Education, Technology and Computer Science"
No. 1(31)/2020
www.eti.rzeszow.pl

Received: 11.02.2020
Accepted for printing: 5.07.2020
Published: 05.11.2020

DOI: 10.15584/jetacomps.2020.1.1

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Distance Sustainable Education. Incentives and Expectations

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Abstract

The present study investigates the motivation for adult participation in distance education on sustainability and specializes in a population group with specific characteristics, that of the Agronomists (Higher Education Graduates). In a global community with shifting conditions, environmental problems and geometrically increasing demands regarding the qualifications of workers and especially the scientists dealing with these problems, this issue is considered of major importance while exploring the incentives that lead to participation – after acquiring the first degree – continuing education and learning, and in particular distance education on sustainable development, is essential. The result so that Agronomists feel a strong need to extend their knowledge mainly through distance education.

Keywords: adult education, distance education, motives, goal, sustainability

Introduction

Distance education has been defined in a number of ways, as several researchers have given their own conceptual version in accordance with their time and along with the achievements of technology. The definitions of Peters (2003), Moore (1993), Holmberg (1977) share two assumptions that characterize distance education and distinguish it at the same time from in person education: (a) teacher-student distance and (b) the structure of the teaching material. Later definitions as those of Garisson & Shale (1987), Barker (1989), as referred to Keegan (2001), highlight the possibilities offered by technology at an interaction and interactivity level (Alivizos et al., 2015). The distance learning programs

have become a tradition for most higher education institutions and disseminated considerably (Roblyer, 2006; Armakolas, Panagiotakopoulos, Karatrantou, 2018).

Distance education institutions, which now operate on all continents, are primarily aimed at adults – regardless of age – and provide education at all levels, from basic adult education and professional training, to undergraduate and postgraduate education (Armakolas, Panagiotakopoulos, Fragkoulis, 2014; Armakolas, Panagiotakopoulos, Magkaki, 2018).

Incentives

An incentive is anything that moves, pushes, or drives an individual into action (Kostaridou-Efklidi, 1997). Incentives can be inherent or acquired, that is, they have a hereditary basis such as instincts or can be acquired through learning processes when the individual interacts with the environment (Kostaridou--Efklidi, 1997). Incentives are divided into external and internal. As external are known those incentives that activate the body due to external effects. Among these incentives are money, privileges, growth, promotion, prestige, social status and more. They are provided to the learner by others.

The second category is internal motivation. Internal motivations refer to the involvement of individuals in activities for personal reasons that is, the feelings of pleasure and satisfaction that derive directly from participation (Deci, Ryan, 1985). When individuals have intrinsic motivation, they engage in activities that interest them, they experience a sense of will and function without the help of external rewards and/or restrictions (Deci, Ryan, 1985). Challenge, curiosity, control and imagination are considered to be (some) sources of internal motivation (Schunk, Pintrich, Meece, 2008).

Education for sustainable development

Education for sustainable development is defined as: "Education that enables one to develop knowledge, values and skills to understand the complexity of the world that he/she lives in and to participate in decisions on important issues of the planet, individually or collectively, locally or broadly for the sake of a sustainable future" (UNESCO, 2012). The changes advocated by the ESD "for the Environment" refer to all areas of human activity and aim at establishing a society of active and interventionist citizens in decision making. The trainees develop, through their personal and active involvement, ecological and political literacy with a view to their full and active awareness as citizens (Sterling, 1996, p. 35).

The evolution of environmental education (EE) to education for sustainable development (ESD) was the step that would contribute to the promotion of an innovative approach of environmental problems and would eventually address their educational processes (UNESCO, 1997). The concept of ESD was intro-

duced by international organizations, (just like that of SD), bringing a new, promising spirit into the field of education. Two paths for the evolution of the ESD are described by Overwien, (2016):

The first path relates to the concept of eco-learning, which emphasized the interconnection of nature with the social environment and was later followed by the more 'biocentric' approach of eco-pedagogy. The second path describes an evolution from environmental education (in the sense of environmental protection) to environmental education designed as preventive environmental planning and subsequently to ESD, which embodied the idea of shaping the future in a self--contained way and overlaps political science. The well-known Environment--Economy-Society triangle depicts ESD (Gomatos et al., 2019). The Huckle & Wals (2015), evaluating the UNESCO Decade on ESD (DESD) characterize the decade as a "more of the same" ("business as usual"), noting that the UNO (United Nation Organization) General Assembly is a union of states, not citizens of the world. It cannot, therefore, represent their common interests (citizens) to SD (sustainable development), because the interests of the more powerful states are closely related to those of global capital.

Reference Framework for ESD in Environmental Sciences and Agronomy

Interactions between Agronomy and Sustainable Development are evident through a correlation that proposes a combination of environmental, economic and social factors to ensure and maximize the benefits of Sustainable Development at an individual and social level. After all, the agronomists are active in all aspects of the agri-food sector but also engage in management and environmental issues, support the sustainable development policy and use daily all their scientific manpower for a sustainable environmental future. Sustainability, in its complex, constructed and contextual meaning, has become a highly controversial issue of our time. On the other hand, education is part of both the problem and the solution (Koutsouris, 2009). To meet the challenges posed by the pursuit of sustainability, it is important to reorganize both agronomic education and rural training to provide agronomists with new sets of skills needed to promote and support sustainable rural development (Charatsari, Papadaki-Klavdianou, Koutsouris, Lioutas, 2018).

However, traditional/dominant scientific assumptions and productive approaches of agriculture, which relate to the technical orientation of the curricula, have not allowed this argument to permeate the discussion and practice of institutions (including research and extension) (Koutsouris, 2009). As society and technologies change rapidly and the amount of information continues to grow exponentially (Nagy, Farmer, Bui, Trancik, 2013), it has become increasingly important for people to keep up with these developments throughout their life--time and increasingly important to participate in distance education programs for sustainable development.

In a time-limited environment, distance learning is an appropriate alternative education and should be supported by studies that will address motivation, goal orientation and academic performance to an extent that we can make all the necessary correlations.

Methodology

The scope of this survey, conducted in February–March 2019, was to study the motivation of adults involved in distance education for sustainability, but through the case study of a group of people with specific characteristics, that of the Agronomists.

Based on the above purpose, there is an attempt to answer the following research questions:

Research Question 1. Why does the sample choose to attend a distance education program?

Research Question 2. What are the motives that lead the Agronomists sample to continue their studies in sustainable development?

The sample included Agronomists (Higher Education Graduates) who continue their education after obtaining their degree using distance education in order to expand their knowledge and skills related to Sustainable Development, that is, to become attuned with the requirements of the times, on EDA. The creation of the key points of the questionnaire was based on the above research data. In addition to the construction of the tool we took into account the existing theories of incentives and mainly the Scale Educational Participation EPS of Boshier (1971), which has been used in various research groups of learners (Dia, Smith, Cohen-Callow, Bliss, 2005; Fujita-Starck, 1990) as well as different forms of education (Haefner, 1995; Michie, Glachan, Bray, 2001) but also the incentives. All the above were grouped in the following categories: a) Development of social relations, b) External expectations, c) Social contribution, d) Professional upgrading e) Escape from other situations and f) Interest in knowledge. The questionnaire was initially created using Word Microsoft Office application packet and then was also made available online with the help of the Google Forms application to meet the needs of the sample expected to cover geographically Greece as a whole.

Analysis

Demographics requested gender, age, marital status and place of residence of the participants. We consider these data to be directly related to the motivation of respondents to participate in distance education. The following items are displayed per question category. Regarding the age of the participants, we had Agronomists of all ages, however the majority of the sample falls into two categories, since the 41.2% corresponds to the age group of 26–35 and the 45.9% of

the sample corresponds to the age group of 36–45. Regarding the marital status the 55.3% of the sample corresponds to the Single category, the 40% corresponds to the category Married, the 2.4% of the sample are Divorced and the 14.1% have children.An important aspect of the demographics section is the place of residence of agronomists surveyed. The extent of the sample is really impressive from a geographical point of view as it covers almost all Greece.

Regarding the employment status of the respondents to the question relating to the years of employment and work experience, their responses are reflected in the following chart, with the 36.5% of the sample to have over 11 years of experience, followed by the 23.5% of the sample with 5–10 years of service, the 22.4% of the sample with 2–5 years of service and the17.6% with up to 2 years of experience.

In the survey on the employment status and working condition the 45.9% of the sample reported full time employment in the private sector, the 22.4% of the sample declared to be self-employed/freelancers, the 15.3% of the sample is employed in the public sector and the 9.4% of the sample is unemployed, while there are 4.7% of the sample working in the private sector on a part-time basis. The unemployment rate recorded by the sample of our surveyed agronomists appears far less than the general average unemployment of agronomists that reaches the 24.5%.

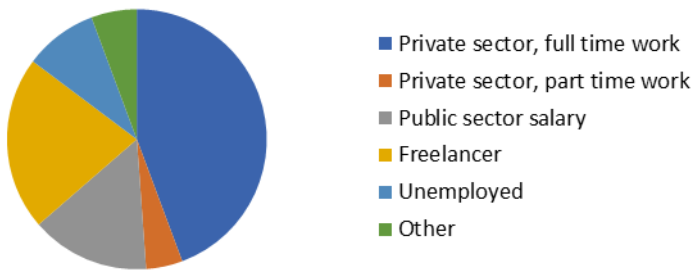

Figure 1. Employment status/Working condition of participating agronomists

Finally the question whether there is a link between the first degree and their current job, the 78.8% of the sample stated that YES it is relevant while the 21.2% stated that there is no relevance between their first degree and the job they are currently covering. In this case too, the percentage employed in a position relevant to the subject of their studies is extremely high.

In reply to whether Agronomists choose to attend a distance education program related to Sustainable Development, as the main reasons that led them to choose to pursue a distance education program related to sustainability, Agronomists respondents indicate the flexibility of the program by a percentage of

72.4%, professional obligations by 70.9%, the less operating expenses by 59.8% while the 52.3% states the lack of time to follow a conventional program. On the contrary, as far as our sample is concerned, there are family obligations that do not appear to influence the choice of educational program as the 29.4% of the sample chooses it as the main reason for attending a distance program. On questions concerning the incentives that drive our sample adults to participate in distance education programs on Sustainable Development, the most popular answers related to sample preferences were I Agree and I Agree Absolutely, as follows:(i). 90.5% "Because I was interested in the topics of this curriculum" (ii) 85.7% "Because I wanted to get a better scientific background" (iii).81.2% "Because I wanted to Learn New Things" (iv).79.8% "Because I wanted to become more effective on issues related to my work" (v). 78.8% "Because I wanted to improve my competitiveness" and (vi).78.6% "Because I wanted to broaden my horizons".

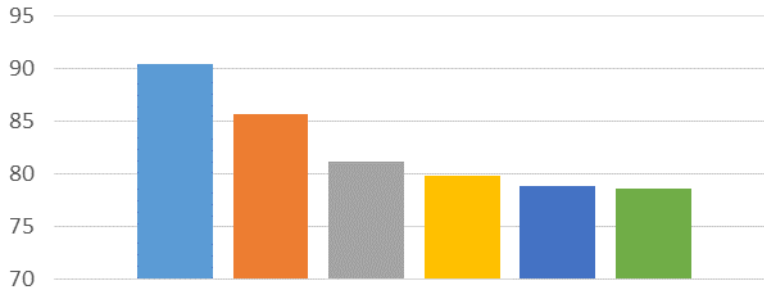

Figure 2. Participation incentives of the interviewed agronomists in Distance Education for adults

In an attempt to classify these motives using the Boshier EPS Educational Scale, we observe that the motivation i, ii, iii & vi belong to the category "Interest in knowledge" and incentives iv & v in the category "Professional Upgrade", which qualify over others and this can be explained perhaps by the fact that most participants are of a productive age and are taking actions that will provide professional development and recognition by strengthening their scientific field. The above findings are in line with the findings of the international literature, since in all surveys "Professional Progress" is one of the highest participation incentives, ranking first and second in the selection (Urbano, Jahns, Urbano, 1988; Gordon, Olson, Hamsher, 1990; Miller, 1992; Haefner, 1995; Nason, 1998; McMilan, Fay, 2003; Raghavan, Kumar, 2007). Also, the survey results are consistent with the objectives set by the European Union concerning Adult Education as a means to "promote excellence in education and skills develop-

ment to ensure future growth based on innovative products, services and business standards in a Europe that is facing aging populations and strong competitive pressures" [EU, (2011/C 372/01)].

But the most important part of the research was that the incentives that drive the agronomists to pursue studies on Sustainable Development are in agreement with the results of Charatsari's specialized pre-existing research (2018), whose qualitative analysis of the results confirmed the need for continuous agronomic education in Greece. In this way agronomists are driven to search for programs that allow them to cover this gap in their education, and seek a better scientific background through the modern requirements of applying agronomic science and eventually acquire new knowledge.

Conclusions

The scope of this research was to study the motivation of adults involved in distance education for sustainability, but through a case study of a particular population group, that of the Agronomists. The Agronomists have proved to be an interesting case, as they belong to the sector that deals with environmental sustainability and are actively involved in the success of sustainability pillar, once entrusted with the difficult task of crop management so that global pollution by pesticides, adaptation and resistance of pests, loss of soil fertility, soil erosion, loss of biodiversity, desertification and so on, become a distant past at some point.

It becomes explicitly clear that conventional farming is no longer suitable for human consumption and ecosystem conservation. Sustainable agriculture is an alternative to solving basic and applied issues related to food production in an ecological way (Lal, 2008). While conventional agriculture is driven almost exclusively by productivity and profit, sustainable agriculture integrates biological, chemical, physical, ecological, economic and social sciences in a comprehensive way to develop new agricultural practices that are safe and do not degrade our environment (Lichtfouse, Navarrete, Debaeke, 2009). But how ready are the agronomists to cope with modern requirements? The need to implement a sustainable way of cultivating the land is more critical than ever, so scientists feel a strong need to extend their knowledge mainly through distance education.

Regarding the first research question and why the geotechnical sample choose to attend a program of distance education over conventional and based on the prevailing reasons, the 72.4% opted for the flexibility of these programs, the 70.9% for professional obligations, while family obligations did not appear to significantly affect the geotechnical sample. Valassidou's (2005) research revealed that distance education comes as a solution to adult time problems since it seems that in this case it helps adults surpass the obstacles of a different time and place. Distance education contributes to the formulation of an interactive

environment of collaborative learning under pedagogical conditions (Anastasiades, 2008; Armakolas, Alimisis, Panagiotakopoulos, 2013; Panagiotakopoulos, 2014).

Finally, with regards to the second research question and the incentives/motives (for participation) that lead the geotechnical sample to continue their studies and more specifically their studies in distance adult education on sustainable development, the geotechnical preferences of the sample recorded the highest percentages ranging from 90.5% to 78.6% in incentives, i). "Because I was interested in the topics of this curriculum", (ii). "Because I wanted to get a better scientific background", (iii). "Because I Wanted to Learn New Things", (iv). "To become more effective on issues related to my work", (v). "To improve my competitiveness" and (vi). "Because I wanted to broaden my horizons". We note, that all the incentives to participate in distance education programs of the Geotechnical surveyed sample fall into two categories of the scale of the EPS Boshier. In particular, incentives (i), (ii), (iii) and (vi) fall under the category of "interest in knowledge" and incentives (iv) and (v) fall under the category "professional upgrading". Other investigations carried out on the motives for participation resulted in these two prevailing categories of the EPS scale. Academic Institutions can address the lack of organized sustainability-oriented learning opportunities through the design of agronomy programs. Web-based distance learning seminars (webinars), training platforms, presentations and even virtual tours of sustainable farms can contribute to learners gaining knowledge of sustainable agriculture and implementing sustainable management practices in rural and agri-food businesses. There is a proven gap between the skills/competencies of the agronomists and the reality of implementing Sustainable Rural Development (Charatsari et al., 2018). The agronomists who wish to enrich their scientific background with sustainable development issues may resort to distance education to become efficient and competitive in their work and also improve the levels of knowledge on Sustainable Rural Development.

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© University Press 2020
ISSN 2719-6550
ISSN 2719-7417 online

„Journal of Education, Technology and Computer Science”
No. 1(31)/2020
www.eti.rzeszow.pl

Received: 14.10.2019
Accepted for printing: 3.08.2020
Published: 05.11.2020

DOI: 10.15584/jetacomps.2020.1.2

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System Analysis of Globalization Processes' Axiological Evaluation on the Bolon Process Ethiology and Chronology

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Abstract

It is justified that the cross-border educational coordination activities have drawn public attention to the global challenges of the 21st century and have declared the necessity for sustainable development education to be at the forefront in the progress concept and strategies towards sustainability. Therefore, it is necessary to create a sustainable development specialists' professional training system, especially, for the professionals with managerial and qualitative competences.

Keywords: education for sustainable development, vocational training, qualitative competence, quality of education, management in education

Introduction

High quality education management in the highly qualified personnel' vocational training system becomes the main goal of the socio-economic and environmental policy of sustainable lifelong development, employment and fight against unemployment and fulfillment of the modern quality demands and humanity safety demands at the modern stage of the social and scientific knowledge.

The 21st century implementation experience convincingly demonstrates the necessity for the first-rate changes in the education system in the context of society development. The necessity to study the etiology of the cross-border educa-

tion, science and innovation integration lies in the theoretical and methodological justification of the prerequisites, as well as in the practical implementation of the quality control concepts and strategies and in the educational system management of the Higher Education Institutions (HEI) in order to ensure the sustainable society development. The transformational educational system development requires the elimination of the global education and science problems of the Bologna process principles' implementation and in the conditions of the vocational training system formation in the sustainable development education.

Main part

The system analysis of the globalization processes' axiological evaluation on the Bologna process etiology and chronology allowed to build a logical chain of stages in the cross-border education integration system. The first stage is independent, declarative and structural. It requires the motivation for the national education system modernization in cooperation with the European Union Association called "European knowledge and scientific knowledge". The second stage is communicative. It includes the integrated implementation of the European working program. The next stage is organizational. It requires the proclamation of the European higher education and science establishment as a core stratagy of the socio-economic development. It is based on the modern European unity scientific knowledge and synergies according to the principles of academic space autonomy in schools, student-centered education, social dimension and legal guarantees of democracy. The fourth stage is integrative. It deals with the education, science and innovations in the process of transboundary implementation of the academic mobility, in the process of the educational and scientific training potential development, while taking part in the retraining or advanced training programs and internships. The following stage is geopolitical. It is a possibility to build a cross-border dialogue not only with the EU representatives, but also with other regions to improve the democratic values of scientific knowledge and to realize the academic freedom implementation and to develop the teaching methods according to the peacekeeping standards.

Thus, the Bologna process becomes the object of scientific knowledge and the object of analytical and expert estimation. At the same time the geopolitical, organizational and managerial activities contributed to the standardization of the practical methodological recommendations on the European quality assurance planning. Such kinds of activities helped to introduce the European dimension of joint training, research programs, exchange projects and internships. Geopolitical academic mobility in the education and science sphere helps to actualize the innovations in the educational and research programs to ensure effective implementation of the educational services, scientific products, professional employment and self-improvement in the future. The cross-border coordination actions

and education drew public attention to the global environmental issues in the late 20-ies of the XXI century.

The causal analysis of the Sustainable Development Education Strategy implemented by the UN Economic Commission in Europe is seen through the Vilnius framework for continuous progress in following stages: 1) political – the establishment of the education institutions in the participating countries, global integration; 2) practical implementation – the national monitoring of the state strategy and plans' implementation; 3) progressive – the realization of the national sustainability strategy purposes in all spheres of social development. The effectiveness analysis of the Sustainable Development Education Strategy implemented by the UN Economic Commission in Europe is viewed through the Vilnius framework as a continuous progress in following stages: 1) political and organizational – the establishment of the education institutions in the participating countries, global integration in the field of education and science, and national plan development using the methodological metric of sustainable development); 2) practical implementation – national control over the implementation of state strategies and plans; 3) progressive – implementation of the goals of the national sustainability strategy in all spheres of social development.

In the process of structural and logical analysis it is determined that education and scientific research acquire nonlinear systemic network and development of the affiliated states with a certain responsibility of the authorities. The World Sustainable Development Goals and the Ukrainian Sustainable Development Goals specify the possibilities of the educational and scientific systems' modernization, in particular, by introducing sustainable development issues in the educational process, promoting an ecocentric lifestyle, ensuring the human rights, gender equality and non-violence as well as the global concept of civil society with an axiological awareness of cultural diversity and the sustainable development academic culture. The analytical platform of our research is based on laws and regulations in the fields of education and science, on the environmental and social development of Ukraine, as well as on the autonomous HEI regulations and the UN guidelines on this matter.

The basis for the legal regulation of the research is to ensure that the education quality specialists' professional training in the HEI is being realized in compliance with the legislative requirements in the fields mentioned below:

1) education and science: professional higher education (2019); education (2017); higher education (2014); pre-school education (2001); after-school education (2000); general secondary education (1999); vocational education (1998); scientific and technical activities (2015); access to public information (2011); innovative activity (2002); copyright and related rights (1993); scientific and technical information (1993); technical regulations and conformity assessment (2015); civil service (2015), basic principles of state supervision (control) in the

economic activity sphere (2007), State Service Regulations on Education Quality of Ukraine (2018);

2) environment: natural environment protection (1991); atmospheric air protection (1992); Fund of Ukrainian Natural Resources (1992); ecological expertise (1995); wastes reduction (1998); flora protection (1999); wildlife protection (2002); Red book (2002); land protection (2003); environmental audit (2004); ecological network of Ukraine (2004); the basic principles of state supervision (control) in the sphere of economic activities (2007); basic principles (strategies) of Ukrainian state environmental policy for the period until 2020 (2010); environmental impact assessment (2017);

3) social protection: citizen status protection and social protection of the people suffered as a result of the Chernobyl disaster (1991); the children protection (2001); occupational safety (1992); state social assistance to people disabled since childhood and to children with disabilities (2000); obligatory state pension insurance (2003); social insurance (2010); employment (2012).

Methodological basis of the future specialists' vocational training system for quality education is built on the following principles: the fundamental philosophical principle, concrete-scientific principles, general scientific principles and the principles of science and management knowledge. The management system methodology is based on the international principles of technical regulation in the field of education, science and innovations, which provide systematic unity, regulations and quality measurement in educational services. The international principles mentioned above ensure the technical regulations in the sustainable development priorities, national security, sustainability policy in the prospects of scientific and technical potential realization, the autonomy of technical regulation institutions, expert & analytical institutions from stakeholders and it also guarantee a holistic unity in the quality management principle implementation.

The measurements of the management coordination metrics rely on the management platforms of systematic interaction for the purpose of quality formation. The measurements are done according to the managers' training system models regarding the structural organization types and the functional purpose of continuous professional education. The HEI development planning on the principles of sustainability was carried out due to the principles of systematic quality analysis, the architectonics of the management hierarchy, the formal interaction and the normalization of the goal setting.

Conclusion

The targeted analysis of the global collections of conferences and conventions held for the twenty years of the sustainable development education modernization indicates a huge scientific interest to the educational system improvement perspectives, not only the environmental scientists and specialists on

global economics, but also teachers and authority representatives, politicians, managers, experts are seeking for the ideas of sustainable development in management education, research and innovations together with students, employers, mentors and representatives of the academic communities. The cross-border cooperation contributed to the realization of integrated political and academic responsibility. It required the development and implementation of the strategic education, science and innovation programs. As a result, a competitive educational and scientific space was formed. It includes a three-dimensional metric of the European standards, based on the research on consistency principles and lifelong employment promotion in the EU.

The World Association of the Universities engaged in the sustainable development process while being analyzed testifies to the global constructive awareness and professional orientation built on the principles of consistency through the environmental education. In general, it ensures the global consciousness and the environmental awareness among the people engaged in the education process, each university is recommended to create a work group in the structural units (including faculties, students, staff, and administrators).

The scientific knowledge concept and the research quality concept were defined in our study as well as a certain lack of scientific works on methodology regarding the existing education system development and transformation.

The process of situation analysis actualized the necessities for the professional training methodology development and the quality value system perfection as well as for the life security improvement and the balanced socio-economic and ecologically safe development of society and nature. Such kinds of modern social demands can be satisfied based on the strategies of the UN Economic Commission in Europe as well as on the axiological principles and new approaches to the education and scientific knowledge. The transformations of the curricula and academic discipline programs should be a priority of the National plan for the UN Economic Commission Strategy implementation. The modern scientific areas of knowledge were also defined due to the results of the research.

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© University Press 2020
ISSN 2719-6550
ISSN 2719-7417 online

„Journal of Education, Technology and Computer Science”
No. 1(31)/2020
www.eti.rzeszow.pl

Received: 20.05.2020
Accepted for printing: 24.08.2020
Published: 05.11.2020

DOI: 10.15584/jetacomps.2020.1.3

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Pedagogical Counseling as a Professional Activity of Specialists in the Field of Education

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Abstract

The article reveals the essence of pedagogical counselling as a sphere of professional activity of specialists in the field of education. Specific features of pedagogical counselling that distinguish it from other types of counselling are defined and characterized. The main directions of professional activity of educational consultants are considered. Requirements for professional counsellors in the field of education are outlined.

Keywords: pedagogical counseling, education, guidance

Reforms of the domestic system of education and implementation of innovative technologies and teaching aids have caused the population's demand for qualified education consulting services. Due to this, the modern direction of professional activity of specialists began to form in Ukraine, which can be defined as pedagogical counselling.

In recent years, counselling has been given attention by many sciences: psychology, sociology, management, pedagogy, etc. Each of them has its purpose, object and subject of research. For us, the object of scientific research is pedagogical counselling. Aleshnikova (2000), Bezkrovny (2009), Zaychenko, Pevzner, Slastenin and Kolesnikova (2006) made significant scientific contributions to the development of certain aspects of pedagogical counselling as a professional activity. However, disclosure of the essence of pedagogical counselling as a professional activity of specialists has not yet been the subject of a separate study.

The purpose of the article is to determine the essence and specific features of pedagogical counselling as a professional activity of specialists in the field of education.

Nowadays, counselling (from the Latin counselling) on education can be provided by specially trained professionals (professional counsellors) or by a person who has experience in solving a particular situation or problem related to education or training. Therefore, it should be noted that counselling should be considered as professional and non-professional activities. In our case, we will pay attention to pedagogical counselling as a professional activity of specialists in the field of education.

The concept of counselling should be considered from two sides: on the one hand, it is the process of providing a client with advisory services and, on the other hand, the sphere of professional activity of certain specialists (medical consultation, legal counselling, educational counselling, child consultation, etc.). If you consider counselling as a process of consulting a specialist, then this is an organized interaction between a consultant and a client aimed at the positive solution of his problem. The counselling process involves the following consecutive steps: studying the client's problem, clearly defining it, developing alternatives to solving a problem, helping the client to choose a solution to the problem, facilitating the implementation of the decision, evaluating, and receiving feedback from the client on the effectiveness of the problem solving. The educational counselling process involves a certain sequence of actions performed by a professional counsellor to achieve positive changes within institutions and educational establishments, the rapid resolution of problems, or the creation of conditions in which consumers of counselling educational services will be able to do so on their own. Compliance with the sequence of stages of the counselling process in education is an important condition for the consultant's professionalism. In the process of counselling, a professional counsellor in the field of education uses a certain toolkit – a set of modes and methods for working with information and clients that help identify and solve a customer's problem.

If considering pedagogical counselling as a professional activity, it is the activity of specialists in the field of education, which is aimed at satisfying the needs of institutions and educational establishments and pedagogical staff in professional counselling and development services. Professional counselling in the field of education involves providing counselling services to individuals as well as education, training, choice of profession, etc.

Educational counselling services can be provided by professionally trained specialists working in institutions and educational establishments and consulting organizations. Among such organizations we include: pedagogical universities and colleges, institutes of postgraduate pedagogical education, school methodical offices, district (city) methodical offices, centres of teaching and methodical work, centres of pedagogical counselling, psychological, medical and pedagogical consultations, educational consulting centres, public educational organizations, etc. Pedagogical counselling in the mentioned organizations is carried out

by specialists of pedagogical direction: teachers of institutions of higher education as scientific directors and consultants, methodologists, educational consultants, supervisors, coaches, advisers, tutors, moderators, independent experts in the field of education.

Knowledge, skills, abilities and personal qualities of consultants in the field of education determine the specifics of their professional activities and allow them to solve customer problems on a professional level. In professional counselling, professional counsellors have to adhere to the following basic principles:

– the principle of voluntariness, which stipulates that the client himself determines the need to apply for a professional counsellor, chooses the form and duration of counselling;

– the principle of equality defines the same responsibility of the client and the consultant for the success of the counselling process. The task of the consultant to create conditions that will stimulate the client to make an independent decision, and the client's task is to effectively interact with the consultant in the process of counselling;

– the principle of variability implies that counselling is situational changing and severely limits the ability to distinguish between universal ways of solving various client problems. The practice of counselling can not be reduced to the development of ready-made solutions for any client problems. It stimulates counsellors to self-analysis and continuous reflexive activity, since there can not be the same clients, the same pedagogical problems and situations, and therefore, the same consulting services;

– the integrity principle reflects the system of consulting services in the continuous support of clients. It is logical interconnectivity and consistency in the provision of a range of counselling services that can ensure the effectiveness of counselling;

– the principle of professional ethics determines compliance with the ethical standards of a professional consultant, which excludes client manipulation, self-advising consultant, imposing subjective professional positions and assessments;

– the principle of independence of the consultant comes from the fact that in the process of counselling the specialist must abstract from other social roles that he performs in a society;

– the principle of confidentiality implies the inadmissibility of disclosure of information obtained by a consultant in the process of consulting a client;

– the principle of cooperation indicates that the consultant, in cooperation with the client, must adequately assess his or her own capabilities and, if necessary, consult a more experienced counsellor or consultancy advisor, which may include specialists from different profiles who can help resolve the client's problem (Zaichenko, Pevzner, Slastenin, Kolesnikova, 2006, p. 15–17).

An advisory service provided by professional consultants in the field of education is a special informational product of the manufacturing activity of a consulting organization that is provided to the client in the form of developed programs, projects, recommendations, advice, etc. It is an intellectual product created by a consulting organization that remains in the possession of the client after the completion of counselling.

Educational counselling services have their own specific features that distinguish them from others. Firstly, the consulting service can be considered as the non-material good that the consumer receives for the development of the educational and cultural outlook, and material – if the consultant provides the client with recommendations in paper, electronic or other media.

Secondly, the provision of specialist counselling services in the field of education reflects the simultaneous process of their production and consumption, as it is carried out through close cooperation between the consultant and the client. However, the quality of consulting services can only be evaluated by the client after its execution.

Thirdly, educational advisory services are a commodity, since they are the subject of sale, that is, they have consumer value and cost. Educational counselling service is a product expressed in the form of special information that is produced and sold by an advisory organization and purchased by a client.

Fourth, identical education advisory services provided by different consulting organizations may differ in form, methodology, content, and implementation technology.

The quality of the educational counselling service and the effectiveness of counselling depend on the client's personal involvement and the professionalism of the counsellor. The main features of the quality of consulting services are:

– reliability of information – the quality of information, which determines the degree of objective, accurate reflection of social reality;

– modernity of information – information should be based on new statistical data, the theory and methodology of pedagogical science;

– completeness of information – means that it is enough for the client to understand the situation and make a decision;

– brief information – a concise and clear presentation of information by the consultant, which allows the client to make a decision quickly;

– usefulness of information – the practical value and importance of information for the client to solve the problem;

– clarity of information – unambiguous interpretation and awareness of information by the client;

– a variety of methods for evaluating information – the same information should be evaluated by different methods, depending on the scope of its application.

Professional counsellors in the field of education provide counselling in the following areas:

– counselling of the child (on the subject of study, meta-subject consultation, professional counselling, pre-professional consultation, social-pedagogical counselling, educational counselling);

– family counselling (didactic counselling, medical-psychological counselling, corrective counselling, information services, consultation on cooperation and interaction);

– counselling of teachers (audit of quality of educational process, methodical consultation, project counselling, procedural and diagnostic counselling, general pedagogical counselling);

– counselling of management personnel (provision of information technologies, program-targeted, command-group, value-oriented, psychological, marketing consulting, provision of public relations, organizational-methodical maintenance, audit of school development) (Zaichenko et al., 2006).

The effectiveness of the professional consultant depends on his theoretical readiness, qualifications, personality traits and customer expectations. A professional consultant in the field of education can not give the consumer a ready-made solution. His task is to help the client to identify the essence of the problem and overcome it. Consumers in the process of counselling must understand the nature of the problem and find solutions to solve it. For this purpose, a professional consultant must possess a variety of methods and techniques of consulting with the client.

Methods in pedagogical counselling, on the one hand, are a mean and a way of knowledge and application of the knowledge created by mankind and pedagogical practice, and on the other, it is the concrete actions of the consultant and the client that contribute to the qualitative professional change of the subject or object. The most used methods in pedagogical counselling are: visual psycho diagnostics, pedagogical and sociology. At the same time, a professional counsellor in the field of education must have the skills of professional impact on the client and conducting an advisory interview. The professional use of methods and techniques of counselling ensures the effectiveness of the counsellor's interaction with the client and the effectiveness of the counselling process.

An important part of the professional activity of a consultant in the field of education is the observance of professional requirements:

– Creation of client consultation process based on interaction and trust;

– Revealing the attention and respect for the client's personality in the process of counselling;

– Creating a favourable psychological climate for counselling;

– Perception of the problem or difficulties of the client and providing him with real help in solving it;

– Continuous improvement of professional skills in pedagogical counselling.

So, after considering the essence of the concepts of "counselling", "counselling process", "counselling", we defined the concept of "pedagogical counselling" as a sphere of professional activity of specialists in the field of education. It differs from other types of professional counselling by the purpose, content, object, subjects, methods, means and results of counselling.

For pedagogical counselling, there are specific features: professional counselling services can be provided by professionally trained specialists working in institutions and educational establishments and consulting organizations; An advisory service provided by a client advisor is an intellectual product created by a consulting organization that remains in the possession of the client after the completion of counselling; the quality of counselling educational services and the effectiveness of counselling depend on the personal involvement of the client and the professionalism of the counsellor; the main areas of professional activity of counsellors in the field of education are counselling the child, the family, management staff and citizens as individuals; the effectiveness of the professional consultant depends on his theoretical training, qualifications, personality traits and customer expectations.

The growth of mobility among young people and the emergence of new types and areas of economic activity in the field of education have led to an increasing demand for counselling education services and the development of pedagogical counselling in Ukraine.

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© University Press 2020
ISSN 2719-6550
ISSN 2719-7417 online

„Journal of Education, Technology and Computer Science”
No. 1(31)/2020
www.eti.rzeszow.pl

Received: 14.10.2019
Accepted for printing: 3.08.2020
Published: 05.11.2020

DOI: 10.15584/jetacomps.2020.1.4

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Education Process Digitalization in Sociocultural Activity Managers' Training

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Abstract

The process of the future sociocultural activity managers' professional training under the conditions of information and educational environment in the higher education institutions is recreational-aesthetic and psychological-rehabilitative restoration of the future specialists' intellectual and professional potential, which can be effectively applied in the different spheres of life.

Keywords: vocational training, future manager of socio-cultural activity, information and educational environment, concept, institutions of higher education

Introduction

In Ukraine, the issue of the sociocultural activity managers' training system improvement is of particular importance for the scientific field 02 "Culture and art", because it includes different spheres of people's activities such as leisure, hotel and restaurant business, tourism, sightseeing and animation, entertainment, exhibitions and various scientific conferences. The necessity for highly qualified sociocultural managers, whose professional competencies must fulfill the demands of the digital society, exceeds the available supply. The main purpose of the specialists' theoretical training is to obtain knowledge, deeply integrated in nature.

Therefore, it is urgent to find the ways to train the highly qualified specialists in sociocultural sphere and to digitalize the educational process in higher education institutions (HEI). The future managers' training and the educational process digitalization are seen as the main directions of the managers' education modernization. Its development is based on the usage of the modern digital technologies. The information & educational environment formation in the HEI creates new opportunities for the further transformation of traditional educational technologies to a new quality level. The innovative approaches to the educational transformation of the future sociocultural activity managers' professional training attracted the attention of such scientists as Karpiuk, Lokshin, Sheremet. The research analysis made it possible to reveal that the modern teaching technology theory and methodology lack the conceptual basics of the future sociocultural activity managers' professional training in the conditions of HEI.

Main part

In the process of analysis of the scientific, methodological, educational and methodological literature on psychology and professional pedagogy it was revealed that there is no special scientific works devoted to the study of the future sociocultural activity managers' professional training concept in the conditions of the IEE. The main conceptual idea of our research is to realize that the future sociocultural activity managers' professional training in the conditions of informative educational environment in the context of multifaceted socio-informative pedagogical system is a crucial component in the holistic process of professional training in the context of the global sociocultural processes, taking place in modern and contemporary economics. The concept is based on the research hypothesis claiming the future sociocultural activity managers' professional training becomes effective if it is carried out on the basis of the theoretical and methodological foundations revealed by the structure of the future sociocultural activity managers' professional socio-informative competence in terms of IEE formed in higher education institutions.

The research concept implies some compliance with the functions, adherence and application of methodological approaches, interaction synchronization with employers in the future sociocultural activity managers' professional training organization in terms of IIEE in HEI in order to form the professional socio-informative competences of student-centered teaching and further mobility space according to the following sequence: 1) educational, scientific, methodical, communicative, organizational, sociocultural, legal, developmental, ideological, managerial, individual; 2) systemic, acmeological, competent, personal, cultural, prognostic, synergistic, information-corrective, transformational and activity sequence; 3) network promoters and translators, hospitality institutions and restaurants, leisure services, educational & educational-scientific institutions, in-

formation & telecommunication institutions, administrative and rehabilitation institutions. The concept factors mentioned above, for the most part, are a social contract for the managers' professional education system, which has a clearly defined legislative framework (National Strategy for the Education Development in Ukraine until 2021, Higher Education Law of Ukraine", Resorts & Tourism Development Strategies for the period up to 2026, Digital Agenda of Ukraine – 2020, Development Concept of Digital Economy & Society of Ukraine for 2018–2020, National Classifier of Ukraine "Classifier of Professions" DK 003: 2010). In the process of model development, we relied on the existing pedagogical approaches to the "development" concept. For example, the A. Schremet's model allow us to characterize the main characteristics of "development" quite reasonably.

The systematic approach ensures the educational process integrity, contributing to its optimization, and allows considering the future sociocultural activity managers' professional training process as a single system with a variety of additional programs, which extends the range of professional activities. On the basis of systematic approach, the future sociocultural activity managers' professional training is a complex pedagogical system with various additional programs.

The acmeological approach involves the creation of the information and educational environment aiming at the active development of the students' desire for professional success and creativity. The competent approach reveals some aspects of the future sociocultural activity managers' professional competence formation in the process of the vocational training in the HEI under the conditions of IEE. "The interdependent practical steps are distinguished on the basis of the competent approach in modeling", which are the basis for the model development. The personal approach gave us an opportunity to unlock the personal potential of the future sociocultural activity managers, which allows us to establish a professional activity segment in the sociocultural sphere and related industries. The diagnostic approach is a systematic monitoring of the educational process itself and the level of the future sociocultural activity managers' professional competence formation in the conditions of IEE. We agree with the scientist A. Sheremet that "Taking into account the activity approach the pedagogical modeling course requires having a purpose and an object".

The cultural approach is considered to be the basic one in the future sociocultural activity managers' professional training. It requires self-determination and self-development of the manager's creative personality, manager's working culture; manager's spiritual, economic and legal culture, manager's interethnic and interpersonal communication culture, etc.

The prognostic approach takes into account the development perspectives of the scientific field 02 "Culture and Art" and is aimed at the professional practice usage in the specialty 028 "Sociocultural Activity Management" of modern sci-

entific achievements and innovative technologies. As far as the information volumes constantly change due to the science development and the information and communication technology implementation, the information-corrective approach is aimed at the information correction and update,

The transformational approach is a selection and methodological elaboration of the modern scientific achievements in the scientific field 02 “Culture and art” and it provides some recommendations for the educational environment transformation in order to improve the future sociocultural activity managers’ professional training system in HEI. Karpyuk once said “Synergy reveals the development principles of self-organizing systems”. The external openness of the IEE provides a flexible response to the extremely changing sociocultural environment, a desire to follow the social order strictly. The internal openness of the IEE “in each case is an attempt to choose for each student's individual development trajectory, taking into account the individual psychological characteristics, abilities and aptitudes”.

The main idea of this research is the next one. The future sociocultural activity managers’ professional training in the conditions of informative educational environment in the higher education institutions involves a number of competences such as professionally important qualities, in particular, organizational and management initiatives, sense of humor and irony, community leadership, cultural and functional competences, pedantry, pragmatism, futuristic vision of optimism, reliability, punctuality, natural intuitiveness and performing discipline, strong-willed determination, sincere hospitality, altruism, ethical virtues, team collectivism. It also requires some socio-managerial skills, including the psychological-pedagogical potential, stress tolerance, self-improvement, self-realization, self-development, organizational, planning, administrative, corporate, political and cultural skills, art management and design, constructive, communicative and realistic assessment of situation development. Besides, it is necessary to gain the different abilities like intellectual, positive-ideological, creative, educational, aesthetic, mathematical, structural, technical, creative, physical, musical, visual, etc., the abilities of recitation, rhetoric, didactics, abstract-project and strategic management thinking, innovation ability and information technology abilities. It also demands to show some commitment to professional, psychological, recreational, educational and social service, art, design, scenario planning, cultural, organizational and managerial duties, socio--environmental expert monitoring, hotel and restaurant, tourism and recreation, information technology duties. The students are asked to take some responsibility for the adopted managerial decisions, career growth and competitiveness, introspection and self-criticism with the elaboration of development strategies, professional development and employment, moral and corporate environment creation, conflict situation solution and prevention, etc. The sociocultural activi-

ty managers' professional training is a socio-informative system complex consisting of combined components including professional competences such as regional, historical, cultural, sociocultural, administrative, recreational and tourist competence, leisure, hospitality, etc. The information technologies, projects, environmental, social, civic, pedagogical, psychological, digital technologies are focused on the implementation into the process of the sociocultural activity managers' professional training, in the public forms of educational environment organization.

The system of the future sociocultural activity managers' professional training in the context of the information and educational environment in higher education institutions is based on the following principles: 1) the study of the hospitality industry traditions (facility and service organization, the functioning effectiveness, etc); 2) the study of the applied activities, covering all constituent systems; 3) the study of basics (the unity of methodological, general, theoretical and practical professional training); 4) the study of scientific relevance (reflects the relevance of the vocational training content to the modern science capabilities); 5) the study of moral values (based on the awareness of the present crisis in the universal system of moral values); 6) the study of personality development (a unity of socialization and individualization hidden in the process of personality development, which requires the establishment of the optimal balance inside the human nature, as far as the professional development is determined by the interaction of individual and social factors); 7) special country studies (chronological genesis, ecological and humanistic outlook); 8) sociocultural management (a systematic unity of the democratic culture and the social economic centralism, the socioeconomic ecological security relevance, motivational, moral and material incentives, the professional training basics and distribution of authority powers, managers' social responsibility to combine the industrial and territorial issues in an optimal way, to manage the inheritance in the dynastic conglomerates and to make organizational and economic decisions, to realize optimal subordination between the personal interests and the general socioeconomic feasibility in order to ensure the effective environmental and life safety, development of the various organization systems.

Conclusions

In order to intensify and improve the educational process it is necessary to create a unified information and educational environment between the university and production. This is due to the necessity to adapt the educational process to the realities of professional activity, which will facilitate the participation in the projects aimed at the meeting of the business demands in the hospitality industry. Besides, it is envisaged that the creation of a unified educational information environment of the Ukrainian Defense will encompass both vocational and edu-

cational institutions and promote the development of the traditional and innovative approaches to the implementation of the scientific, educational, administrative and leisure activities. Qualitative characteristics of IEE, such as web technologies, should contribute to the improvement of the quality and accessibility of vocational education for the various population categories been currently in crisis. The most fruitful drive for innovation is a contact with employers, collaboration and networking, as well as positive changes in the working environment. Innovations also include a renewed attitude to the old manufacturing practices, such as mentoring. Therefore, the latest technologies have great prospects for the vocational training in the workplace.

Thus, the concept introduced envisages the possibility of its transformation in response to the economy and education digitalization in the country and in the world. In the future, there is a necessity to study the ontological aspect of the future sociocultural activity managers' professional training concept in the conditions of IEE.

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© University Press 2020
ISSN 2719-6550
ISSN 2719-7417 online

„Journal of Education, Technology and Computer Science”
No. 1(31)/2020
www.eti.rzeszow.pl

Received: 16.05.2020
Accepted for printing: 3.08.2020
Published: 05.11.2020

DOI: 10.15584/jetacomps.2020.1.5

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Optimization of Vehicles' Trajectories by Means of Interpolation and Approximation Methods in Education in Technical Fields of Study

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Abstract

The need to optimize the trajectory of vehicles is still highly topical, regardless weather the means of transport are robots, forklifts or road vehicles. It is not only important the safety by passing obstacles, but also the energy balance, i.e. the energy expended on the movement of the vehicle and on the change of its direction. This paper presents a mathematical approach to solving this problem through interpolation and approximation curves. This is a very important scope of knowledge for the education of future engineers.

Keywords: means of transport, trajectory optimization, interpolation curves, approximation curves

Introduction

Movement of vehicles only rarely proceeds in a straight line. On the contrary – regardless weather transporting material or people into smaller or larger distances, it is almost always necessary to deal with obstacles on the path. This includes both safe avoiding obstacles and selecting the best possible trajectory from several possible options. Choosing the optimal trajectory makes thus the movement safer, may reduce the transportation costs and last but not least it may also save time.

Mathematically it is possible to perform an interpolation or an approximation of the trajectory. These mathematical procedures are used in this case as generating principles, which allow to model continuous arcs of the line. While by an interpolation the curve always passes all the associated points, by an approximation the curve passes only the first and last point, and does not have to include necessarily other associated points, which depends particularly on the given approximation function. From the mathematical point of view, it does not matter whether it is about the movement of a mobile robot in a production hall, a forklift in a storehouse or a road vehicle on a street (Kvasnová, 2008).

Ferguson interpolation curve

Ferguson interpolation curve of third degree allows an easy following of individual sections. The mathematical description of Ferguson curve bases on the position vectors $\vec{G}$ a $\vec{H}$, respective points G and H, as well as on the tangent vectors $\vec{g}$ and $\vec{h}$ of the curve at these points. Ferguson curve is then given by equation (1) (Farin, 1993),

$$P(v) = \vec{m}.v^3 + \vec{n}.v^2 + \vec{p}.v + \vec{q}\,, \tag{1}$$

where:

$\vec{P}(v)$ – position vector of a point of the curve,

$\vec{m}$, $\vec{n}$, $\vec{p}$, $\vec{q}$ – coefficients' vectors,

v – a parameter, for which is true that $\vec{P}(0) = \vec{G}$ a $\vec{P}(1) = \vec{H}$.

Performing the corresponding calculation, we obtain the vectors $\vec{m}$, $\vec{n}$, $\vec{p}$, $\vec{q}$, expressed by four equations (2), (3), (4) a (5)

$$\vec{m} = 2\vec{G} - 2\vec{H} + \vec{g} + \vec{h} \tag{2}$$

$$\vec{n} = -3\vec{G} + 3\vec{H} - 2\vec{g} - \vec{h} \tag{3}$$

$$\vec{p} = \vec{g} \tag{4}$$

$$\vec{g} = \vec{G} \tag{5}$$

Ferguson curve can also be expressed in form:

$$\vec{P}(v) = A(v)\vec{G} + B(v)\vec{H} + C(v)\vec{g} + D(v)\vec{H}\,, \tag{6}$$

where: $A(v)$, $B(v)$, $C(v)$ a $D(v)$ are third degree polynomial, for which is true:

$$A(v) = 2v^3 - 3v^2 + 1 \tag{7}$$

$$B(v) = -2v^3 + 3v^2 \tag{8}$$

$$C(v) = v^3 - 2v^2 + v \tag{9}$$

$$D(v) = v^3 - v^2 \tag{10}$$

If we select in equation (7), (8), (9) and (10) the parameter v of the interval $\langle 0,1 \rangle$, then we obtain a smooth curve that starts at point G and ends at point H. This type of curve is relatively suitable for modeling the trajectory of vehicles, since it ensures – due to appropriate choice of control points – safe passage of obstacles, although the length of the trajectory may increase.

Bezier interpolation curve

Bezier interpolation curves allow simple networking of following segments because the first two and the last two control points define a tangent to the curve at the endpoints. The touch vectors at the endpoints are determined by equations (11) and (12) (Pavlovkin, Jurišica, 2003a, 2003b):

$$C'(0) = n(B_1 - B_0) \tag{11}$$

$$C'(1) = n(B_n - B_{n-1}), \tag{12}$$

where: n is the degree of the curve.

On the other hand, Bezier interpolation curve may cause – by selecting identical control points as by Ferguson curve – a risk of collision with an obstacle, moreover, the length of the trajectory increases.

Interpolation B-Spline curve

B-Spline curves exhibit many useful properties, in particular the parametric continuity C^2 of third degree curves, so that they can also be used as interpolation curves. The parametric continuity C^i defines in which way are the respective curves connected; the index of the continuity indicates the equality of respective i-derivates of the end-points of the individual curves; i.e. the continuity C^0 indicates that the curves are connected with an edge (the first derivatives are not equal), the continuity C^1 enables a smoother connection of the curves (as the first derivatives are equal) but with different convexity or concavity and thus with an abrupt change of centripetal acceleration. The continuity C^2 ensures that the connected curves have the same convexity (concavity), as the both second derivates are equal. The computation can be performed by means of two methodes – matrix inversion or searching for Bezier's control points.

Matrix inversion is a general method which can be used for all curves. If we can – based on the control points – calculate the coordinates of some points on the curve, then it is possible by the inverse procedure to determine the control points from known curve's points, too. The point, where the respective segments are continuing, lies in the anti-centroid of the triangle, defined by three consecutive control points. The location of the anti-centroids is obtained by following construction, which is depicted graphically in Figure 1. The initial point of the arc *P(0)* is a point of the median connecting the edge P_1 and the center of the opposite side P_0P_2 of the triangle $P_0P_1P_2$, which lies in one third of the length of the median line from the edge P_1 (anti-centroid of the triangle $P_0P_1P_2$). The final point *P(1)* of the arc is the anti-centroid of the subsequent triangle $P_1P_2P_3$, which lies in one third of the length of the median line from the edge P_2 to the opposite side P_1P_3.

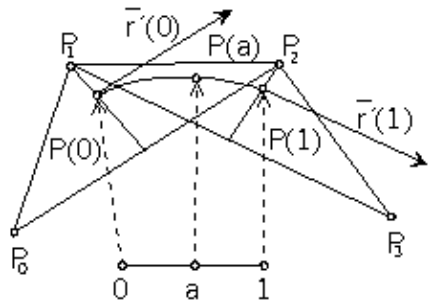

Figure 1. Construction of the anti-centroid (Novák)

Searching for Bezier's control points is basically an extension of Cardinal curves method, allowing to obtain a continuous C^2 curve. Bezier's control points V_i are located at the distance d_i from the interpolation points P_i; this ensures C^1 continuity. If the curve C^2 is to be continuous, it must be satisfied (13):

$$P_1 - 2(P_1 - d_1) + (P_0 + d_0) = (P_2 - d_2) - 2(P_1 + d_1) + P_1 \qquad (13)$$

The sections d_0 and d_n we have to choose. Subsequently, we calculate the coefficients A_i and B_i and then we recursively calculate also the remaining sections $d_{i-1} = A_{i-1} + B_{i-1}d_i$, thus obtaining the Bezier's control points. The possibility to choose the tangential vectors at the endpoints is a great advantage by vehicles, since the initial vector should have the same direction, as the vehicle is oriented. Thus it will not be necessary to turn the vehicle before starting the movement along the trajectory.

B-Spline curves obtained by both of these methods are almost the same (as we are looking for the same control points), and they differ only at the edges

(different choice of tangential vectors at the endpoints). However, the method of searching for Bezier's control points is more preferred, as it is significantly faster than the matrix inversion method. Additionally, interpolation B-Spline curves are like Bezier curves susceptible to creating "loops" and therefore they are used only where the development of such drawbacks does not mind or is excluded (Pavlovkin, Jurišica, 2003a, 2003b; Demidov, 2003).

Bezier approximation curves

General Bezier curves allow an approximation of $n+1$ given points by an *n-degree* curve. The curve is described by the equation (14):

$$C(t)=\sum_{i=0}^{n} B_i^n(t)P_i \qquad t \in <0,1> \tag{14}$$

The basis functions of Bezier curves $B_i^n(t)$ constitute Bernstein base polynomials:

$$B_i^n(t)=\binom{n}{i}^i (1-t)^{n-1} \tag{15}$$

General Bezier curves have a relatively high smoothening ability, so that they are only marginally nearing to the individual control points. This is considerably disadvantageous in some applications, but elsewhere it may be useful; it depends on the specific conditions in which the vehicle is moving.

The general disadvantage of Bezier curves is the non-locality of changes – each point of the curve is influenced by all control points; i.e. changing an individual control point changes the shape of the whole curve. Therefore Bezier curves often consist of shorter segments. This way it is possible to obtain the locality of changes and to simplify the difficulty of the calculation, while maintaining all the advantages of the curves. To connecting individual sections, Bezier curves of third degree are mostly used. Basis functions can be determined in advance, since the order of the curve is always known at the beginning.

B-Spline

Classic B-Spline curve is formed by linking Coons curves in such a way that the last three control points of one segment are identical to the first three points of the next section. In most cases there are used Coons curves of the third degree. The first segment is then determined by the points P_0, P_1, P_2 and P_3, the second segment by the points P_1, P_2, P_3 and P_4. The last point of the first segment and the first point of the second segment are identical, as they lie in the anti-centroid of the same triangle; thus the C^0 continuity is ensured (Demidov, 2003).

Joining of the individual sections is very smooth. B-Spline curves ensure the continuity C^{k-1} in the joint point, where k means the degree of the curve; i.e. B-Spline curve of the third degree guaranties a C^2 continuity. Using a Bezier curve, only the C^1 continuity is ensured. B-Spline curve therefore retains all the advantages of Bezier curves and it is a lot smoother when connecting the individual sections. B-Spline curve, however, has one major disadvantage – it does not pass the outermost points of the control polynomial. It can be removed by any of the control points will be multiple (Demidov, 2003).

If one control point is double, then the curve is significantly closing to that control point, and in a certain section it may even overlap the control polynomial. If the control point is triple, then the curve passes directly through this control point and it in the surroundings of such point it is identical with the control polynomial; however, this feature is useful only for the endpoints. So if the endpoints of the control polynomial are triple, the curve will interpolate the endpoints. The disadvantage is that near the endpoints the curve degenerates into line segments and it loses its smoothness. Another, more efficient method is to use different basis functions for the first two and the last two sections of the curve so that the curve passes through the endpoints. However, this method requires at least seven control points, so it cannot be used for simpler trajectories.

Interpolation by Ferguson curve

The interpolation by Ferguson curve, which is depicted in Figure 2, is a suitable method for optimizing specific vehicles' trajectory, but it must be expected that the length of the trajectory gets extended compared to the direct path. The vehicle does not have to stop at the edges of the control polynomial; it has only to slow down sufficiently respected to the radius of turn. With this option of control points, the trajectory passes in a safe distance from individual obstacles and thus the risk of collision with one of the obstacles is eliminated.

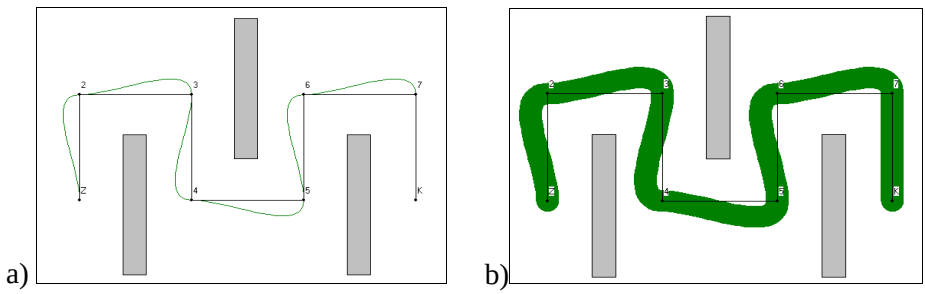

Figure 2. Interpolation by Ferguson curve (Pavlovkin):
a) for a pointwise vehicle; b) for a real vehicle

The calculation of the interpolation is always performed every second point. An element of the array has the coordinates of the point *(x, y)*; an empty element of the array has the coordinates (–1, –1). The drawing of the interpolation curve is solved by means of the C++ graphics program Borland Delphi 2.0. This program draws the Ferguson curve basing on two given points and respective direction vectors at these points.

Interpolation by Bezier curve

Interpolation by Bezier curve, shown in Figure 3, is by the specified setup of control points inappropriate for generating the trajectory of a vehicle, as it causes collisions with obstacles. Total length of the path is also substantially greater than by the interpolation by Ferguson curve. For use in a real environment, it would be necessary to the change are the coordinates of points 3, 4, 5 and 6 to achieve the desired path. The collision-free path of the vehicle for this way changed points is demonstrated in Figure 4. From the comparison of trajectories in Figure 3 and Figure 4 it is apparent that the selection of the supporting points affects significantly the length and the shape of the trajectory. However, a suitable arrangement of the individual control points enables creating a usable trajectory, provided it is possible in respect to the location of the obstacles.

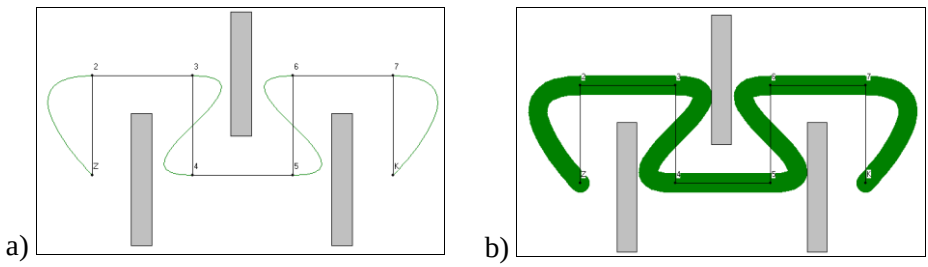

Figure 3. Interpolation by Bezier curve (Pavlovkin):
a) for a pointwise vehicle; b) for a real vehicle

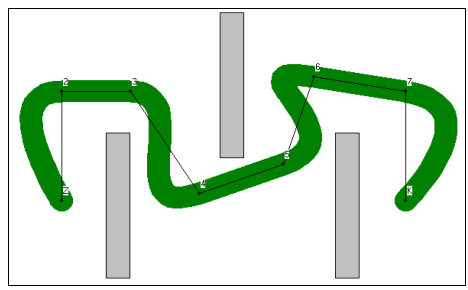

Figure 4. Interpolation by Bezier curve after changing the coordinates of the control points (Pavlovkin)

Approximation by Ferguson curve

Unlike the preceding interpolation cases, by an approximation the trajectory does not necessarily include the control points along the path. Approximation by Bezier curve, which is depicted in Figure 5, is more convenient and shorter than the preceding two cases, but a large-size vehicle may interfere with an obstacle, as shown in Figure 5b. The possibility of such a conflict can be avoided by changing the coordinates of the control point 4; the subsequent change in trajectory is demonstrated in Figure 6. In such setup of control points, it is also possible by an appropriate shifting of the point 6 to shorten the overall length of the trajectory.

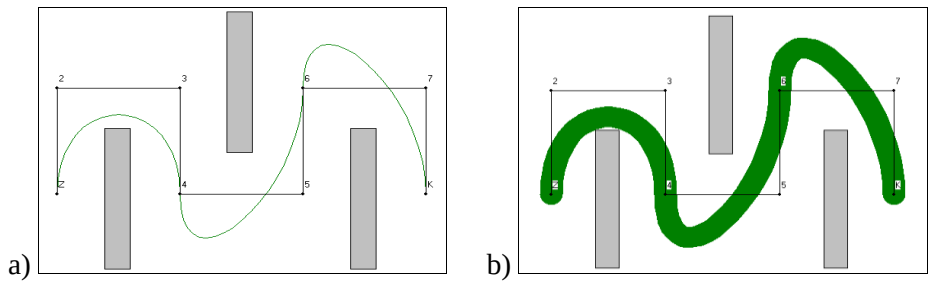

Figure 5. Approximation by Ferguson curve (Pavlovkin): a) for a pointwise vehicle; b) for a real vehicle

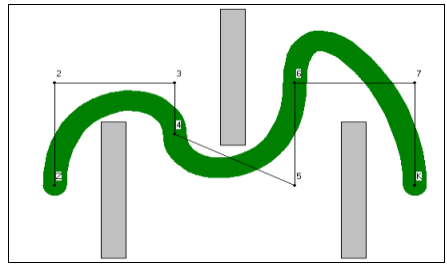

Figure 6. Approximation by Ferguson curve after changing the control point 4 (Pavlovkin)

Approximation by Cubic B-Spline

By approximation of a piecewise linear trajectory by means of Cubic B-Spline curve we obtain a trajectory, which is shorter and smoother, and thus less time- and energy-consuming. The vehicle moves smoothly along such trajectory, i.e. with a smooth change of direction and speed of its movement, as depicted in Figure 7 (Pavlovkin, 1999; Demidov, 2003).

The basic principle of generation of B-Spline curves is that we define Bezier curves of degree n at intervals (u_i, u_{i+1}); where n is the degree of the polynomial of the respective B-Spline curve and L is the number of segments of the B-Spline. So we create a sequence of points, namely the sequence $u_0 \ldots u_{L+2n-2}$. Not all points u_i, however, are different; if $u_i = u_{i+1}$ then it is a multiple point.

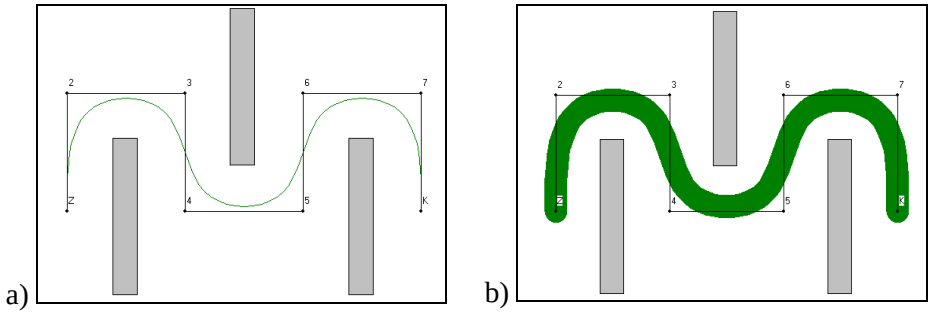

Figure 7. Approximation by Cubic B-Spline (Pavlovkin): a) for a pointwise vehicle; b) for a real vehicle

To define B-Spline we use the interval (u_{n-1}, u_{n+L-1}) as its domain, these points are called domain points, while L means the potential number of segments of the curve. If all domain points are simple, then L is also the number of domain intervals. For every multiplicity of a domain point, the number of domain intervals reduces by one. The sum of multiplicity of all domain points corresponds with L, as it true that:

$$\sum_{i=n-1}^{L+n-1} r_i = L+1, \tag{16}$$

where: r_i means the multiplicity of domain points u_i.

For generating the B-Splines we used De Boor's algorithm. Let's true that: $u \in [u_I, u_{I+1}] \subset [u_{n-1}, u_{L+n-1}]$. We define:

$$d_i^k(u) = \frac{u_{i+n-k} - u}{u_{i+n-k} - u_{i-1}} d_{i-1}^{k-1}(u) + \frac{u - u_{i-1}}{u_{i+n-k} - u_{i-1}} d_i^{k-1}(u) \tag{17}$$

where $k = 1,\ldots,n-r$ and $i = I-n+k-1,\ldots,I+1$

which is the degree of B-Spline given the parametr u.

$$s(u) = d_{I+1}^{n-r}(u), \tag{18}$$

while $d_i^0(u) = d_i C$.

Conclusion

An overall comparison of the various options optimizing of the vehicles' movement between obstacles give the best results for the approximation based on Cubic B-Spline (Pavlovkin, Jurišica, 2003a, 2003b). The mathematical model of such trajectory exhibits fluency, both in terms of necessary speed changes,

and regarding the smoothes of the change of direction. Important is also the fact that of all the analyzed trajectories this one is the shortest, which yields energy saves. Although the shortening of the trajectory need not be regarded as considerable, compared to other options, the total saving of energy may be high, in particularly over a longer period of time or if the same trajectory repeats regularly several times (stock houses, factories, agricultural activities). Finally, it has to be pointed out that the trajectory approximated by Cubic B-Spline exhibits relative high level of safety, as it passes all the obstacles – unlike some other trajectories – with sufficient distance and virtually eliminates any possibility of collision of the vehicle with an obstacle (Kvasnová, 2014).

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PART TWO

SELECTED ENVIRONMENTAL EDUCATIONAL PROBLEMS

© University Press 2020
ISSN 2719-6550
ISSN 2719-7417 online

„Journal of Education, Technology and Computer Science”
No. 1(31)/2020
www.eti.rzeszow.pl

Received: 8.05.2020
Accepted for printing: 3.08.2020
Published: 05.11.2020

DOI: 10.15584/jetacomps.2020.1.6

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Exploitation of Mineral Resources for Sustainable Development on the Example of Poland

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Abstract

Nuisance for the people living in areas covered by the direct or indirect impact of the mining industry is an important social problem. The development of the mining industry depends on high environmental requirements, in particular, it is closely related to the fulfillment of obligations of safety for human health and life. Through consultation with the local society and targeted actions degraded land can become attractive. In contrast, the lack of reclamation leads to the intensification of negative phenomena: erosion, surface mass movements, changes in the ecosystem, eutrophication of water tanks.

Maintaining balance in the natural environment is the basic criterion for the proper functioning of industrial facilities. Mining activity is a threat to the environment, including human health and life.

Use of the environment by mining is subject to adjustment to the legislation and carrying out mining activities in line with environmental requirements.

Mining activities and nature protection can operate in a sustainable manner. Appropriate selection of methods for mineral exploitation allows you to minimize the impact on the environment components. The positive impact of opencast mining is reflected in the creation of new habitats of plants and animals in post-mining areas, in the creation of new recreation places, in diversifying the landscape thanks to the construction of water reservoirs. Lakes formed after use of natural aggregates overgrown vegetation reed, acting as a convenient place to settle the water birds.

Keywords: moral education, educational environment, child development

Introduction

In 1965 eminent Polish scientist Valery Goethel introduced the term sozology, meaning the science about the causes and consequences of the changes taking place in nature due to human activities. Sozology deals with complex changes in the natural environment under the influence of technical progress. It also indicates the ways to prevent or mitigate these effects (Dziewański, 1993). Primary energy carriers are organic fossil fuels, nuclear fuel, geothermal and unconventional sources. The fossil fuels include: coal, lignite, oil and natural gas. Forecasts of world mining of coal and lignite are promising. According to the currently identified resources of its sufficiency is estimated at 200 years, assuming a constant rate of consumption. Highly developed countries gradually bring to power a cleaner conventional fuels, e.g. natural gas, shale gas. Increasingly important role play alternative sources of primary energy. Poland is a leading coal producer and consumer of energy based on this medium. The high share of coal and lignite in domestic electricity production makes it an implemented economic development model that should be compatible with social acceptance.

The impact of mining on the environment

The natural environment includes the external part of the Earth's crust and soil cover, part of the atmosphere, hydrosphere, fauna and flora. The environment is transformed by human activity through economic, industrial and human living. Mining activities cause transformations in the environment, which are called mining damage. On the negative change in the most vulnerable are the lithosphere and hydrosphere, and to a smaller degree, atmosphere and biosphere (Kulczycka, Pietrzyk-Sokulska, Uberman, 2015). According to the geological and mining law mining damage includes damage to objects on the earth's surface or underground and other damages caused by mining works. In fact, these are different kinds of deformation of the earth's surface and damages to buildings and infrastructure in mining areas, or in close proximity. The most common are: deformation of the land surface, pouring depressions, pollution of rivers of mine waters (especially salinity). The costs of removing the consequences of the damage are covered by special legislation.

In Poland three methods of mineral extraction are used:

- hole (sulfur and salt mining),
- pit (brown coal, minerals and rock materials common)
- underground (coal, copper ore, barite, zinc and lead).

Each of these methods has a negative impact on the environment.

Mining effects on the elements of the environment directly and indirectly. Direct impact is occupying agricultural land, forests and recreational activities at mines and landfills.

Indirect impact is the broad influence of mining activities, including the geomechanical transformation, soil degradation, water and atmosphere pollution.

Assessment of the impact of mining on the environment should include information on the impact on human, flora and fauna, air, water and soil in the landscape, material assets and cultural heritage (Kowalska, Sobczyk, 2010, 2014; Sobczyk, Kowalska, Sobczyk, 2014).

After the completion of the exploitation at the mine is obliged to restore degraded land. The main environmental problems of coal mining are deformations with the secondary effects (mining damage and the impact of the rock mass to buildings, roads, infrastructure, agricultural and forest lands), the discharge of saline waters from the drainage of mining plants, mining waste, lands requiring reclamation and management, emissions of methane, emissions of dust and gases. Coal mining discharges to surface waters millions of tons of salt along with unused mines water.

At the same time the coal mines generate millions of tons of mining waste. Waste economically used on the surface is used for leveling areas (reclamation and removal of mining damage), production of construction materials, engineering and hydraulic engineering works. Coal mines lead reclamation and revitalization on the surface covering more than 80 hectares of land degraded by industrial activity.

The study public opinion on the post-mining reclamation

The use of the environment by mining is subject to adjustment to the legislation and carrying out mining activities in line with environmental requirements. The public discussion gives the opportunity to speak to people affected by industrial nuisance, both the government and the local community. In an efficient manner conducive to optimal decisions take into account the interests of all stakeholders. It can also be an excellent example of a process of environmental education.

The public opinions about the harmful impact of mining on the environment have been the subject of many studies, including scientists from the Polish Academy of Sciences in Krakow, AGH University of Science and Technology and the Central Mining Institute in Katowice.

Conclusions

Mining areas often are adjacent to protected areas, natural and valuable, arable land, or simply from the housing estates. By this fact are areas of conflicts (Sobczyk, Kowalska 2015).

The environment is subject to unfavorable changes in the mining districts. Therefore, you must create a protective zone around the mining facilities in order to prevent the negative consequences of their impact on the environment,

and consequently, on the health and lives of people. Most of the respondents underlines the paramount importance of the human factor as the object of most sentient effects of mining activity. Determination of the degree of nuisance industrial facilities is an indispensable step to identify the real environmental risk. Understanding the views of the public on the environmental nuisance mining sector will develop a proper environmental policy in the region.

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© University Press 2020
ISSN 2719-6550
ISSN 2719-7417 online

„Journal of Education, Technology and Computer Science”
No. 1(31)/2020
www.eti.rzeszow.pl

Received: 1.06.2020
Accepted for printing: 3.08.2020
Published: 05.11.2020

DOI: 10.15584/jetacomps.2020.1.7

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The Anthroposphere and Mining Activities

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Abstract

This article presents some aspects of goals and tasks of sustainable development. The theoretical preliminary analysis of environmental hazards in mining in the anthroposphere is described. The publication is focused on influencing people and environmental elements that affect people's living conditions.

Keywords: sustainable development, anthroposphere, mining

Introduction

The main objectives of sustainable development are making sure that the needs of the present are met without compromising the ability of future generations to meet their own needs, but also providing the society with a long-term perspective on development prospects (WCED, 1987).

Seeking harmony, the effect of which is sustain-ability of development, is achieved through paying special attention to protecting the natural environment and ensuring social growth potential that follows economic growth. Protection means care for the natural environment and its resources so that they could be used – in an undeteriorated state – by future generations. This means focus on education, healthcare, safety and proper living conditions of human beings so that the social growth potential of future generations is preserved (Piecuch, Hewelt, 2013). In this way one can provide protection of rare assets and resources, thus making it possible to maintain sustainability of development.

Due to the accelerated development of modern societies and the necessity of resources to sustain this expansion, the environmental damage has increased at

a level in which a priority in our society at a global level, is the need of sustainable development where the protection of the biosphere from human beings is guaranteed. This is a natural born requirement in which the adverse effects of human activity on the environment must be controlled, regulated and minimized in order for our species to keep benefiting from the resources that make possible our survival and development. A critical implement in this regulation to achieve sustainable development is the Environmental Impact Assessment of different projects and aspects carried out, that imply any type of alteration of the natural ecosystem, to ensure its preservation (Brutland, 1987; IUCN, 2018).

The process serves us to evaluate and analyse the conditions generated in the environment to make the best choices regarding this concern. Mining is one of the most influential fields for our specie in terms of the provisioning of resources for the human race, there is a constant and fluctuating demand of minerals to preserve and improve our development and way of living, but as opposed it, is also one of the most harmful practices to our environment from different angles if not supervised and regulated.

Social impacts

Social impacts created by big scale mining are controversial and complex. Mining development may produce a lot of economic benefits but also big alterations. Mining projects propose the creation of employment, roads, schools, and to increase the goods and services in poor and isolated zones, but the costs and returns may not be equally distributed. If communities feel that they are unfairly treated or that their compensation is not just, mining projects can lead to social and violent conflicts.

Mining industry might underestimate or even ignore their project´s impact on the local population. When the relation between communities and authorities are weak or the environmental impacts implied on mining affect the subsistence and support of the local population, communities feel very exposed.

A sense of social deprivation may flourish in communities when there is an unbalanced power when facing changes and effects implied in projects carried by big and powerful foreign companies. Environmental risk assessment might include a way to allow the local population to take an effective role in decision making processes. Extractive activities should ensure the protection and fulfillment of the fundamental individual and collective rights, which includes the right to own and use the land, to clean water, to enjoy a safe environment and lifestyle, the right against intimidations and violence and fair compensation in case of loss.

The displacement of established communities can lead to conflicts with large scale mining projects. Communities lose their lands and as a consequence their means of livelihood, creating a disturbance in their community institutions

and power relations. Entire communities might be forced to move to settlements with no resources access, built for that purpose, or to stay close to mines where they are exposed to contamination. The resentment is much bigger and devastating to native indigenous communities with big cultural and spiritual roots in their lands.

One of the biggest impacts in mining activities is the people migration to mining settlements where the economic activity is centred. The sudden population increase leads to higher pressures on land, water and other resources and more waste management and sanitation problems (Sobczyk, Kicki, Sobczyk, Szuwarzyński, 2017).

Effects might be extended longer than the mining surroundings, as the infrastructure improvement may attract more settlers.

One of the most important mining impacts on the population is the one affecting the quality and amount of water supply. Even though the industry insists in the use of modern technologies that ensures the preservation of the environment, there are overwhelming evidences that prove the negative impacts of mining activities and lack of environmental legislation fulfillment which contributes to create a mistrust feeling among local population located downstream mining facilities, as they are worried with the negative effect on their water supply. It may affect the maintenance of local families' water supply or even the solvency of national governments. These fears concerning the quality and amount of the water supply may lead to the numerous and sometimes violent conflict between miners and communities.

If mining activities are not properly managed and controlled they can lead to a ground, water, biodiversity and forest resources disturbance among other demands needed for local productive activities and local population subsistence. When there is an uncontrolled contamination, the effects may be altered to other economic activities such as agriculture and fishing. The problem gets more severe as many times extractive activity takes place in zones inhabited by historically outcasted and excluded populations.

Mining projects must ensure that individual and collective fundamental rights are not endangered, these rights include the right to control and use the land, to clean water and to sustenance. Those rights must be ensured by the legislation, organizations and international human rights treaties. The interests of the most vulnerable groups must be identified and protected.

Human health

Mining projects often do not correctly evaluate potential risks that toxic substances and waste products in water, air or land may have on human health. The World Health Organization defines health as the complete state of physical, mental and social wellbeing not only as the absence of disease (https://www.who.int).

Dangerous substances due to the amount, concentration, and physical, chemical or infectious properties may cause or contribute to the increase of mortality or to the increase of severe or disabling diseases; or represent a potential risk for human health or the environment if not properly treated, stored, transported or managed.

Problems created on human health by extractive activity commonly include:

– hydrosphere: surface and underground water contamination with metals, elements, microorganisms from sewers or drainages and waste from settlements and workers, residences,

– atmosphere: exposure to high concentrations of SO_2, particles, heavy metals including, plumb, mercury and cadmium,

– litosphere: precipitation of toxic elements suspended on atmospheric emissions.

Extractive activity impacts may severely affect the air quality and physical, mental and social well being. Mining improvised settlements commonly affect the food disposal and security (quality and amount) increasing the malnutrition risk, not only due to the exposure to harmful substances but also by nutritional deficiency. Many times mining projects create a visible indirect impact on population´s health such as an increase of tuberculosis, asthma, chronic bronchitis and gastrointestinal diseases among the population.

Mining and sustainable development

The mining and metallurgical industry is one of the most influential pillars of the economy, not just to provide material needs for the industrialized world, but also to ensure and support the growth of developing countries. The materials and products consumed by all countries, especially those who are still developing their economy and basic needs, are provided directly or indirectly through their extraction from the natural environment by the mining sector. At a lower scale mining is also considered to have an important role in the economy at a local level due to investment and job market increase. Mineral resources are a very profitable option to increase the economy of a country, just by the extraction and exploitation of resources, if the treatment and transformation to consumer goods is not possible or efficient enough. As opposed, mining has a very negative image from the social and cultural point of view, as it is associated with high contamination levels and degradation of the biosphere due to the uncontrolled human activity and the adverse effects provoked in the environment on its process. These socio-cultural agents can't be ignored and must be assisted to develop the industry and change its negative view. It is necessary to point out that even though the defense of the environment is a crucial and very important aspect, is not the only factor that determines the social acceptance of the extractive industry. In many occasions there is mutual interest from both parts (mining

corporations and social communities) in land acquisition, water owning payments, present of subcontractors, compensation, local purchases, social investment strategies etc. To make mining socially accepted is impossible to omit the creation of measures from a legislative level, combined with a good execution of the activity regarding their environmental impact and an ethical motivation in the design of the processes involved. The alteration of the biosphere is implicit on mining activities, so every mining project must consider the management of the effects they cause on the environment, starting with design and business decisions. The industry must ensure the preservation of the environment and consider it a main step in the typical cycle involved in mining activity (prospecting/ exploration, development, mineral extraction, metallurgic process and closure/ reclamation).

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PART THREE

SELECTED PROBLEMS OF CONTEMPORARY EDUCATION

© University Press 2020
ISSN 2719-6550
ISSN 2719-7417 online

„Journal of Education, Technology and Computer Science”
No. 1(31)/2020
www.eti.rzeszow.pl

Received: 21.05.2020
Accepted for printing: 3.08.2020
Published: 05.11.2020

DOI: 10.15584/jetacomps.2020.1.8

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How Does One Learn? Is There a Method?

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Abstract

The definition of learning is to gain or acquire knowledge of or skill in (something) by study, experience, or being taught. We discuss here the different methods of learning in traditional and modern societies. We conclude that what we have learned to date is negligible compare to what remains to learn.

Keywords: knowledge, learning, rationality, reflection, intuition, reasoning

The definition of learning is to gain or acquire knowledge of or skill in (something) by study, experience, or being taught.

How does one learn?

From birth, the new born learns. He learns to feed himself. He has to learn to communicate, express himself, ask for food. As an infant, learning comes from the outside. He learns how the surrounding world works.

English philosopher Locke (1689) believed that knowledge is derived through experience of the senses. Through the senses, we learn what is cold, sweet or bitter. The second source of knowledge is reflection, called inner sense: to think, to doubt, to believe, to reason.

The teenager learns who he is. This learning is difficult: he has to find himself, oppose himself, understand the possible choices, learn to say no, understand his limitations.

For Coehlo (1988), teenagers see everything in black and white. They are not afraid to dream and to wish everything they want to do with their life. How-

ever, as time goes by, a mysterious strength demonstrates that it is impossible to realize all your wishes.

Therefore, at adulthood, humans have to learn to know themselves, to choose between dream and reality and to act according to their own personalities and to their environment.

Is there a method to learn?

For Bacon (1620), man can only discover the natural order of things. He understands quickly that nature can only be conquered by obeying it. It is the principle of experimental science.

Descartes (1637) suggested for learning a method based on different notions: doubt, intuition, reasoning.

For the French Philosopher Comte (1844), human knowledge passes through three stages: theological, metaphysical and positive stages.

– **Theological stage:** the human mind directs his searches towards the inner nature of the beings; towards the origin of everything that it registers, in another world towards the supreme knowledge. The mind represents each phenomenon as a result of the direct action of supernatural factors and it helps to explain all apparent abnormalities of the universe.

– **Metaphysical stage:** the supernatural factors are replaced by abstract forces capable of recording all phenomena observed.

– **Positive stage:** the human mind, realizing the impossibility to ever get the supreme knowledge, stops to look for the origin and destination of the universe, or the origin of phenomena to concentrate only on learning through reasoning and observation of their physical laws.

We should never stop learning. Acquired knowledge allows progression while relearning what has been forgotten leads to stagnation.

We learn through experience

Confucius says experience is a lantern attached on our back that shines only on our past. The past feeds the present and gives references and benchmarks. But the present feeds also the past by adapting old legends to the present time.

Our life is made of successes and mistakes. Our learning is richer from the analysis of our failures than that of our successes. Experience feeds our life.

We have to dedicate our life to this continuous learning.

Learning in traditional and modern societies

In traditional societies, knowledge is transferred through initiatic rituals. These rituals happen usually at important stages of life, the most important one certainly being the transition between childhood and adolescence where one needs to part from their parents. The ritual is carried out by the elders. The

pain of this separation is compensated by the benefit of being part of a new social group.

In modern societies, learning is conducted towards knowledge rather than the know-how. Rationality drives the mind of the modern man, imposing barriers to access the irrational world. Man has overcome his superstitions but has lost contact with the sacred world. Man has succeeded in conquering nature, but has failed to conquer himself.

I will conclude by quoting Platon: “when mankind would have learned a great lot, they will think they are knowledgeable but in fact they will mostly be ignorant and unwise in the purpose of life”.

What you have learned to date is negligible compare to what remains to learn.

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© University Press 2020
ISSN 2719-6550
ISSN 2719-7417 online

„Journal of Education, Technology and Computer Science”
No. 1(31)/2020
www.eti.rzeszow.pl

Received: 6.04.2020
Accepted for printing: 3.08.2020
Published: 05.11.2020

DOI: 10.15584/jetacomps.2020.1.9

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Artificial (un)Intelligence – an Opportunity or a Threat?

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Abstract

The article contains considerations relating to the dynamic development of artificial intelligence, which is the fastest growing technology in the world. The article attempts to define concepts that state what intelligence and artifical intelligence is (1). It also draws attention to the development of artificial intelligence (2). All of them are closing arguments seeking answers to the question: Artificial intelligence – an opportunity or a threat? (3). It should be borne in mind that the continuous improvement of the possibilities of artificial intelligence means that it will be able to surpass human intellectually.

Keywords: artificial intelligence, human intelligence, chatbots, bots, intelligent virtual assistant, robots, dissemination of robots

Intelligence and artificial intelligence – what is it?

The concept of artificial intelligence (artificialintelligence, AI) is not easy to define. The reason for this obstacle is the lack of proper understanding of what intelligence is and what it means “to understand something” (Hawkins, Blakeslee, 2005, p. 17). The issue of intelligence is a great mystery of modern science, and it is fortunate that we live in times when this mystery can be solved. However, there is still no consistent theory explaining how the brain works and what intelligence is (Hawkins, Blakeslee, 2005, p. 5–6). Intelligence has many different definitions and, for example, according to Strelau (1997, p. 19) it is a “theoretical construct ralating to the relatively constant internal conditions of man, determining the effectiveness of action requiring the participation of typically human cognitive prosesses. These conditions are shaped by the interaction of genotype, environment and own activity”. A prominent German scholar Stern (1997, p.15) understood “intelligence as a general ability to adapt to new conditions and to carry out new tasks”. By contrast, G. Ferguson

suggested that intelligence should be understood as the ability of learning, whereas Spearman believed that intelligence is an ability to see the dependencies, relations and reasoning. At the end of the last century, this concept was compared only with intellectual capacity. The modern perception of intelligence is understood to be a bit broader as the ability to interact with the abilities created in the motivational, emotional and interpersonal human mind (Różanowski, 2007, p. 110).

Artificial intelligence (AI) was born together with digital computers. The fundamental figure in the early stage of the development of AI was a mathematician A.Turing, who was one of the computer-creators. Within 1939–1940 he started wondering of building intelligent machines and offered a test for intelligence – the Turing test. The basic dogma of this statement says that the brain is a kind of a computer. It is not important what the artificial intelligent system is designed like providing that it behaves as a human (Hawkins, Blakeslee, 2005, p. 17–19).

The reverse form of the Turing test is used on the Internet as a CAPTCHA, while A.Turing is considered to be the father of artificial intelligence and information technology (Alan Turing). The term "artificial intelligence" was introduced and defined by McCarthy in 1956. According to the researcher, artificial intelligence is a science that includes engineering for the development of intelligent machines, in particular intelligent computer programs. It is seen as a method for solving complicated and complex problems, reasoning and drawing conclusions identical to those taking place in human brains (McCarthy, 2007, p. 2). Whereas Nilsson (2014, p. 2), one of the leading scientists studying artificial intelligence, believes that AI is structued and gives direction to the design of „smart machines" to behave in a way that mimics the intelligence of people. In Furmanek's work (2018, p. 277) we can find the following definition of artificial intelligence: "This is a field of science dealing efficiently with non-algorithmic issues on the basis of knowledge modelling (…) it is a function of human intelligence; it is learning to teach machinery like humans; it is learning how to teach machinery to do things that people are doing better; it is learning about computer models of understanding, reasoning and action". Looking at the definitions of artificial intellience, it can be noted that many of them, to a greater or lesser extent, are similar and relate to the same issues and problems. It is important to unify and summarise this knowledge. Generally speaking, artificial intelligence is a branch of information technology involved in the construction of machines and algorithms that have signs of intelligence. Artificial intelligence is the use of intelligent human behaviour in algorithms and computer programs that can be used and mapped. Word and text recognition programs, traslators ang simulation games are the examples of such solutions (Różanowski, 2007, p. 111).

Development of artificial intelligence

The dynamic development of information and computer technologies makes artificial intelligence applicable in everyday life, and the devices that use it surround us. These are precisely the solutions based on intelligent algorithms in recent years that have influenced the economic development of the countries. The prospect of intelligent machines capable of thinking and decision-making, introduces many concerns and worries among people. They are concerned about significant technological progress and limitations of the importance of the human factor by creating a smart machine, but also having a consciousness and personality (Różanowski, 2007, p. 109). According to the NASK study, artificial intelligence has an impact on the everyday life of society. The Polish are mainly afraid in the context of the invasion on privacy – more than half of the surveyed (60%), of cyberattacks (37%) and job loss (22%) – the replacement of jobs with intelligent robots. Only one out of six people would benefit from the help of an artificial intelligence device instead of a doctor's specialist, according to the NASK report "An artificial Intelligence in Society and Economy" (Matura, 2019). W Microsoft visionary Coplin announced at the London conference artificial intelligence to be the most important of the world's technology. An artificial intelligence was created while The Olympic Games and it was to write short articles on the basis of the results of the event on its own. D. Coplin believes that artificial intelligence will change the approach to technology as well as the perception of the essence of humanity (Shead, 2016). International IT sector companies have been successfully using artificial intelligence targeting consumers for many years, e.g. **Cortana (Microsoft), Alexa (Amazon) or Siri (Apple)** (Styles-Snapmek, 2018, p. 502–503).

Cortana, Alex, Siri, and Google Assistant, is an intelligent virtual assistant (intelligentvirtualassistant), which is based on artifcial intelligence algorithms. Virtual assistants can provide a wide range of services such as information about the weather, news, can set alarms, create a list of things to do and shopping lists, can play music from the streaming services, play radio stations, read audiobooks, play films, operate conversations like ordering food, shopping via Facebook, Messenger, WhatsApp using a chatbot. The reports estimate that an online automatic assistant has reduced the workload by 30% in the case of a customer call service (Virtual assistant, 2020).

Facebook, among others, conducted the study and was forced to close one of the AI systems after the chatbots started objecting the internal codes and speak their own language. Musk, Tesla Chairman, said that artificial intelligence is the greatest threat to mankind. At first the AI bots would communicate with each other using English, but later they created a new language understood only by the AI systems. Facebook AI Reserach Lab (FAIR) scientists notices that the

chatbots created their own language without human help and bots started to communicate in a completely new language (Kunat, 2017).

The Internet bot is an application that triggers automatic scripts in the Internet. As a rule, bots carry out tasks that are simple and reproducible to replace man but at a rate that is much higher than it would have been possibile for him. Every now and then, their function is to pretend to be a human behaviour. There are also „politically-oriented" bots – these tools can and often are used to control the society in order to control the interaction and can be unpredictable even for their creators (Baron-Polańczyk, 2019, p. 220–221).

Looking at the transformations of the information society, which are rooted in the projects of Japanese scholars and visioners – Umesao and Masudy, there is no way to see that there is another information revolution going on before our very eyes. As a part of this resolution, learning computers are changing human life. The coming era in civilization development will undoubtly belong to artificial intelligence. Researchers working on the AI are aware that computer can achieve capabilities that can make the AI overgrow human intelligence. Current reports of AI research show that this breakthrough can occur between 2045 and 2060. If this happens, we will face huge changes of unpredictable consequences (Fehler, 2017, p. 69–70).

Artificial intelligence – an opportunity or a threat?

The main threat connected with the development of artificial intelligence is the emergence of supermachines, smarter than people, with strong artificial intelligence (artificialgeneralintelligence AGI), which will be able to develop and improve themselves. In this way the AI will achieve the level of uncontrolled growth, a higher level of human intelligence. Scientists like Gates, Fly or Hawking fear that when we build artificial intelligence smarter than us, the day of annihilation of mankind may come. Warning of unbridled development of AI systems, Hawkind points out that thinking machines can create dangerous weapons and the emergence of full artificial intelligence can mean the end of the human kind. The threat may occur at the time when the systems themselves modify their own algorithms and algorithms that would not be possibile at the time of self-awareness (Fehler, 2017, p. 79–80). Media reports of not only the benefits, but also the risks associated with the creation of AGI, run smoothly. Kurzweil predicted the moment of development of the civilization where technological progress rapidly accelarated the so-called imminent advent of Singularity (Singularity). According to Kurzweil's calculations, the singularity will revolutionise the world in about 2045. The researcher believes that an AI, capable of self--perfecting of itself-the supermind will solve the problems that our brains cannot handle. The black scenario seems to be the fact that an AI more powerful than human AI, gets out of human control and becomes the contoller of human world

(Fehler, 2017, p. 81). Within the next 100 years AI will be able to do the same as human but more effectively. Many scientists believe that by 2053 a computer will be able to perform a surgeon's work. Thanks to the development of AI it is possibile to identify early signs of disease and diagnose cancer. Computers are fluent at translating the speech, and Yahoo language processing system even detects sarcasm. The algorithms write music, make jokes, draw pictures and even create scripts for movies. Artificial intelligence helps to control ground and air traffic. Deep neural networks, looking at faces, can identify people's sexual orientation as it is stated in the result of study at Stanford University (in 2047…, 2020).

Thanks to artificial intelligence everything is the fastest, the easiest, the simpliest and the cheapest. An intelligent fridge is able to predict the need of ordering the products which are to run out, on the basis of the conversation with its user. Internet shops create individual shopping profiles on the basis of previous purchases or searching analysis, thanks to which the customer gets the offer he expects and does the shopping willingly (Suwart, 2028). Artificial intelligence may soon replace many lawyers involved in control of confidentiality agreements. LawGeex is a programme established in 2014 by an AI specialist. There were twenty lawyers in two-month trials with the programme. The accuracy of the programme was 94% and of people only 85%. The most shocking is the time at which the task was done. While the workers needed about 92 minutes, artificial intelligence needed only 26 seconds (Mazurek, 2018). A real artificial general intelligence could fool people in such a way that they wouldn't know if they were talking to a robot or a human being. A Turing Test 2014, a chatbot pretending to be a 13-year-old child deceived a third of the judges. E. Musk predicts that AGI will be similar to an immortal dictator that we will never be able to escape.

Conclusion

Today, the impact of AI development is dominated by the voices of doubt and disbelief. We are afraid of the progress, and we suspect technologies of false intent, the vision of artificial intelligence itself contributed to a vison of brains trapped in vessels that are looked after by infirm constructors (Kutk, 2018, p. 188). The best solution is to construct the algorithms that can be checked at every stage of their creation. Let's imagine that they are built to suport people in decision-making, not to think and instruct people what they should do (Fry, 2018, p. 258). Artificial intelligence is a technology that offers great opportunities. However, its development involves huge dilemmas and threats. With the development of robotics and artificial intelligence, it will be necessary to define android rights. In the near future, we also need to be aware of their rebellion. It is becoming increasingly common that a change May come that the world has never experienced before and is not ready for.

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© University Press 2020
ISSN 2719-6550
ISSN 2719-7417 online

„Journal of Education, Technology and Computer Science"
No. 1(31)/2020
www.eti.rzeszow.pl

Received: 18.03.2020
Accepted for printing: 3.08.2020
Published: 05.11.2020
License: CC BY-SA 4.0

DOI: 10.15584/jetacomps.2020.1.10

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Comment: ~~ICT~~ in Preschool

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Abstract

ICT Tools are not primary, but secondary learning source for teaching abstract mathematical concepts at preschool institution. As a matter of fact, for children ICT Tools don't have the power of immediate and practical experience or experimental work, which are the primary source of learning such contents. ICT Tools can only be used to revise knowledge after children have acquired it through direct manipulative activities and experiments, which require sensory experiences (eyes, hands). In that way children estimate volume of different liquids and their dishes firstly subjectively and then objectively.

Keywords: Experimental-manipulative work, working methodology, sensory experience, professionalism of preschool teachers, ~~ICT~~

Introduction

The nature of learning, knowledge, skills and habits acquisition have its own phylogenetic-psychological and methodically-motorically legalities, which ranges from showing, through presenting, to displaying, and in big number of subjects which involve sensual experiences, experimental work, repeating and practicing, which, even the most developed applications cannot replace (Kamenov, 1997).

In methodical procedure of acquisition of abstract mathematical concepts (for instance measuring of volume, mass, body length; notions: conservation and reversible operation), personal sensible experience of children and experimental work cannot be replaced with IKT in this moment (Hilcenko, 2019, 2017a, 228–229).

Unit for measuring liquid – liter

Development of the notion of **volume of liquid** and conservation operation (= unchangeability) of volume at children develops the slowest due to abstraction, usually when they are between 10 and 11 years old, which means, in 3–4 grade of primary school. By curriculum for pre-school institutions, it is anticipated that children meet this subject even in middle age group of pre-school institution. *"Why?"* The intention is to accelerate the maturation of children, especially their intellectual potential – through the development of notion of volume of liquid and conservation operation of volume associated with manipulative activities (Hilcenko 2017b, 355).

In development of the notion of liquid volume and conservation operation volume, the educator will rely on previous experiences of children (each played on the shore of the sea with sand, water, cans and small shovels, in a park in sandbox, bake cakes with mom or grandmother). The educator begins with subject by placing children in situations in which they play with familiar materials (liquid and bulk) in the centers of interest. In interestingly designed tasks, by playing, children will evaluate their characteristics and quantities (volume).

The educator's aim is not children to understand – *mathematical notion of volume as derived value from the length of cube's edge as basic value in physics!* It refers to understanding of volume only as another quantitative property of the object from immediate proximity – in other words, as characteristic of liquids and bulk materials; training for OBSERVATION and ASSESSMENT of relation between different "in which, all children's senses are irreplaceable – BUT WHICH CAN DECEIVE!"; perception of constancy of volume of liquid (material) during the change of the container's shape.

Also, in the case of assessment of liquid volume and conservation of volume, observation mechanism gives to the child unreliable data again due to insufficiently developed logical thinking, so it concludes intuitively. Only with the development of reversible operation and conservation operation (= unchangeability), child's opinion will become more logical. That is the reason of faster development of these logical operations, respectively, increasing of possibility to develop mathematical notions generally, creators of curriculum include this subject also in schedule of pre-school institutions.

It is educator's job to design suitable experimentally-playable activities with liquid and bulk materials. IKT applications are useful here, but only in testing phases, in knowledge establishing phase, and they are INCOMPARABLE with experimental experiences of children, in which they manipulate, compare with concrete didactical materials.

Elkind's research (1961), determined development of conservation operation at children depending on their age. It is noticeable that conservation of volume is not developed at majority of children, which were tested before age

11. Besides that, time frame was established for some other conservation operations too.

In methodical sense, it is the mostly meaningful to begin activities with children's playing around corners with different bulk materials: *sand, flour, bread crumbs, different cereals, soya, rice, beans, Styrofoam in small balls*… (while liquid materials should be avoided during free activities!). In activities in which children pour, count and compare, they are willing to participate! These tasks, at various corners, will refer to situational tasks in which children can mimic people's interests, who, while doing their jobs: pour and compare bulk materials (for instance clerk in supermarket; worker in dyehouse; organic food shop etc.). While playing, they will gain new experiences and intuitively understand relations between volumes of some containers, quantity relations (= number) and volume (for instance with how many plastic glasses will they fill two or more different containers – by shape or size – with some bulk material).

Educator take care for children, induce them to verbalize their observations during comparation of volumes of bulk materials in different containers. Activities with liquid materials require more control from educator and more fundamental preparations (covering of work surfaces with waterproof pads, sponges, empty buckets for collecting spilled water).

Thus, for instance, during the work on this subject, in **main part of activities**, it would be the most suitable that educator organize EXPERIMENTAL GROUP WORK with children, in which they will, in the most obvious way, expand their experiences in the field of developing the notion of volume of liquid and conservation operation of volume. If they use liquid materials in experiments (the most suitable is water, which, due to easier observation and mutual differentiation, is colored with ecological colors, and containers, which will be used, would be made from plastic transparent materials, different sizes and shapes and by one funnel.

We recommend the example of experimental work with 5 groups of four children. Educator earlier prepared "experimental stations", in which he/she allocated and equalized all children, and then frontally gave them all instructions for realization of 5 different experiments. During the work, educator visits children by "stations", monitors their activities and encourages them to verbalize their observations.

Upon completion of the experiments, results referring and conclusions generalization are following. If the work is organized on different experiments, as it is the case here, groups can be rotated in order to all children have opportunity to try all experiments.

After experimental work, the number of children, who will be able to precisely estimate relation of volume among containers and explain causes of this occurrence, will be increased. It is up to educator to permanently encourage

children to announce their experiences, in which the notion of **volume** will be even more present. The essence of all, is to induce children to conclude properly (not to succumb to perceptual observations (which may be in the case of an educational software) – not to be hasty in making conclusions!) about that, that pouring (of liquid or bulk materials) does not change their volume: that if, at equal volumes in two identical containers, we transfuse one of them in container with different shape or more smaller containers, **its volume will stay the same** – it stays identical to original volume.

Experimental and independent group work of children (in which cooperation, experience/opinion exchange exist…) with educator's monitoring, will give best possible results. It is up to educator to create experiments (the way of realization: competition, types of liquids and materials, tidiness…) which are the most suitable in his opinion.

Regardless of the imagination of the experimental work, **reversible option** always follows in the end, in order to undeceive (prove!) children that they made a wrong conclusion concerning the volume of some liquid and container. Comparation analysis of liquid volume should always be observed in the context of the notion of number (for instance *"Total volume of 5 smaller glasses is contained in bigger container – carafe!"*), totally, the notion of the container's shape etc.

The experienced educator will continue to observe the work of every child during the adoption of notions of volume, and to see those who have difficulties in understanding certain concepts. They will give more attention to them, not only in the activities of mathematics, but also in every other convenient and spontaneous moment (for example, during play in the court-pedestrian, in gym, dining room, excursion, etc.). He will refer to the problematic part.

He will effectively ask everyone the questions such as *"Who can tell me, for example ...?"* We all know that *"Knowledge should not be known, but it should be known how to apply it!"* The educator will know to give to every child the necessary confidence and instructs him to check his doubts – experimentally – by proving! With every new experience, children will be rich in their knowledge, and in the activities organized in the form of experiments, educator will have a great ally when it comes to attention (interest, motivation, joy).

However, as we pointed out at the beginning, understanding of the abstract notions of volume and developing a volume conservation operation will be accepted by the educator as successful, if most of children adopt them at an intuitive level, verbalizing those experiences – *"loudly thinking"* during experiments, describing what they perceive, work, think and explain their views.

In the final part of the activity, as we have already mentioned, an appropriate relay game can be organized in which the main task is to fill a larger container in

which children participate, filling each of their container with liquids (or working on e-tasks[1]).

Conclusion

The volume can be defined as size of part of some space which is occupied by certain matter, represented by – **spatial unit of measurement**. From the topic itself, which is also emphasized, the notion of conservation of material volume stabilizes the slowest and the latest. It could be seen on the examples of tasks which mostly included principle of obviousness[2]. We approach to this subject with different demands, depending on children's age. Regardless of age, it must always be spontaneous and directly in interestingly designed activities. And while, at younger age, they gain their first experiences and knowledges about the concept of volume (pouring-filling-emptying, pour various liquid or bulk materials from containers with smaller volume in containers which are bigger by the size and different by the shape, approximately compared and objective proving of perceptive estimations), while it is different at middle-aged children. Children of this age should be supported to come to the knowledge through the tasks of manipulative-logical character, whose solutions require thinking in a sense of, *"Who can fill the big washbowl with the lowest number of offered buckets* (of different shape and size)*?" etc.* In this way, they will gradually stabilize the knowledge of the effect of the container size on the volume (= quantity) of matter (liquid or bulk material). When it comes to older (pre-school) children, demands in perception and understanding of volume are even greater. We must demand thoughtful answers on questions such as: *"Why teeter outweigh on Milan's side, if he brought only two glasses of cereals, and NOT on Jelena's side, who brought 4 glasses of cereals?".* With such and similar game activities, we will create prerequisites in which children will notice the occurrence that the same level of volume (quantity) of some matter in containers of different sizes and shapes is NOT the same! Knowledge of this type will be sturdy, if their experiences in a sense of immediate manipulation (pouring, pouring of the same quantity of some matter in containers, which are different by the size and shape, subjectively judging-comparing their volumes) to be more numerous.

We will point out again the fact that during the cognitive activities of children in a sense of material volume, perceptive mechanisms influence is extremely expressed and lasts the most. As a consequence, we have the fact that children

[1] The example of e-presentation on the subject "Measurement unit – L" as auxiliary teaching tool for adopting this topic can only be addition, and not main teaching tool in adopting abstract topics, as well as when basic didactic-methodical principles are respected in the process of adopting this topic [Hilcenko 2014, p. 24–29; 2012a, 2012b, 2008).

[2] Similar to Dale's (1969) classification of medias, it can be said that, by growing of the abstraction of teaching content, obviousness of teaching tools, forms, methods of work are growing too and vice versa!

in the assessment of some volumes almost exclusively lean on **"what their eyes are saying"** to them, respectively, the level of matter (fluid or solid). In order to realize the **constancy of volume** – the quantity of some matters, a longer period of time is required, many experiential experiments (= analytical procedures), during which the processes of reversible operations become "conditions of all conditions" for constructing the notion of a **liter** as a constant of liquid volume.

To gradual understanding of the essence of volume measuring, it will come with organizing a series of focused activities in which the educator takes the children's attention to the fact of **containing the unit of measurement-number** (= at the beginning of a conditional measure) **in the measured size** – quantity or volume of matter (*"How many times it contain in it?"*). This "conditional" initial unit of measurements – separated quantities of some matter (volume) at the beginning of the process of adopting the notion of volume of liquid can be literally everything *(= hand of rice, glass of water, water bottle of juice, carafe of milk, bag of sand, scoop of flour).*

What is important is to draw attention of children that, for instance, 10 spoons of flour together represent 1 packaging of flour in supermarket. In order to make even more precise counting-comparing of measured quantity of matter-volume (flour), we join 1 object (for example logical block) to each "conditional measurement unit". In that way, we form countable equivalent sets: **1st set** of "conditional measurement units of volume" and **2nd set** of logical blocks in the process of measuring. In this process, it is important that educator draws the attention of children to the necessary precision in the measurement process, which implies that "conditional units of measurement" (glasses, pots, etc.) are filled to the top or to some marked measure-line (for example as with calibrated measure – a glass for measuring liquid). When practicing pouring, and especially during reversible operations, it is important that nothing is missing (neither spilled nor added) to determine that the amount (volume) of matter has not changed.

The aim of diverse and numerous play activities is that children gradually notice how the same amount of a substance (fluid) is measured with "conditionally-**different** measurement units" (= containers of different shape and size), respectively, **different volumes**. In fact, this diversity depends on the measure number of the size of measurement unit (= a container that measures the volume of a matter).

The educator will instruct children to compare volumes of "conditional units of measurement", on the basis of which they should independently conclude that it is about the relations **GREATER ≠ SMALLER**. This would relate, for example, to activities for an older age group in which they may find that, for example, in the case of a measure which is 3 x greater than a small measure, and if it contains 3 x in the measured volume, it should be assumed that the smaller measure in the same volume contains 6 x.

Manipulative activities, in which children perform various pouring of liquids in containers of different shapes and sizes, contribute to the improvement of development of the concept of volume conservation. On that occasion, they gauge-evaluate (= approximately) the height of liquid column and their volume. The essence of activities with this kind of content is encouraging of development of children's abilities to do **compensation**, or taking into account some other characteristics of a filled container, for example, its width. Upon completion of a series of such manipulative activities, educator will also try to stimulate the thoughtful activities of children with questions. It can be in the form: *"Can it be confirmed only on the basis of the height of a container, in which of them there is more liquid?", "On which characteristics of a container, except its height, we have to pay attention to, when assessing the quantity (volume) of liquids in them?"* etc.

Generally speaking, for understanding of **volume constancy** (= quantity of matter), which should be assessed (= measured), there are two approaches:

1) reversible operation or returning the liquid (without spilling or adding) in primary container, and

2) by measuring the liquid with "conditional unit of measuremen" both in the 1st and 2nd containers, which should result in the same measures or the same measuring number.

Only after the systematic and long-lasting organized activities, when educator gets the impression that children are qualified to perform conservation operations, i.e., compensations – perception of several variables of containers, such as shape (height, width) as conditional measures, can approach the construction of the notion of **liter**. Liter (**L**) denotes a precisely determined amount of volume or **conventional** (= agreeable) **measurement unit for liquid volume**.

In that sense, based on focuses activities, educator organizes didactic games that simulate real life situations, such as a store where groceries are sold (yogurt, milk, juice, etc.) packed in various packaging-materials (cardboard, plastics, glass) and shapes. Common to all these packages is that it is about standard volumes of **1L**. By appropriate methodology, educator will demonstrate that regardless of the different outer form of these packages, it is always a volume of **1L**. Providing of evidence is carried out in such a way that a **container of standard volume of 1L** (= graduated cylinder) is brought in front of children.

It is necessary to pour content of any exposed packaging (for example juice from glass bottle with volume of **1L**) into graduated cylinder (= standard measurement unit – etalon) and vice versa.

An example of such an experimental task (in which the development of the notion of a liter is encouraged – measurement unit for volume of liquids) can look like this:

There are 4 different packaged groceries in front of children (*plastic bottle of vinegar, cardboard packaging of milk, glass jar of honey and glass carafe of olive oil*).

Educator offers to children to think about the problematic task: *„Does any of these packs contain more liquid?"* Perceptual impact will have a decisive significance on children's answers this time too! It is almost certain that no one will give the correct answer. In making the conclusion, they will be guided by different shapes of packaging volume. Therefore, the educator will suggest to children to jointly perform an experimental check (= proving) the (IN)accuracy of their assessments. For this purpose, educator has prepared 4 equal plastic bottles in which he will pour the content of packaged groceries and one funicular. After this procedure, children will unanimously conclude that the contents of all 4 plastic bottles are identical. By analogy, they should concluded that the content in the original packs of groceries was the same at the very beginning.

An important moment is following, in which educator asks questions like: *„Does anyone know, how much liquid is in all these packages?"* It is likely that most children have previous experiences regarding the purchase of groceries with their parents. If they did not hear it then, (or remember) the name for the volume measurement unit, educator told them. So, it is about measurement unit which purpose is to check the accuracy of the volume of the liquid and call it a **liter**. This moment is used to demonstrate them a **1L of calibrated measure**. At the end of the experiment, the last checking (proofing) is following – pouring of liquid groceries from plastic bottles to calibrated measures of **1L**, with the conclusion that all containers together are identical in volume of **1L**, despite the difference in shape and size.

From all this, it follows that the methodology of work (manipulation, repetition) must be used before ICT, whose applications can serve in phases, checks and knowledge determinations, but not as a basic / primary teaching tool in learning abstract (mathematical) notions!

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ISSN 2719-6550
ISSN 2719-7417 online

„Journal of Education, Technology and Computer Science”
No. 1(31)/2020
www.eti.rzeszow.pl

Received: 5.06.2020
Accepted for printing: 3.08.2020
Published: 05.11.2020

DOI: 10.15584/jetacomps.2020.1.11

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Requirement of New, Effective Educational Programs – Necessity for Future Development of Society

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Abstract

The article analyses demands of new concepts of student education on the level of secondary schools with technical focus. It urges the necessity to create new educational programs that prepare new future technical operators towards requirements of the labour market in future years in harmony with specifications of Industry 4.0. Many of job specializations is possible, at present time, to estimate only as a frame, but considering a length of study it is necessary to realize predictions at sphere of education needs consistently, expertly and continuously to introduce their results into innovations of existing educational programs or to introduce completely new, perspective educational programs by needs rising at production sector.

Keywords: education, CNC machine, software, complexity

Introduction

There are enacted some significant events at present:

- Formation of following phase of industrial revolution – Industry 4.0,
- Change of demographic structure of population – aging of population,
- Constraints implicit from health protection of population by effect of Covid 19,
- Emulation of big economic subjects: USA, Europe Union, China.

All upper mentioned events, but also another as: migration waves and wildly developed countries with large numbers of inhabitants (for example India, Brazil) generate assumptions towards changes in economy at the Central Europe territory moreover. Standard request is high quality, effective, rational and smart production including ecology requirements also. These significant demands call for

a continuously rising automation of the production process from the point of view of decreasing manpower at production.

Requirement of education change

Upper mentioned matters of facts create an assumption of necessity of continuous manpower quality preparation increasing. At present, it is probably not optimal to separate professions to purely machine, electrical and so on. Future apparently belongs to diffusion of different professions into specializations with different particular specialization abundance ratios so that resultant knowledge enables to perform required activity. This implies for example – manufacturing employees would be able to design patterns of machine components and consequently to produce it by entering specification. Employee needs for such activity knowledge about:

- Software that enable design of component
- Labelling of component by actual norm
- Technological proceeding of production in term of how to achieve required qualitative parameters
- Creation of software for CNC machine control, that produce component from particular material
- Achievement of effectiveness by economical aspect
- Ecology requirements compliance in term of health protection during production process
- Possibilities of material used at production process liquidation – produced products have to be designed since start by all aspects in terms of possibility to recycle them and to minimize influence to the environment.

It is not simple to join all aspects, not only mentioned. Profile of various educational specializations is necessary thoroughly to reconsider, theoretical aspect and hands-on training moreover, for secondary school level. Though, relatively small mistakes in terms of unconsidered development of education, can originate big complications in future. Considering terms of secondary study 4 years and preparation of educational program 1 year means – accomplishment of new education program will be manifested approximately after 4–5 years. Production process is not static, it is dynamically developing. Because of that, it is necessary to prepare and to introduce new educational programs corresponding to future requirements of the future without delay – as it is popularly told: it was late in the day yesterday.

Development of documentation – design of component

We can assume that employees should produce components – the example is in Figure 1. Future employees (students now) have to learn how to do design and whole preparation of component production at school. Whole process of compo-

nent preparation consists of many actions mentioned above (amount of actions is in real practice many more). Detailed specification of the final product is the first act. On the basis of product specification is a realised scheme by technical norms. At present, schemes are not realised manually, but correspondent software is used. The category of software that makes it possible to create 3D schemes is used. According to it, a student has to be acquainted with this software, with its potentialities and servicing technique in detail at school. It is not a simple job as indicate panel of instruments only of the introducing display shown in Figure 2.

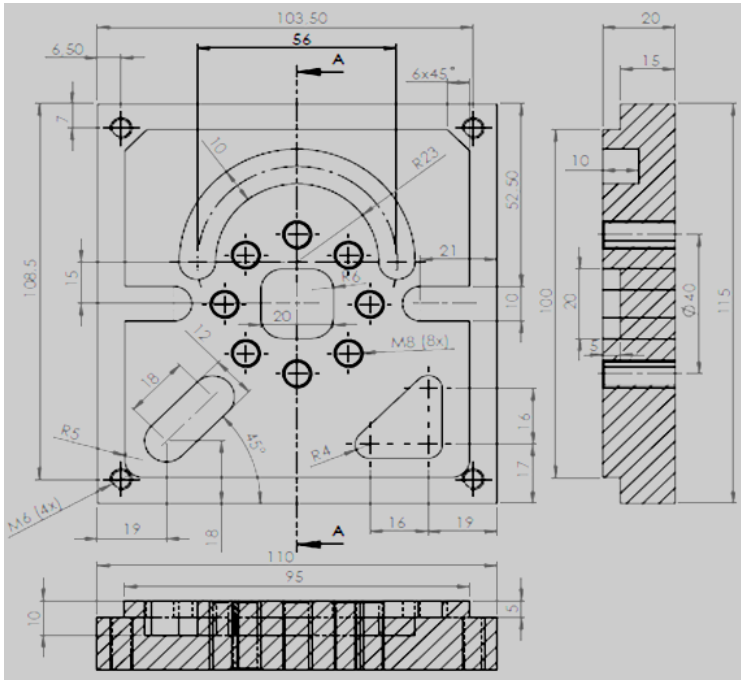

Figure 1. Designed component

A quantity of alternatives on panel of instruments and screens related to alternatives and next screens displayed consequently, with additional possibilities of separate activities, is large and a student (future employee) has to be able to use them effectively.

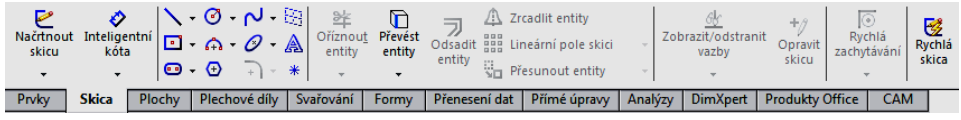

Figure 2. Panel of instruments – basic alternatives

Separate screens that enter in sequence into different depths – consequently subsequent and subsequent screens are shown into one primary option. An employee has to have the idea about software structure – not to "get lost" into software or uselessly look for the instrument needed for creation of the required part of the scheme. A scheme of created components will be displayed in sequence in 2D presentation (Figure 3) in the desktop of used software. After finishing the whole scheme, including needed 3D design, it is necessary to dimension all parameters (as it is shown in Figure 1) by actual norms – to give all information to everyone. When all documentation is complete in complex proportion, then has to be defined: corresponding material for component production, mode of machine work, the type of machine suitable for production and instruments necessary for particular working operations. CNC machines controlled by a computer are used at present. CNC machines are complex technical machines working with high speed and precise, that means CNC machines have considerable price.

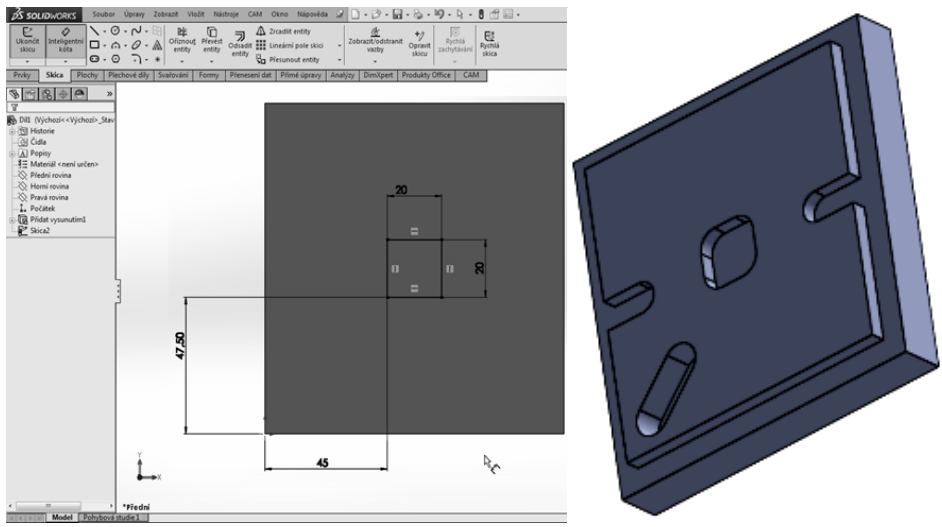

Figure 3. 2D and 3D schemes of component

Because of upper mentioned reasons, an employee has to be in detail acquainted with operation of the CNC machine, so as to prevent extensive damages on machine, used materials, health of employees or environment when operation by employee is unsuitable. The CNC machine is prepared by the employee for the production process – an integral part of this process is: selection of suitable tools, inserting tools parameters into software of the CNC machine, physical inserting of tools into relevant container of tools in specific CNC machine, etc. (Figure 4).

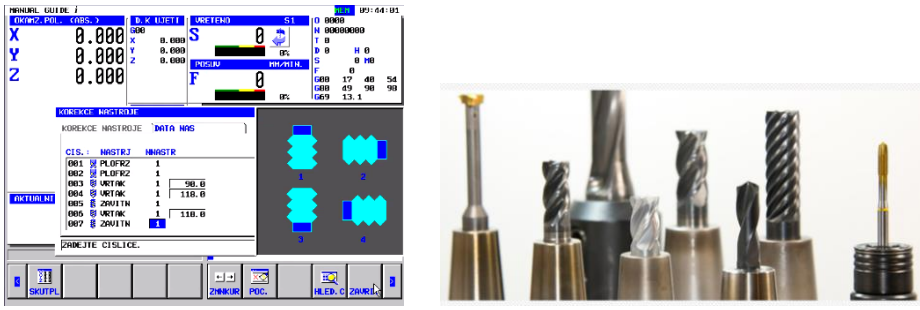

Figure 4. Tools and their parameters inserting into software of CNC machine

A hardware of CNC machine without needed software that will control its actions, do not do anything. It is necessary to make a program for CNC machine – that is following creative activity (Figure 5).

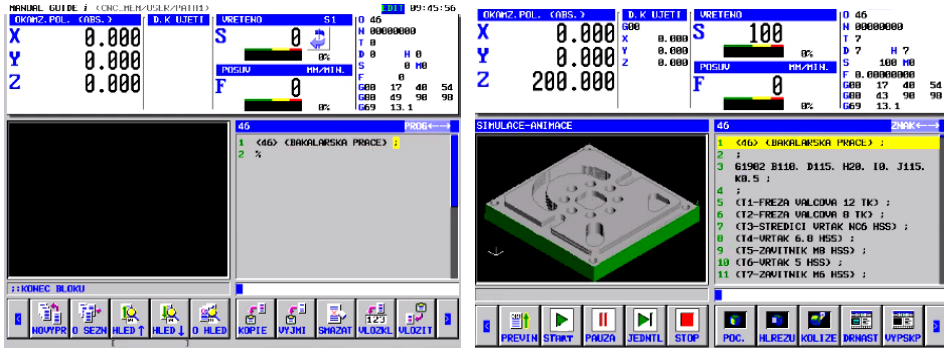

Figure 5. Control of CNC machine is realised by specialized software

An advantage of actual specialized software for CNC machines control is the offer of many functions that make easier creation of software, including presentation of what the machine will do based on separate instructions. An employee has immediate supervision over instructions that he insert into the program for machine control. Quantity of needed operations for different machining of components is very large – possibilities of software are suited to it. A student has to learn particular software that is another serious and long-time activity. Simplification of this educational activity markedly supports qualified theoretical and practical activity of an educator. Good knowledge is not possible without the activity of a student – a student has to have possibility to work with the software practically, because still is valid: you learn the most by the activity that you do personally practically on the base of high quality theoretical preparation (Figure 5).

Complex study about CNC machine control

There was mentioned the sequence of professional activities joining each other, but we do not mention the self CNC machine – we have done preparation steps before the production process yet. Each CNC machine contains a control panel that operates an employee most frequently. Examples in Figure 6 illustrate relatively considerable complexity of machine control. A student has to learn this machine under command of a competent teacher. A student – employee has to control the machine for fair at different regimes of its operating.

Figure 6. Examples of control panels of CNC machines

At present, a lot of programs for different regimes of machine control are prepared by simulation software except the real machine (Figure 7).

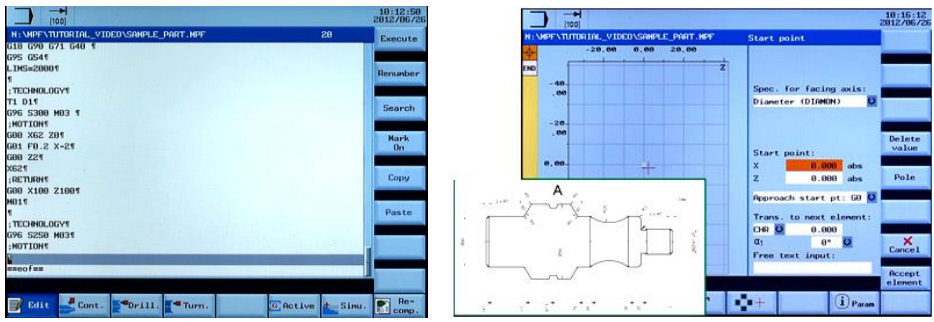

Figure 7. Examples of simulation programs using

Working time of a real CNC machine is saved this way (expensive real CNC machine is not blocked by preparation of the program). Simulation program prevents potential accidents at the process of control program preparation.

A program can be divided into separate parts that are programmed by a team of programmers. There can start evaluation of the program – by separate subprograms linking together into a complex program and by transferring the program to a real CNC machine. At this process, different separate operations can be reprogrammed or supplemented according to objective realization of component machining by CNC machine. An CNC machine can save many programs into its memory and an employee has to be able to find out and to apply relevant programs. Innovations and software upgrading by different aspects are very frequent – for example: an effectiveness of machining increasing, a quality of component machining increasing, a wear of tools decreasing, etc. For all that, an employee has to be able to replace the original program with new, more powerful programs. By upper mentioned, some cardinal activities illustrate the seriousness of student preparation for their future professions – machining of materials by modern machines.

Conclusion

The article describes some activities that future employees have to know at a process of component machining. The article, by that activities example, points out the requirement of a new approach to content and methods of student education for the field of industry production. The competent representatives of manufacturers have to cooperate on development of education – they have to formulate specifications to education for future employees with perspective at least 10 years. These specifications have to competent workers in the field of education to transform into study programs – so as school-leavers had needed theoretical knowledge and practical high-tech abilities and were able to develop them during the production process.

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© University Press 2020
ISSN 2719-6550
ISSN 2719-7417 online

„Journal of Education, Technology and Computer Science"
No. 1(31)/2020
www.eti.rzeszow.pl

Received: 13.06.2020
Accepted for printing: 3.08.2020
Published: 05.11.2020

DOI: 10.15584/jetacomps.2020.1.12

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Didactic Significance of Modern Simulation Programs in Vocational Education – Divagations from Own Research

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Abstract

Simulation programs in polytechnic (vocational) education have an important didactic function. On the one hand, they are a great example of modern didactic software, on the other hand, knowledge of the simulation software environment by a future graduate of a technical university increases the qualifications of the future employee and allows him to acquire an attractive profession. In the era of high requirements set by employers and competition on the education market, their knowledge seems highly justified. However, whether simulation programs, especially deterministic ones, can also act as teaching aids is not so obvious. In this article, in addition to purely theoretical considerations, will be presented stages of own research on didactic efficiency, or more precisely the impact of this group of software on the cognitive process during learning. More importantly, the didactic effectiveness was tested based on typical pedagogical research as well as by means of electroencephalographic tests using the QEEG method.

Keywords: simulation programs, electroencephalographic tests, QEEG, cognitive process, modeling

Introduction. Analysis of basic concepts

Simulation modeling has been included in the curricula of various fields of study for many years (although it does not necessarily function under that proper name). As part of vocational training at the Jan Długosz in Częstochowa and Częstochowa University of Technology, students build computer models of real or hypothetical systems developed for the teaching process. Usually theoretical elements are included in the content discussed during one course: model construction, statistical analysis of results, etc. as well as practical: programming, use of various simulation tools, etc. It is important to remember that simulation is a set of techniques and not just a single method. There is no special type of model, which may suggest the frequently quoted

phrase “simulation model”. In fact, the term simulation refers to a methodology for collecting system information by observing the behavior of a mathematical model using a computer program. Three main simulation currents are most often considered, these are: simulation games, static simulation and dynamic simulation. Although each of these variants is unique, simulation games are fundamentally different from the others. The term “computer simulation” is also defined by the PWN Encyclopedia: “computer simulation, a method of reproducing real-world phenomena (or some of their properties and parameters) using their mathematical models, defined and operated using computer programs”. In short, computer simulation is the final effect of combining a physical and mathematical model. After entering data about the object and saving the calculations in the simulation program, we can make a visualization that we care about. The most useful use of simulation techniques is using complex techniques, where analytical determination of the solution is too laborious. Almost all simulations are currently carried out using the most modern IT equipment together with computer software. This problem has long been significant, especially in Polish schools and colleges, where the financial factor clearly limited the use of this group of programs. The biggest advantage of computer simulation is the ability to observe the future. It is very important because we can test this simulation without using any resources. We can control the duration of the simulation, we can trace the whole event step by step and thanks to visualization, complicated systems become easier to pick up. Thanks to the simulation, we can avoid the costs associated with improving errors and performance, we can examine the behavior of non-existent phenomena. Computer simulation also has negative aspects, i.e.: simulation design requires experience so as not to make mistakes when designing, which may be reflected in the final work result. According to the definition of simulation formulated by Naylor: “Simulation is the process of designing a mathematical and/or logical model of a real system and then conducting computer experiments on this model to describe, explain or predict the behavior of the real system…”.

Simulation programs can be divided into three main categories:

- board and fantasy games;
- simulations similar to games accidentally referring to program content;
- simulations built with a specific pedagogical intention (Bruce, 1999, p. 135).

Types of computer simulations

An additional, significant difficulty in shaping the content of the program is the variety of methodological approaches that occur under the common banner of simulation. Computer simulations can be divided according to:

- event predictability,

– stochastic – they use a pseudo-random or (very rarely) random number generator (the Monte Carlo method is particularly popular),

– deterministic – the result is repeatable and depends only on the input data and possible interactions with the outside world, e.g. an operator,

– the way time passes,

– with continuous time – time increases with constant increments, as in the simulation with discrete time, but the values of signal samples are interpolated for intermediate moments between the reading moments,

– with discrete time – time increases steadily, and the time step is optimally selected due to the resource availability of the system, its performance and the nature of the simulated object and/or phenomenon (microseconds in electrical circuits and millions of years simulating star evolution),

– discrete event simulation – time increases by leaps and bounds, but its increments are variable (the sequence of events is more important here than the actual or virtual passage of time),

– the form of the output,

– static – the result is a data set, static image, etc.,

– dynamic – the result is a process that takes place over time, e.g. animation,

– interactive – react to signals from the outside world, e.g. an operator,

– noninteractive,

– the number of computers used,

– local – processing takes place on a single computer,

– distributed – processing takes place in many computers connected in a local area network (LAN) or external, e.g. the Internet.

Due to the research nature, the simulations are divided into deterministic and stochastic. In technical education (vocational, polytechnic), we will be particularly interested in deterministic simulation. If we call the simulation putting the model in motion, it is this term that best suits deterministic simulation. The deterministic model is a useful and most commonly used model in describing many physical, biological, sociological or economic phenomena. The deterministic description can be contrasted with a probabilistic model, such as a stochastic or accidental process.

Simulation as a method of active learning process

Simulation is a method of active teaching and learning, in which you imitate reality in order to gain experiences similar to those that we implement in the real world. If teaching is to serve the assimilation of material to the maximum degree and the entire perception system of the student, student or trainee is to be involved in the cognitive process, then it is worth reaching for visual and multi-

media techniques. Educational computer programs perform many cognitive, educational and didactic functions in the teaching and learning process. These functions are directly or indirectly related to learning about reality and knowledge about it, shaping the emotional attitude to the environment and training the action that causes its processing (Okoń, 1995).

According to the Encyclopedic School Dictionary, physical experience (experiment) is the induction of some phenomenon in controlled laboratory conditions, ensuring its repeatability, in order to make observations and measurements. The results obtained are the basis for a qualitative and quantitative description of the phenomenon, and are also used to explain it based on current knowledge (Cach, 2002). Experiments that are carried out during classes can be divided into two types. These are shows that can be an "experimental illustration" of the phenomenon, law or model, instrument or device discussed by the teacher. These are also laboratory exercises, which are a form of experimental research carried out by students independently (Przybylak, 2010).

Didactic programs supporting teaching can be divided into:

- programs supporting conducting experiments using a computer;
- programs supporting solving tasks in the subject using a computer;
- programs supporting theoretical lessons in the given subject;
- programs supporting checking of messages learned during lessons – control tests (Kiedrowicz, 2000).

Information technology has been included in the core curricula. It should be used as far as possible and in the process of teaching all subjects. Classes enriched with information technology provide students with the skills to properly use information sources and appropriate tools for its processing, and to understand the new possibilities provided by this technology, its effects and limitations (Sysło, 1996). It is important to emphasize the fact that simulation is a set of techniques and not a single method. There is no special model type, which may suggest a frequently cited phrase simulation model. In fact, the term simulation refers to the methodology for collecting information about the system by observing the behavior of the mathematical model using a computer program (Mielczarek, 2003, p. 133–141).

Simulation modeling is a field of knowledge that serves to deepen the level of understanding of the interactions occurring in the system and the system as a whole. It can be argued that the computer simulation method is only a means and not an end in itself. The overriding task of the course in the field of simulation should be to teach the ability to ask the right questions regarding system behavior and recognize the correct answers. Therefore, the distinction between acquiring knowledge and developing certain skills seems appropriate. Acquired knowledge should make a student skillfully introduced to the model of real

world uncertainty, will feel at ease when dealing with large, complex systems, will know how to properly plan a simulation experiment to move in the maze of various solutions. However, his skills will allow him to efficiently use a selected programming tool, build a correct computer model and carry out its verification (Mielczarek, 2003, p. 134).

There are various approaches to the term "simulation" in the literature. Alternatively, concepts such as simulations, social simulations and simulation games are used. Definition problems are not the result of the method's novelty, but rather a consequence of different ways of imitating reality and different ways of using simulation in pedagogical practice. Before starting the simulation, make sure that students have the appropriate knowledge needed to analyze the simulated process and that they are ready to actively participate in it. Define the objectives of the simulation, present the scope of the topic, prepare additional texts that will engage the group in the initial search, allow you to feel the "atmosphere" of relationships between people, characteristic of specific events, and provide students with a basic set of concepts. It is the responsibility of the teacher to prepare materials with a description of the situation and roles, and to outline the situation framework. It should be remembered that the simulation is to accurately reproduce a given event or process. Therefore, it is necessary to precisely develop the rules and scenarios. Participants are not allowed to go beyond the framework created in this way – all ingenuity and activity must be used to develop the best solution in their opinion within the imposed restrictions, and not to circumvent or break them. Summary is the most important thing in simulation. Based on the experience gained during the simulation and the behavior of others, participants have the opportunity to compare and analyze what happened. This can be done in the forum, or students can be encouraged to work in smaller groups. That is what the selected literature related to didactics says, and how is it in practice? As an answer to this question, the results of own research conducted for many years and concerning generally speaking didactic effectiveness in vocational education will be presented in a form of extremely concise.

Review of author's research

In the years 2010–2015 scientific research was conducted on the main research problem: Does and to what extent the use of deterministic computer simulations in technical education has an impact on the increase in the effectiveness of education compared to traditional didactic methods used in laboratory classes? The results of the research were included in the author's scientific monograph (Prauzner, 2016). Pedagogical research was carried out with the help of comparative groups among technical students in traditional and expe-

rimental form using deterministic simulation software. In detailed studies statistical calculations were carried out, confirming the assumed detailed hypotheses and showing the strength of relationships between the adopted independent and dependent variables. To conclude and not go into the details of the research here, it turned out that deterministic computer simulations in technical education can be an interesting didactic proposition for those conducting the classes and in the self-education of students, of course, provided that a number of conditions are met, the quality of these programs, their algorithmic construction, etc. In subsequent years of scientific work, it was possible to continue the above-mentioned research problem in a different way by means of electroencephalographic tests. As part of EU funding, the Biofeedback Experimental Research Laboratory of the Jan Długosz in Częstochowa. To assess cognitive activity, brain electroencephalographic studies based on the EEG test and the more advanced QEEG method (brain mapping – quantitative – or "quantitative" EEG) were used. Mitsar EEG 202 measuring apparatus was used in the tests. The brain is a complex organ that regulates human activity. It consists of many different structures that play a different role in regulating behavior. In the study, signals from sensors located on the scalp were observed, i.e. signals generated at various levels of the brain structure. The reflection of the work of neurons in the form of recorded impulses can also be interpreted by specific cognitive activity occurring in the brain and typically body movement. Specific signals were extracted and subjected to computer analysis. Students performed various problem tasks in simulation software, and the apparatus measured the activity of various wave frequencies in the brain at that time. These waves are divided based on their frequency, and so we distinguish the waves: Theta, Alpha, Beta1, Beta2, SMR and Gamma. By comparing the results obtained with separate functional areas and medical literature, it is possible to determine with certain probability a specific human activity during work. It should also be mentioned that various wave frequencies also arise in humans in certain states of biological or mental activity. Conducting this research takes a lot of time for the researcher, it is also methodically complex, which is why at this point I also refer the reader to my numerous publications. In conclusion, this type of research additionally provided further data on the assessment of didactic effectiveness. These studies also allowed us to explain the differences in cognitive activity in the didactic process, but resulting not so much from the quality of the prepared materials, but from interpersonal differences resulting from the different structure and functioning of the brain in people. QEEG research will continue and the results confirm the belief that it is an interesting and non-invasive method of research, thanks to which it can be used not only in medicine, but primarily by educators and psychologists.

Figure 1. Example of QEEG tests while working with a computer

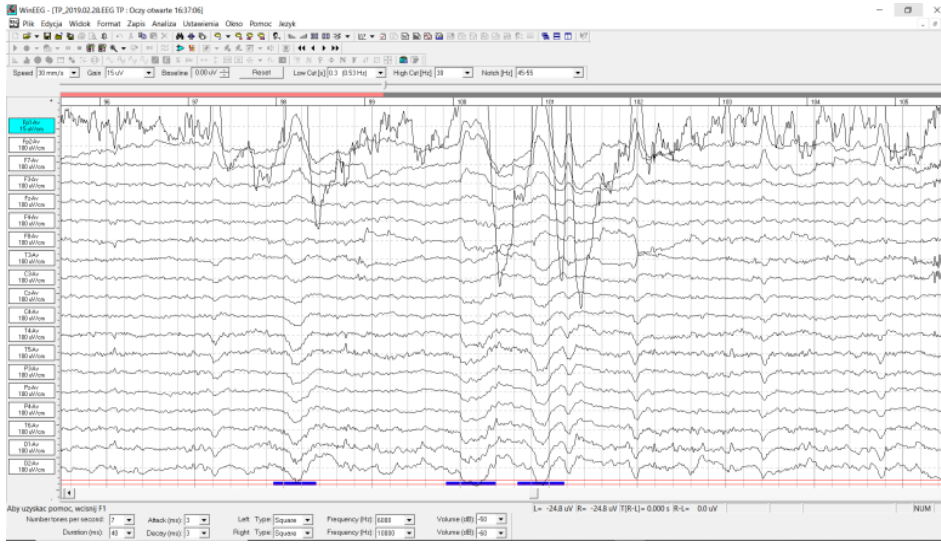

Figure 2. Example of brainwave waveform with separated artifacts (read errors)

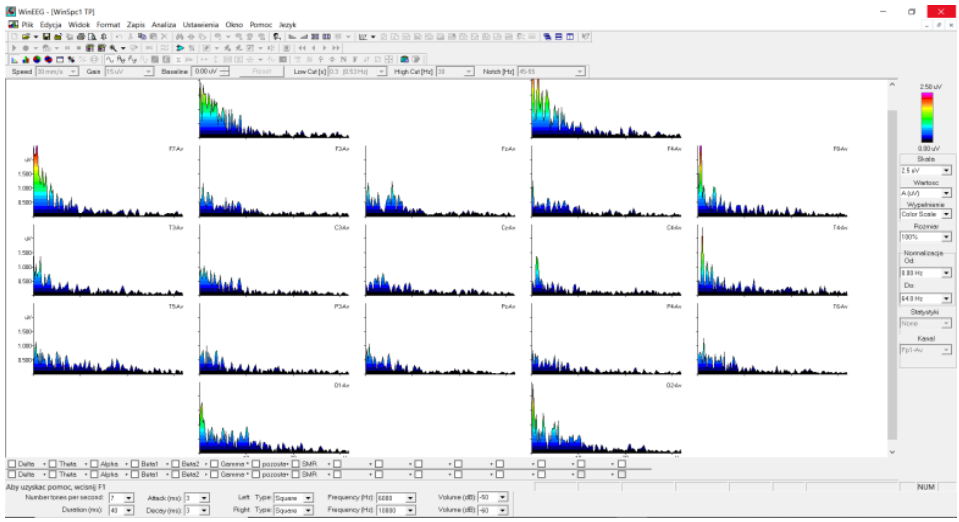

Figure 3. The course of frequency characteristics from individual sensors

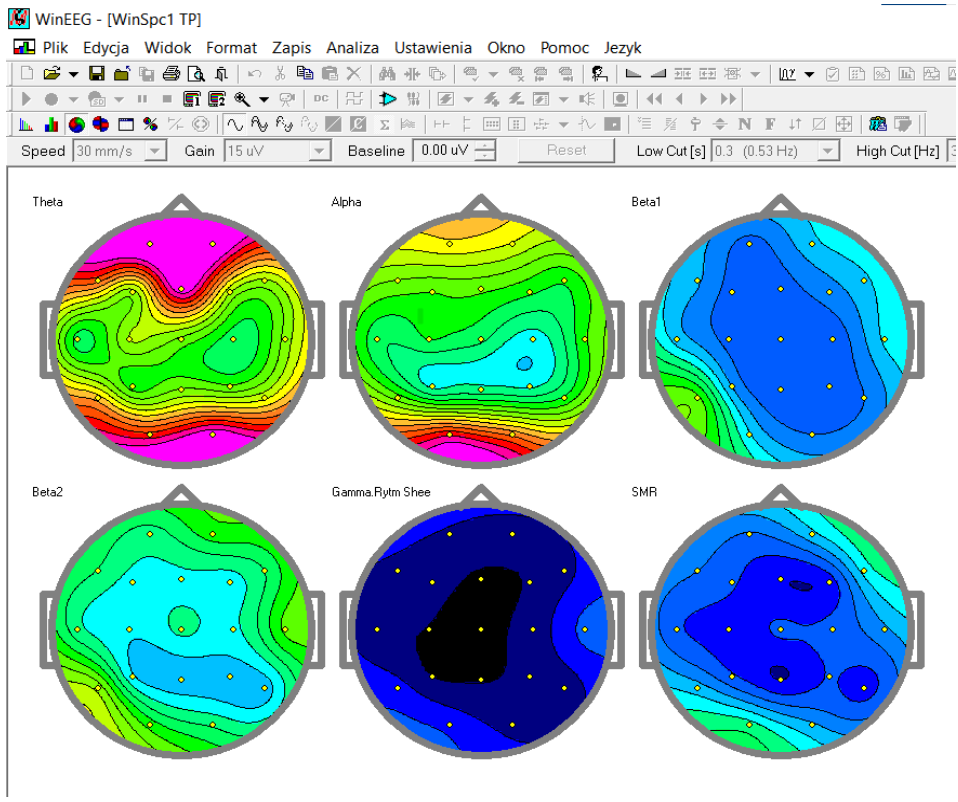

Figure 4. Visualization of the map of brain activity

Summary

The above research method is a non-invasive form of conducting scientific research. Like any research technique, it also has its drawbacks. They mainly result from insufficient resolution of measurements, because the limited number of sensors on the head affects the approximation of the results of activity of certain areas of the brain. The reliability of results is also strongly influenced by the care of processing of recorded "raw" signals that require complicated mathematical calculations. As research shows (Prauzner, 2015, p. 19), one can observe above all high activity of the waves: Beta1, Beta2 and SMR when working on a computer with simulation programs. Their location of occurrence in the brain and signal amplitude is interpreted in detail and on this basis appropriate conclusions are drawn.

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© University Press 2020
ISSN 2719-6550
ISSN 2719-7417 online

„Journal of Education, Technology and Computer Science"
No. 1(31)/2020
www.eti.rzeszow.pl

Received: 27.04.2020
Accepted for printing: 7.08.2020
Published: 05.11.2020

DOI: 10.15584/jetacomps.2020.1.13

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Fatigue and Health Behaviour of Ill Youth from Rural and Urban Areas

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Abstract

The issue of chronic diseases in the population of children and youth should be constantly monitored due to the dynamically changing conditions of life. The risk of health deterioration and the process of convalescence are related to negative health behaviours, the feeling of fatigue and lowering quality of life. These phenomena are determined by the type of disease, individual decisions and many other factors of social nature: support, place of residence or income. The aim of this paper is to analyse the feeling of fatigue and health behaviours declared by youth in the period of late adolescence.

Keywords: a sense of fatigue, health behaviors, health, chronic illness, youth

Introduction

It seems that in the case of studies of chronically ill youth considering social determinants of health is much needed. At present it is a simple truism to say that the financial situation or social background are related to man's health (Cockerham, 2017; Mikkonen, Raphael, 2010). Social factors determine also health behaviours contributing to health improvement or deterioration. Fatigue is a constant element accompanying chronic diseases. It is also related to life environment. Unfavourable environmental conditions (e.g. noise, congestion, etc.) can intensify the feeling of fatigue and modify health behaviours the shortcomings of which can contribute to aggravation of the disease and fatigue. The overview of research into health behaviours of youth carried out by Fleary, Joseph and Pappagianopoulos (2018) showed a shortage of analyses of the moderating role of social and demographic factors in the studies of youth health behaviours.

However, the works by other authors (Petrovic et al., 2018; Jordan et al., 1998) indicate that both the research into health behaviours and the feeling of fatigue are sensitive to social conditioning due to their high mutual correlation. In view of the above information, in this paper we focused on the preliminary assessment of differences between the researched groups as regards the selected demographic factor. Thus, the aim of this paper is to present differences in the experienced feeling of fatigue and declared health-related behaviours between chronically ill youth from urban and rural areas.

The Feeling of Fatigue and Health Behaviours

At present fatigue is one of the commonest phenomena accompanying a modern human being. It is defined as a subjective feeling of a lack of energy which does not resolve with proper rest and is not related to depression or a weakness of muscles (Nijhof et al., 2011). Chronic fatigue is diagnosed on the basis of the occurrence of at least four or more symptoms within 6 months, such as: memory and attention impairment, sore throat, tenderness of lymph nodes, muscular and joint pains, headaches, sleeping disorders which are not relieved and feeling unwell (Fukuda et al., 1994). It is estimated that chronic (prolonged) fatigue affects ca. 3% of adult population (Hotopf, as cited in: Kulik, Szewczyk, 2004) and shows an upward trend. In the population of children and youth, the frequency of fatigue occurrence fluctuates and is between 0.1% to 1% (Nijhof et al., 2011). This entails many negative effects, such as a high indicator of school absence (Crawley, Sterne, 2009) or long-term psycho-social consequences (Missen, Hollingworth, Eaton, Crawley, 2012; Kennedy, Underwood, Belch, 2010) including lower quality of life (Winger et al., 2015). Social and economic conditions, among others the place of residence, can become risk factors for developing the full picture of chronic fatigue (Nijhof et al., 2011).

Health behaviour is "any activity intentionally undertaken by an individual for the purpose of maintaining, promoting or protecting health, whether or not such behaviour is objectively effective towards that end" (Ostrowska, 1999, p. 28). Due to a wide range of problems, research takes into account selected, most representative and not indifferent for health behaviours. "The problem with precise defining of health behaviours results from the fact that the relationship between behaviour and health is ambiguous, it undergoes changes as our knowledge about health and illnesses develops and must be more specific" (Heszen, Sęk, 2007, p. 93). In the period of adolescence these behaviours change and evolve revealing an unfavourable tendency for risky undertakings and contempt for principles of a healthy lifestyle (Krawczyk, 2012). The studies by Oftedal et al. (2019) draw attention to the risk of health deterioration as unhealthy behaviours intensify.

Materials and Methods

The research problem: Are there any differences in the feeling of fatigue and declared health behaviours between youth living in rural and urban areas and, if yes, what are they? The general hypothesis is contained in the statement that there are differences between the groups surveyed in respect of their place of residence. To answer the above research problem we used a diagnostic poll method with the use of a survey technique, a Cumulated Fatigue Questionnaire (CFIQ) by Kosugo (1991) and Health Behaviour Inventory (IZZ by Juczyński, 2001). The Student's t-test was used to verify the hypothesis.

The study involved 403 students of secondary schools representing the ages between 16 and 19 years. They were the persons suffering from chronic health problems. The group of boys contained 192 individuals, whereas girls accounted for 52.3% of the group. All persons had chronic diseases, but in the case of 18.9% of the survey participants these were congenital diseases. Others (81.1%) suffered from them from several weeks to several years. Majority of the researched people lived in rural areas (233 persons). The town dwellers were represented by 170 persons.

Analysis and Discussion of Results

The fatigue level revealed by ill students within all components of the analysed variable indicates the lack of significant differences between the groups surveyed. Moreover, the data presented referring to both rural and urban youth are close to each other. In the case of results concerning the feeling of fatigue in youth with health problems, a high result regarding general fatigue of youth living both in the countryside and in towns is worth mentioning. It may indicate general overburden of youth by responsibilities and their problems with both physical and mental well-being.

Table 1. Comparison of mean outcomes for the feeling of fatigue among youth with health problems by place of residence obtained with the use of the Cumulated Fatigue Questionnaire (CFIQ), *p < 0.05

Fatigue	Town (N = 170)		Village (N = 233)		t-test		
	M	SD	M	SD	t	df	p
General fatigue	19,48	3,73	19,15	4,17	–0,800	401	0,424
Decreased vitality	8,99	4,11	9,22	4,42	0,533	401	0,594
Mental overload	7,99	4,12	7,73	4,10	–0,627	400	0,531
Physiological symptoms	8,91	3,84	8,85	4,48	–0,132	401	0,895
Anxiety	6,11	3,36	5,74	3,67	–1,034	401	0,302
Decreased willingness to study and school	8,78	3,86	8,52	4,06	–0,667	401	0,505

Statistical analysis revealed that the place of residence does not differentiate the intensity of declared health behaviours in all researched dimensions within the examined group of youth.

Table 2. Comparison of mean outcomes regarding health behaviours of youth with health problems by place of residence obtained with the use of the Health Behaviour Inventory (IZZ); *p < 0.05

Grupa / Wymiary IZZ	Town (N = 170)		Village (N = 233)		Istotność różnic		
	M	SD	M	SD	t	df	p
Appropriate eating habits	18,35	4,88	17,88	4,17	–1,024	401	0,306
Prophylactic behaviours	18,35	4,90	18,33	4,32	–0,036	401	0,971
Positive mental attitude	20,38	3,73	20,16	4,05	–0,554	401	0,580
Health practices	19,48	3,73	19,15	4,17	–0,800	401	0,424

Analysis of eating habits reveals certain tendencies in the researched group pointing to better eating habits among people from urban areas which was confirmed by the studies carried out by Stępień and co-workers (2015). Considering prophylactic behaviours or a positive mental attitude, higher results were obtained by town dwellers, although the differences were neither big nor statistically significant. In the case of studies dealing with the models of daily eating habits among youth aged 12 to 17, the differences related to the place of residence were statistically significant and concerned packed lunches and dinners (to the disadvantage of children from rural areas) or a place of having lunch (children from urban areas less often have lunch at home) (Sygit, 2015). The frequency of anti-health behaviours was also significantly correlated with the place of residence (Sygit et al., 2011).

Conclusions

The results presented in this paper show the lack of significant differences of declared health behaviours and fatigue between the researched groups of young people with health problems. Perhaps the only significant variable which has not been examined in this study is the financial situation which is also a component of the concept of social determinants of health (Zięba-Kołodziej, 2012, p. 331). Hence, there is a need for research in this area.

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