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Study on the possibilities for the industrial water purification from heavy metal ions

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Abstract: Among the various methods for water purification and treatment from contaminated industrial pollutants, one of the most used is the adsorption methods based on activated carbons. The purpose of our study is to investigate the correlation between the porous texture and chemical nature of the surface and sorption capacity of the activated carbon, obtained based on lignite coal. The object of the study is also to determine its effectiveness as a sorbent for Cd-ions purification of contaminated industrial water. The obtained data from the conducted investigation show that the adsorbent based on such kind of activated carbon has good qualities for water purification from various pollutants and heavy metals.

Keywords: ACTIVATED CARBON, ADSORPTION, PURIFICATION, INDUSTRIAL WATER

1. Introduction

Nowadays the industrial water purification from heavy metals is of the basic importance due to their toxic nature and risk of potential accumulation in the food chain. This requires applying the appropriated methods of reducing the heavy metals ions concentration to the acceptable levels. By using a very promising cost-efficient technology for purifying of industrial water can be applied various adsorption methods based on carbonaceous materials, i.e. activated carbon. The activated carbons (AC) represent one of the most effective approaches to ecosystem remediation [1-7]. The most common material used for AC preparation are different carbonaceous materials like wood, peat, coal, coconut shells, wasted biomass from cellulose industry and etc. The activated carbons are widely used in water filtrating system due to its excellent adsorption capacity. They are the best way for remediation of industrial contaminated water. The ability of AC to trap and absorb various contaminations is well known but the scientists look for and develops new methods and materials for this purpose [8-10].

Uses of the AC as a sorbent is determined by its low cost and the best combination of physicochemical properties such as: developed specific surface, porous structure and presence of functional groups on the surface, as well as the high adsorption capacity to different substances. An additional requirement for AC is weak interaction of the hydrophobic carbon surface to the water molecule and good to the organic substances; well developed mesoporosity, providing good access to micro and super micropores; high selectivity and ability to be regenerated. Adsorption properties of the activated carbons can be explained by the transport pores and adsorption pores. However different AC has different surface area and porosity, depending of the kind of source of carbon and the activation process. The main parameters, allowing the specific application are the texture parameters: specific surface area, meso- and micropores volumes, their ratio and micro and mesoporous distribution. AC are defined as microporous materials, but more often as a micro- mesoporous or as a meso-microporous material. It is established that the high sorption capacity of AC to the metal ions in an aqueous medium is mainly related to the presence of oxygen functional groups on their surface [11]. Activated carbons typically contain chemically bound oxygen, which depends on the method and conditions of the production, and form the basic or acidic surface compounds [12]. The explanation of the AC adsorption capacity to the metal ions is based predominantly to the role of the surface oxygen groups, and can be given by the theory model of Grou-Chapman-Stein-Grahame (G.C.S.G) [13], the theory of ion exchange [14] and the theory of formation of surface complexes [15]. The amount and pore distribution will affect the efficiency and the adsorption capacity of the AC. The purpose of our study is to estimate the influence of the porous texture and chemical surface nature of the activated carbon, based on lignite coal and determine its sorption capacity, its effectiveness as a sorbent of Cd-ions purification of the contaminated industrial water.

2. Experimental

For the purpose of our investigation was used activated carbon, obtained by water vapor pyrolysis of lignite coal [16]. The ash content of the activated carbon was determined by slowly treating the sample in a muffle furnace at 1073 ± 50K and glowing of the ash residue to a constant mass. [17]. pH of the AC was performed using „Hanna instruments – 211“meter, Germany. The carbon isoelectric point was determined by Noch-Schwarz method [18]. The acidic and basic surface oxygen groups was determined by Böhm neutralization method [19]. IR analysis of the AC sample was done using a Bruker IFS 25 FTIR spectrometer in the range 3000 - 4000 cm⁻¹, giving an additional information for the type of surface oxygen groups.

The characterization of the texture parameters and the specific surface area of AC were performed by low- temperature nitrogen adsorption (at 77.4 K) using conventional volumetric apparatus. Specific surface of the samples (Å²g⁻¹) was determined by BET method from the low temperature data of N₂ (77 K) in p/p₀ = 0.05 - 0.35 relative pressure range [20]. Determining of the sample volume: total pore volume (Vₚ) in accordance with the Gurvich rule at relative pressure p/p₀ = 0.95 [21]. The volume of mesopores (Vₛₑₛ) was calculated by the formula: Vₛₑₛ = Vₚ − W₀, where W₀ (the limit volume of the sorption space, calculated using the simplified Dubinin - Radushkevich equation [22,23,24]. W₀ was determined from the N₂ isotherms in the relative pressure range <0.1. The micropore volume (Vₘₚ) was determined by the tₜ method [24]. The volume of super micropores (Vₛₑₘ) was determined by the equation: Vₛₑₘ = W₀ − Vₛₑₛ. The size distribution of micropores was done using (Simplified Equation-SE) [25]. The size distribution of mesopores was carried out by the Pierce method [26].

3. Results and discussion

Table 1 presents the ash content and results of the elemental analysis (wt.% of the sample of ACVM.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Ash content (%)</th>
<th>C. %</th>
<th>H. %</th>
<th>N. %</th>
<th>S. %</th>
<th>O. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACVM</td>
<td>10.1</td>
<td>91.8</td>
<td>1.63</td>
<td>0.78</td>
<td>0.66</td>
<td>5.13</td>
</tr>
</tbody>
</table>

Table 1 shows that the ash content of the activated carbon is 10.1 wt.%, similar to the ash content of activated carbon based on such coal type. The elemental composition of the activated carbon is characterized by a high carbon content (91.8 wt.%) and a sulfur content in carbon of 0.66 wt. %, but it does not affect the adsorption process of the studied ions. The values of pH, IEP and the results from the Boehm neutralization method for ACVM activated carbon are presented in table 2.
Table 2. pH, IEP and functional group content according to Boehm neutralization method for ACVM

<table>
<thead>
<tr>
<th>pH</th>
<th>IEP</th>
<th>NaOH</th>
<th>NaCO₃</th>
<th>Na₂CO₃</th>
<th>HCl</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.3</td>
<td>7.5</td>
<td>0.43</td>
<td>0.05</td>
<td>0.96</td>
<td>0.8</td>
</tr>
</tbody>
</table>

From the results obtained for pH, IEP and functional groups content, according to the Boehm neutralization method, their values are close (7.8 and 7.5). According to the results from the Böhmen neutralization method, it is obvious also, that the acidic oxygen groups prevail on the carbon surface, which is characteristic for activated carbon, obtained by vapor-gas activation. Based on the Böhmen neutralization method and the results obtained for pH and IEP may be assumed that the activated carbon will adsorb metal ions, which hydroxides are less basic and their salts are hydrolyzed during the experiment.

The FTIR spectrum of the studied sample is presented on figure 1. It cannot be clearly identified vibrations of acidic oxide surface groups, except in the range 1600-1545 cm⁻¹, which according to [27] is characteristic of the enol form of the dicarbonyl groups.

**Table 3. Adsorption-desorption texture parameters of the sample of activated carbon**

<table>
<thead>
<tr>
<th>A_{BET}</th>
<th>AMES</th>
<th>V₁</th>
<th>V₄</th>
<th>V₉</th>
<th>V₉ₛ</th>
<th>X₀</th>
<th>τ₀</th>
</tr>
</thead>
<tbody>
<tr>
<td>388 m². g⁻¹</td>
<td>33 m³. g⁻¹</td>
<td>0.36</td>
<td>0.04</td>
<td>0.13</td>
<td>0.21</td>
<td>0.99</td>
<td>1.9</td>
</tr>
</tbody>
</table>

It can be seen from the texture parameter data (table 3), that AC is characterized with not so developed specific surface area (A_{BET} = 388 m².g⁻¹), and slightly developed micropores volume (V₉=0.04 m³.g⁻¹), opposing to those of super micropores (V₉ₛ = 0.13) and well developed mesoporous transport texture, with ratio V₉ₛ/V₉= 1.4.

Based on the results obtained, it can be concluded that in the microporous texture of the AC super micropores dominate, and the volume of the typical micropores is four times smaller than the super micropores. All this confirm the fact that the sample ACVM is obtained by high degree of activation.

The analysis of the textural parameters of the sample AC based on the lignite coals, shows that it is suitable adsorbent for organic and inorganic substances (contaminants) from aqueous medium.

As a result of meso-microporous texture developing of the sample during the activation process and the obtained favorable V₉ₛ/V₉ ratio, it can be concluded that the adsorption process is facilitated for the contaminated substances to the sorption centers on the surface and in the porous texture of the AC.

3.1. Study of the adsorption capacity of the obtained ACVM for Cd²⁺ ions contaminated aqueous solution

The adsorption of metal ions from aqueous solution depends on many factors, but the most important are ionic radius, ionic potential, q/r (q ionic charge, r – ionic radius), pH, chemical properties, hydrolisis and etc.

Cd²⁺ has relatively larger hydration radius (compared to the radius of Cu, Zn, Pb ions) and hence has significantly greater access to the carbon surface area. His ionic potential is smaller than the potential of the other mentioned heavy metals ions. Therefore, the interaction forces between AC - Cd²⁺ will be relatively weak, which means that Cd²⁺ ions are retained only on the center of hydrocarbon surface, with a higher negative charge.

The effect of pH of the solution on the adsorption value (xₙ, μmol.g⁻¹) to Cd²⁺ is given on fig. 4. At constant temperature, ion concentration, time contact and stirring rate, pH of the adsorption medium has the important influence on the adsorption process. From the presented adsorption isotherm it can be seen a sharp increase of the adsorption of Cd²⁺ ions in region 3.2≤pH≤4.2, which reaches constant values for pH: 5=7.

The sharp rise of pH in the range 3.2÷4.2 of X=f(pH) (fig.4) for the Cd²⁺ ions adsorption associated with the surface charge of the activated carbon, which is extremely dependent from the solution pH value. [28]. The IEP value of the AC is 7.8 (table 2). At low value of pH, as a result of protonization of the surface oxygen groups, the electrostatic repulsion forces of Cd²⁺ ions from the positively charged carbon surface occur, so a lower degree of adsorption is observed. The increased pH solution value leads to the amount of the protonized surface functional groups decreasing (respectively the strength of the hydrogen bonds between hydrogen cations and these groups also decreases). As a result Cd²⁺ ions will easily displace H⁺ from the surface oxygen groups and the adsorption of Cd²⁺ will increase.

The results obtained show that the adsorption of Cd²⁺ of the obtained activated carbon depends on the texture parameters (their hydration radius) and adsorption-desorption characteristics. The adsorption of Cd²⁺ is low at low pH values (pH≤3) and increases significantly in the pH range from 3.2 - 4.2, reaching constant values at pH>5.
Conclusion

The Cd\textsuperscript{2+} ions are serious environmental problem of waste water and contaminated groundwater. The obtained adsorption-texture parameters of the investigated activated carbon derived from the lignite coal show that it is a suitable sorbent for organic and inorganic substances (contaminants) from a liquid medium.

The results obtained by studying the adsorption capacity on the obtained ACVM by static method of Cd\textsuperscript{2+} ions from aqueous solution show that the adsorption of these ions depends on both the adsorption-texture parameters and the chemical nature of the carbon (in particular IEP) and as well as from the pH of the solution. The adsorption of Cd\textsuperscript{2+} is low at low pH values (pH<3) and increases significantly in the pH range from 3.2 - 4.2, reaching constant values at pH>5.

However, its practical use for the purification of contaminated industrial water from Cd\textsuperscript{2+} ion needs of an additional investigation on the so-called dynamic carbon adsorption capacity and on the possibility of regeneration of the sorbent.

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Analysis and prospects of cruise tourism in the east Black sea region: the case of Georgia

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Abstract: once a part of the Soviet Union, a backwater country, Georgia in a couple of years flips the script and rushes into tourism industry as one of the most popular emerging destinations on the Black Sea coast. With unprecedented number of tourists spotlighted by the leading international journals Georgia wins hearts of millions and becomes a revelation for the USA and Western EU countries.

This paper assesses current situation in Batumi Port that serves small cruise ships and explores potentials of cruise tourism development based on statistics, industry experts and investors reviews. The article uses a mixed method, a combination of qualitative and quantitative data analysis.

The findings show how Black Sea region will benefit from country’s cruise tourism development.

Results of the study can be applied as basis for investment analysis of Georgian cruise industry.

KEY WORDS: CRUISE TOURISM; BLACK SEA REGION; GEORGIA; BATUMI PORT; CRUISE SHIP TERMINAL.

1. Introduction

The cruise industry went underwater after the novel coronavirus pandemic hit the world in March 2020. Some ships are still stuck in the middle of the oceans with passengers and crews onboard waiting for the ports to accept them. (April 2020) [3] Once a “phenomenon of our times”, a fairy tale on the water, an incredible business machine that multiplies ships sizes, numbers of passengers and profits exponentially, today is facing obscurity and unprecedented function. As a $46 trillion/ year worth and 26 million passengers/ year industry, cruises went to a total full stop.[4]

Since the beginning of Covid-19 outbreak newspapers such as BBC News, The Washington Post and The Telegraph have burst out in writing negative articles regarding cruise ships companies. Main accusations and objects for affronts in these damaging posts are the enormous incomes of the industry, social irresponsibility, little contribution to local economies and no tax payments to the resident country’s budget.

“No one is willing to bail them out because of their tax avoidance, but also because of the negative impacts they have at their destinations… they contribute very little to the local economy,” stated Plymouth University professor Sheela Agarwal.[6]

Let’s overview the industry and its real contribution to world’s economy before the pandemic.

According to Cruise Lines International Association’s (CLIA) report “2020 State of the Cruise Industry Outlook” the cruise market has been expanding steadily since 2009. Above 15,000 travel agencies with 53,000 travel agent members earn a living from this market, and the most famous, and perhaps the first foreign cruise ship in the Black Sea waters under the flag of the North American United States, visited the ports of Odessa and Yalta in August 1867, was the Baltima. According to CLIA data (2018) Europe rates number two biggest cruise source market after the North America. Western Europe - 6,731,000 passengers; Eastern Europe - 213,000 passengers. As well as number two cruise destination worldwide, after the Caribbean - 17%.

As a part of Mediterranean cruise market Black Sea region (BSR) has all the support and potential to become new emerging destination for Europe. However, while the rest of the world suffers from the deep crisis due to well-known international events, BSR cruise shipping has been facing problems in the industry long before the pandemic.

The most famous, and perhaps the first foreign cruise ship in the Black Sea waters under the flag of the North American United States, visited the ports of Odessa and Yalta in August 1867, was called “Quaker City”. There were 55 American tourists onboard, including a journalist Samuel Langhorn Clemens, better known as the writer Mark Twain. That was the beginning of international cruise shipping on the Black Sea. However, Black Sea cruising didn’t get mass since then. Until the collapse of the Soviet Union, mainly Soviet cruise ships sailed in the Black Sea. Since the mid-1990s, various domestic shipping companies tried to revive cruise shipping in the region. Due to political and economic instability all the attempts were in vain. Black Sea cruising got a second wind in 2010-2011, when Italian cruise company MCS plot a route between Odessa and Venice. According to MedCruise previous president, Stavros Hatzakos (2014), the cruise traffic in the BSR between 2000-2015 was steadily growing. The number of calls at MedCruise member-ports located in Turkey, Georgia, Ukraine, Romania and Russia increased from 200 in 2009 to almost 450 in 2013. The tendency kept to be relative till “ship deployments were affected by the Ukraine unrest.” Passenger numbers (pax) also increased from around 110,000 in 2009 to almost 225,000 in 2013. [22]

As Plymouth University professor Sheela Agarwal commented in BBC News article “Will we ever take cruise holidays again?” of April 9: “Tourists have very short memories.” “Three months maximum, and they are back to normal.” [5] Reviewing the financial situation of such a giant as “Royal Caribbean” cruise company, comparing “then” and “now” Will Ashworth, a financial blogger at InvestorPlace stated that “I just don’t see people giving up cruising”[6]

And later in the reply to Prof. Agarwal words, Will Ashworth assured the industry 100% to recover, as well as Royal Caribbean (NYSE:RCL) stock will reach $100 mark again. However, InvestorPlace contributor added that “It’s going to take many months for this to sort itself out”. (Apr 14, 2020) So it’s most likely to be as soon as travel restrictions are lifted.[6]

Meanwhile, notwithstanding pandemic conditions, damaging articles and the rest of tourism market taking unprecedented break from operation and acting pretty cautiously, some cruise companies have already announced the restart in May 2020.[8]
In 2013, more than 400 cruise ships flying a foreign flag entered Istanbul and only 73 of them to the Black Sea. The main reason was the lack of infrastructure, inability to accept vessels longer than 200 m. [19]

The specifics of the Black Sea geography make BSR ports partners, not competitors: the more ships are attracted to the Black Sea region, the more benefits get each of the ports. Given this feature, in 2012 at one of the International Cruise Exhibitions the idea initiated a non-profit marketing project to promote the Black Sea cruise line as a united brand. To promote this project was created an advisory group on infrastructure development of cruise tourist services in the Black Sea Region. [20] After a short promising 2 years of development BSR hits another political crisis, this time in Ukraine. Despite the significant amounts of money spent on development and promotion of cruise itineraries in the area, another BSR cruise industry recession has begun.

It is noteworthy that MedCruise President Airam Diaz Pastor in his speech during the meeting did not mention Batumi Port/Georgia as one of the BSR cruise ports. Here is the speech:

‘The launch of this Working Group will have a positive impact on the regional cruise sector and it will bring new opportunities to all MedCruise members from the Black Sea – Port of Odessa, Port of Varna, Port of Constantza, Port of Burgas, Port of Trabzon and Port of Istanbul - as well as the cruise-industry-related-companies that operate in the region.’

However, he announced his plan to conduct negotiations with the port of Batumi in the nearest future.[11] As Diaz Pastor stated, all the mentioned ports have necessary infrastructure, and the cities themselves are interesting enough for tourists from the point of historical and cultural attractions.

So, the question is: why there are still no cruise ships calling Georgia since 2016?

According to Craig Turp, the editor of Emerging Europe: “Georgian tourism first took off in 2012, jumping from 2.8 million visitors to 4.4 million in the space of 12 months.” With its peak in 2017 “which really placed the country on the map” (7.5 million tourists) [1], Georgia hasn’t stopped since that. For today Georgia is named “World’s greatest hidden travel gem” and ranks #1 in the top 30 emerging travel destinations on the planet for 2020. [2]

Still there are lots of properly undiscovered opportunities for tourism development in this country. One of them is cruise tourism potential of West Georgia.

As cruise market with its growing demand hunts for new interesting destinations, Georgia has all the advantageous variables to become a new cruise breakthrough. Some of them are:

- country’s rich history;
- attractive sights;
- favorable geographical location;
- good political relations with neighboring cruise countries;
- reasonable prices;
- and a vast variety of one-day tours.

There are 5 active seaports in Georgia: Poti, Batumi, Anaklia, Kulevi and Supsa. According to experts, Batumi port is the most promising one for cruise shipping development among them.[12] Batumi- a subtropical port city rounded by mountains, rich in greenery, history and confessions, famous for delicious Adjarian cuisine and hospitable people. Also known as “ Las Vegas of the Black Sea” due to lots of legal gambling establishments. Batumi is the third largest city of Georgia and a capital of Autonomous Republic of Adjara. The city is considered to be a transportation hub between Europe and Asia. [15]

Batumi port is a multiterminal port (Oil terminal, Container and the railway ferry terminal, Dry Cargo Terminal, Marine Passenger Terminal) with annual revenue of $200-300 million. [16]

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Batumi port is a multiterminal port (Oil terminal, Container and the railway ferry terminal, Dry Cargo Terminal, Marine Passenger Terminal) with annual revenue of $200-300 million. [16]
Since the moment Georgia lost MedCruise membership, zero cruise ships have called Batumi port.

Department of Tourism and Resorts of Adjara Autonomous Republic commented on the situation and stated that cruise tourism development requires a number of issues to be settled by the government, including port modernization (access to larger ships), cooperation with Black Sea ports, optimization of harbor dues and improvement of port management. [17] According to the World Association for Waterborne Transport Infrastructure (PIANC) there are special requirements for cruise terminals. In compliance with “Guidelines For Cruise Terminals” presented to Medcruise General Assembly in 2016 the average LOA (length over all) has to be at least 300 m. [14] For today only 2 BSR ports have the requested infrastructure: Constantza (Romania) and Odessa (Ukraine). As it was mentioned previously, to organize a full-fledged round trip for an average size cruise liner we need at least 5 ports with LOA 300 m. Until then BSR is doomed to welcome only small cruise ships and suffer from periodic crises, that take place during last 20 years.

In 2011 Royal Caribbean and Government of Adjara signed a memorandum of cooperation on the development of the new Batumi seaport Terminal that would be able to accommodate all kind of cruise ships by 2015. However, the project was frozen due to internal political changes in Georgia. [21] MedCruise Black Sea Working Group was formed during General Assembly in Malta in May 2018 with 4 official port-members: Odessa, Burgas, Constantza and Varna. The group had several meetings in Odessa and Constantza in 2019. As a result, there were discussed a marketing strategy for the next 3 years and upcoming Seatrade Cruise Global 2019 exhibition in Miami, namely the Action Plan to be submitted there on how to return cruise tourism back to BSR.

For now, 12 cruise lines are going to visit Odessa port this year: Olsen Cruise Lines, Azamara Club Cruises, Phoenix Reisen and others. Azamara and Crystal Cruises planning eight calls to Odessa in 2021 so far.

Constantza has welcomed Amara in October 2019 and is expecting 9 more calls from 6 cruise lines in 2020. Burgas is preparing to host a MedCruise GA in 2021. [23] Notwithstanding the fact that Batumi seaport is not MedCruise member anymore, Georgia is going to benefit from Black Sea Working Group’s diligence anyway. After 4 years of absolute hull in cruise calls at Georgia, there are 2 Azamara ships calling at Batumi port in July and September this year (2020) and 5 more by Azamara, Crystal and Silver Cruises in 2021. [24] For analysis, of current cruise situation in the Black Sea Region was applied desk research using combination of qualitative and quantitative methods, as well as statistical and general analysis. Qualitative method was applied to process and evaluate experts’ interviews in industry journals, quantitative -to collect, analyze and compare parameters of cruise ships and terminals. Statistical and general analysis was made for getting a full picture of the situation. The purpose of the study was to examine Batumi seaport as a cruise terminal of BSR, identify current state, consider the problems, challenges and potentials of its development, to study available cruise infrastructure and make recommendations for country’s sustainable cruise tourism development.

3. Conclusion

The cruise tourism represents one of the fastest growing sectors of the tourism business. Industry has a need to develop new ports, discover new itineraries and to accommodate larger sizes of ships. It is important to understand how the development of cruise ports may impact local economy and country’s communities overall. Tourism made up 7.6% of total GDP of Georgia in 2018. According to The World Travel and Tourism Council (WTTC) 2018 report, direct contribution of travel and tourism to GDP in Georgia is anticipated to increase up to 10.5% by 2028. [25] It’s obvious, that tourism sector is more than important for Georgia. Engaging in cruise tourism will benefit local infrastructure, country’s economy and social life, as well as will attract foreign investments and reveal new opportunities for international cooperation.

Main conditions for attraction of cruise lines to Georgia are:
- Favorable and goal-oriented cruise politics of government;
- Modernization of Batumi seaport. In order to be available for mass cruising and be able to welcome average size cruise ships, port has to meet technical requirements;
- As history has shown, political stability is vital for cruising shipment and development in country and in the whole region;
- Another key to success is internationally active policy. Membership in MedCruise became crucial and defining for its members.

And last but not the least, reasonable port charges. Batumi cruise terminal is an unprecedented opportunity to make Georgia a cruise country and place it on the map one more time. Cruise ships calls may multiply tourism incomes several times, increase urbanization rate in the city, attract new capitals, expand international inclusion and diverse transportation hub. As a maritime country Georgia has to consider global trends which emerge in BSR. The necessity to develop port infrastructure is defined by profitability of cruise market. Thus, Georgian government and business sector have to promote Batumi seaport as a promising European destination of cruise tourism. Development of cruise shipping will set off all the neighboring sectors, such as transportation, city tour business, catering, shops, touring companies, etc.) and ultimately will create new jobs and contribute to regional economy.

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Monitoring of the quality of ambient air using high volume air sampler

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Abstract: The quality of ambient air is a noticeable demonstration because the ambient air plays a cardinal preface on the human activities and most of environmental processes. The monitoring of the quality of air is an important part of the pollution control because the ambient air was confirmed as an affected branch on the earth from both anthropogenic activities and natural phenomena. In the existing investigation, there were expected to test the selected important air quality parameters of the ambient air at around the Peradeniya region in Sri Lanka which is known as relatively populous region with the traffic. The ambient air samples were collected through a glass fiber filter paper which was attached to the high volume air sampler and both PM$_{10}$ concentration and total suspended particles (TSP) of the ambient air were determined using weight differences of air collection bottle and filter paper. Beside of that the lead (Pb) concentrations and NO$_X$ concentrations of the ambient air were investigated using hot acid extraction method while having the contribution of atomic absorption spectrometer (AAS) and of absorbing method in to a liquid with the aid of UV- visible spectrometer. As the results, there were obtained 0.0141 ppm of PM$_{10}$ concentration, 0.0214 ppm of total suspended particles (TSP) concentration, 0.151 µg/m$^3$ of NO$_X$ concentration and 0.015µg Pb/m$^3$ of lead (Pb) concentration of the ambient air at around the Peradeniya region at that moment. When comparing of those results with the air quality standards and norms, it was identified the non hazardous atmosphere at the selected region at that occasion.

Keywords: PM$_{10}$ ANALYSIS, NO$_X$ ANALYSIS, LEAD ANALYSIS, HIGH VOLUME AIR SAMPLER, AIR QUALITY

1. Introduction

The ambient air is a platform for most of natural and anthropogenic activities. The quality of air is much important for the most of anthropogenic and natural incidents as given in the below.

- Breathing
- Equilibriums of natural cycles and processes such as the green house effect and depletion of the ozone layer

According to the anthropogenic activities in the modern world, the composition of the ambient air is varied either instantly or gradually. The highly considerable anthropogenic activates are as follows [1-3].

- Vehicle emissions
- Industrial emissions
- Disposal of pesticides in agricultural purposes
- Bushfires

Also according to the natural phenomenon the ambient air is affected as follows.

- Volcanic eruptions
- Equilibriums of natural cycles and processes such as the green house effect and depletion of the ozone layer

However, the impact of such natural phenomena is less on the ambient air quality because these are occurring in less frequently and also such activities cannot be controlled or prevented by humans. But in the case of anthropogenic activates, it is possible to be minimized. As a part of mitigation of the air pollution, the monitoring is identified as a prominent stage prior of the making decision [1-6].

The environmental pollution/ air pollution would be a critical problem for the human health due to the following components.

- Particulate matter
- CO$_2$, CO
- NO, NO$_X$, N$_2$O (NO$_X$)
- Cd, Pb, Hg (heavy metals)
- Organic and inorganic pollutants
- Aerosols
- Chloro –Fluoro Carbon (CFC)

The impacts of such compounds will be considered based on following risky conditions.

- Carcinogens (heavy metals)
- Acid rains (CO$_2$, NO$_X$)
- Diseases of respiratory system (particulate matter)
- Ozone depletion (CFC)

Therefore, the monitoring of air quality is frequently performing series of experiments at the different locations in the world time to time based on following purposes [3, 5, 6].

- Medical/ health/ sanitary purposes
- Meteorological purposes
- Environmental rules and regulations
- No laboratory analysis or less analysis
- Need some sophisticated maintain and well calibration of the instrument
- Readings are continuously measured and recovered
- The measurements are recorded concurrently
- Provide directly comparable information
- Need a series of stations permanent or long term stations

II. Fixed sampling
- The measurements are recorded concurrently
- Provide directly comparable information
- Need a series of stations permanent or long term stations

III. Continuous sampling
- Readings are continuously measured and recovered
- No laboratory analysis or less analysis
- Need some sophisticated maintain and well calibration of the instrument

IV. Integrated sampling
- Continue for good coverage
- A single result would be obtained after laboratory analysis

According to such categorizations, the instrument high volume air sampler was categorized as a fixed sampling instrument which is working under the principle of integrated sampling technique [1-6]. The analyzing of the air quality in both indoor and outdoor environments is allowable using the instrument high volume air sampler.

2.1. PM$_{10}$ Analysis
There were identified the all of important parts of the high volume air sampler. The Whatman filter paper was attached to the high volume air sampler while following the important precautions as given in the below [2-6].

- The micro-cracks and tiny holes of the filter paper were observed using a bright light source.
- The moisture of filter paper was removed placing in a desiccator.
- The weight of moisture free filter paper was measured for four decimal points using an analytical balance.

The dust collection bottle was removed, cleaned and measured the empty weight of such bottle. The bottle was fitted again to the cyclone. The instrument was placed at the selected location and the following important aspects were checked before switching on the instrument.

- The climatic conditions around the position
- Manometer liquid level was tested and confirmed that it was appeasing zero.

The sampling time was set as three hours and also a vehicle count was taken nearby that location while observing the background conditions such as the temperature and rainy conditions. At end of the sampling time period the instrument was transported to the laboratory.

At the laboratory, the dust collection bottle and the filter paper were removed from the instrument and their weights were measured using sample analytical balance.

The PM\(_{10}\) concentration and total suspended particles in the air sampler were computed using following equations [1-6].

\[
\text{Weight of PM}_{10} \text{in the dust collection bottle} = M_f - M_i \quad (1)
\]

Where,

- \(M_f\) = Final weight of the dust collection bottle (g)
- \(M_i\) = Initial weight of the dust collection bottle (g)

Weight of the particles (>10µm) in filter paper = \(M_F - M_I\)  \( (2)\)

Where,

- \(M_F\) = Final weight of the filter paper (g)
- \(M_I\) = Initial weight of the filter paper (g)

The volume of air sampler was computed by using following equation.

\[
V = Q^t \quad (3)
\]

Where,

- \(V\) = Volume of air (m\(^3\))
- \(Q\) = Average sampling rate (m\(^3\)/min)
- \(t\) = Time (min)

2.2. Lead Analysis

In the analysis of the lead (Pb) concentration in the ambient air the hot acid extraction method was used in the sample preparation. According to the hot acid extraction steps, a piece (16'' x 8'') strip was cut from the removed filter paper after three hours sampling time period. The filter strip was placed in a beaker and about 50 ml of the extraction solution which is prepared from 3% HNO\(_3\) and 8% HCl was added to the beaker. It was confirmed that the filter strip had been completely dipped in extraction solution. The beaker was heated and kept in a fume hood for sufficient time period. The system was refluxed for 30 minutes while covering with a watch glass. The beaker walls were rinsed and washed using distilled water. A portion of 10ml of reagent was added and the system was allowed to stand for 30 minutes. The extraction solution was transferred into a volumetric flask after filtering that. The transferred solution was analyzed using the Atomic absorption spectroscopy (AAS) [1-6].

The lead concentration of the air sample was computed using following equation.

\[
C = (M_p-M_b) * V_t * F_r / (V_s * F_d) \quad (4)
\]

Where,

- \(C\) = Concentration (µg metal/ m\(^3\))
- \(M_p\) = Metal concentration (µg/ mL)
- \(M_b\) = Blank concentration (µg/mL)
- \(V_t\) = Total volume of extraction (mL)
- \(F_r\) = Total area of exposed filter (cm\(^2\))
- \(V_s\) = Volume of air sampled (m\(^3\))
- \(F_d\) = Area of filter taken for digestion (cm\(^2\))

2.3. NO\(_X\) Analysis

In the analysis of NO\(_X\) in the ambient air, the NO\(_X\) in ambient air was absorbed into a liquid. The methodology was summarized as follows [1-6].

The required chemicals for NO\(_X\) analysis are as follows.

- N-(1-Napthyl) - ethylenediamine Di-hydrachloride (NEDA) (0.1%)
- Anhydruous sulphamlic acid
- Glacial acet acid
- Hydrogen peroxide solution
- Sodium nitrite – assay of NaNO\(_2\) (> 97%)
- Sodium nitrite solution (1000µg NO\(_2\)/ml)
- Sodium nitrite solution (10µg NO\(_2\)/ml)
- Sodium nitrite solution (1µg NO\(_2\)/ml)
- Sulphanilamide solution
Preparation methodology of absorbing liquid is as follows.
- The NEDA sample was prepared by dissolving 0.1g of the reagent in 100mL of water.
- 5g of anhydrous sulphamic acid was dissolved in almost a 1L of water containing 140mL of glacial acetic acid.
- 20mL of 0.1% stock solution of NEDA was added into the above mixture and diluted up to the 1L.

The sample collection methodology is as follows.
- Sampling train was prepared with air impinge bottles. The bottles were already washed with distilled water and air dried.
- 40mL of absorbent was filled impinge bottle and unexposed blank impinge bottle.
- The calibration curve was prepared by following the standard procedure.

Determination of NOX value of the collected air samples were done as follows.
- The lost amount of water by the evaporation during the sampling was replaced by adding distilled water calibrate mark and mixed thoroughly.
- Absorbance value of the prepared sample was measured by the UV visible spectrophotometer and the NOX concentration of the sample was calculated at the selected location.

The NOX concentrations of the air samples were determined using following equations [1-6].

$$C_{NOx} = (A_s - A_b) \times CF \times V_s / (V_a \times 0.82) \quad (6)$$

Where,
- $C_{NOx}$ = Concentration of nitrogen dioxide ($\mu g/m^3$)
- $A_s$ = Absorption of the sample
- $A_b$ = Absorption of reagent blank
- $CF$ = Calibration factor ($\mu g/m^3$)
- $V_s$ = Volume of air sampled (m$^3$)
- $V_a$ = Volume of sample (ml)
- 0.82 = Sampling efficiency

### 3. Results and Discussion

#### 3.1. PM$_{10}$ Analysis

Manometer Readings are given in the Table 1.

<table>
<thead>
<tr>
<th>Table 1. Manometer readings</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manometer Reading</td>
<td>0.9</td>
</tr>
<tr>
<td>Initial Reading</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Filter paper weights at different moments are given in the Table 2.

<table>
<thead>
<tr>
<th>Table 2. Weights of the filter paper</th>
<th>Value (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moment of Weights Taken</td>
<td>20.0624</td>
</tr>
<tr>
<td>Initial Weight</td>
<td>20.0842</td>
</tr>
</tbody>
</table>

The weights of the cyclone dust collection bottle in different moments have been mentioned in the Table 3.

The relevant determinations of the experimental results were given in the Table 4.

<table>
<thead>
<tr>
<th>Table 4. Important determinations of the experiments</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of PM$_{10}$ in the dust collection bottle (g)</td>
<td>0.0425</td>
</tr>
<tr>
<td>Volume of air sample (m$^3$)</td>
<td>0.0141</td>
</tr>
<tr>
<td>PM$_{10}$ concentration of the air sample (ppm)</td>
<td>0.2128</td>
</tr>
<tr>
<td>Weight of the particles &gt;10µm in filter paper (g)</td>
<td>0.0643</td>
</tr>
<tr>
<td>TSP concentration of the air (ppm)</td>
<td>0.0214</td>
</tr>
</tbody>
</table>

According to the obtained results, it seems that the PM$_{10}$ concentration and total suspended particles (TSP) concentration were not caused any considerable environmental impact when comparing of such results with Sri Lanka norms [3-5].

The concentrations of such solid particles and some other gaseous pollutants are depending on the environmental conditions at sampling occasions apart from the emitted amount of pollutants by the sources. The important environmental conditions are as follows.
- Rainy conditions
- Wind patterns (speed and direction)
- Moisture content of the atmosphere and humidity
- Variations of the temperature
- Errors of the filter paper (invisible errors)
- Errors in the analysis

Therefore, it is more useful the analysis of such meteorological parameters related with the specific moment and mitigation of the technical errors.

#### 3.2. Lead Analysis

The observations were listed in the Table 5.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Concentration (ppm)</th>
<th>Concentration (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blank Sample</td>
<td>0.01</td>
<td>0.00001</td>
</tr>
<tr>
<td>Sample 1</td>
<td>0.05</td>
<td>0.00005</td>
</tr>
<tr>
<td>Sample 2</td>
<td>0.06</td>
<td>0.00006</td>
</tr>
<tr>
<td>Sample 3</td>
<td>0.03</td>
<td>0.00003</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 6. Conclusion of the lead concentrations in air samples</th>
<th>Value (µg Pb/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1</td>
<td>$1.33 \times 10^5$</td>
</tr>
<tr>
<td>Sample 2</td>
<td>$1.66 \times 10^2$</td>
</tr>
<tr>
<td>Sample 3</td>
<td>$6.67 \times 10^2$</td>
</tr>
<tr>
<td>Average</td>
<td>$1.50 \times 10^5$</td>
</tr>
</tbody>
</table>

In the comparison of obtained results with the relevant permissible limits for such pollutants which were promulgated by the authorized organizations, the obtained values are considered as normal conditions because the maximum permissible limit for lead concentration in ambient air is 1.5 µg Pb/m$^3$. Therefore, it is possible to conclude that the impact from lead on the environment is non-hazardous. However, the remaining of even the existing condition would be dangerous because the accumulation of lead could be happened in the human body as a result of long term berating. However, the following reasons would be affected in the accuracy of the results of the existing experiments.
• Moisture content in the air and the pressure of gas.
• Some errors in the high volume air sampler and folds of the filter paper.
• Variations of the climatic conditions of the background with the collection time period that samples were collected.
• Experimental errors and some errors occurred by the analyst.
• Some errors in the analytical instrument and sample preparation.

Also following activities have been identified as the harmful phenomenon regarding the releasing of lead into the ambient air with the fate of those activities [2-6].

• It is possible to rapidly increase the limit of lead in the ambient air due to some instant or long term natural phenomena such as the volcanic eruption, plants, forest fires, weathering and erosion and some anthropogenic activities such as lead acid batteries, pesticides, and gasoline.
• If the lead gets into the blood cells, it is able to reduce the strength of the bones in the human body.

3.3. NO\(_X\) Analysis

The observations with respect to the analysis of the prepared samples have been given in the below.

Table 7. Data for the calibration curve

<table>
<thead>
<tr>
<th>Concentration (µg/ml)</th>
<th>Absorbance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.006</td>
</tr>
<tr>
<td>2</td>
<td>0.223</td>
</tr>
<tr>
<td>4</td>
<td>0.461</td>
</tr>
<tr>
<td>6</td>
<td>0.647</td>
</tr>
<tr>
<td>8</td>
<td>0.871</td>
</tr>
<tr>
<td>10</td>
<td>1.106</td>
</tr>
</tbody>
</table>

Table 8. Readings for the absorbance of the samples

<table>
<thead>
<tr>
<th>Sample</th>
<th>Blank solution</th>
<th>Sample 1</th>
<th>Sample 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>0.012</td>
<td>0.204</td>
<td>0.157</td>
</tr>
<tr>
<td></td>
<td>0.013</td>
<td>0.200</td>
<td>0.156</td>
</tr>
<tr>
<td></td>
<td>0.012</td>
<td>0.202</td>
<td>0.158</td>
</tr>
<tr>
<td>Average Reading</td>
<td>0.012</td>
<td>0.203</td>
<td>0.157</td>
</tr>
</tbody>
</table>

Table 9. Conclusion of the obtained results

<table>
<thead>
<tr>
<th>Sample</th>
<th>NO(_X) Concentration (µg/m(^3))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1</td>
<td>0.172</td>
</tr>
<tr>
<td>Sample 2</td>
<td>0.130</td>
</tr>
<tr>
<td>Average</td>
<td>0.151</td>
</tr>
</tbody>
</table>

The air quality standards and permissible limits have been given in the below.

Table 10. Air quality standards in Sri Lanka for NO\(_2\)

<table>
<thead>
<tr>
<th>Average time (Hours)</th>
<th>Permissible limit of concentration (µg/m(^3))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>250</td>
</tr>
<tr>
<td>8</td>
<td>150</td>
</tr>
<tr>
<td>24</td>
<td>100</td>
</tr>
</tbody>
</table>

In the comparison of the existing results with the Sri Lankan standard norms for the permissible limits of NO\(_X\) emissions, it was not detected the hazardous conditions. Also some of following factors would be affected on the results of the experiments.

• Occurring some heavy wind and spreading the polluted air vastly to become thin.
• Due to some rainy and highly moisturized conditions some portion of NO\(_2\)/NO\(_X\) might be dissolved in the water.
• Experimental errors, errors of the analyst and the instrumental errors might have affected for the accuracy of the results.

Since the current conditions are non-hazardous, some of long term impacts of the emissions of NO\(_X\) could be emphasized as follows due to the increasing combustions of the mixture of nitrogen and oxygen gases that associated with activities of vehicle emissions and the burnings of fissile fuels [3-6].

• Formations of the acid rains and green house effect (N\(_2\)O)
• Formation of the classical and photochemical smog

The monitoring of air quality has become into the important aspect based of following reasons.

• Preventions of the spreading of pollutants
• Precautions for the mitigation of diseases and reduction of health risk
• Protection of water bodies, flora and fauna
• Maintain the equilibrium of the atmosphere

Apart from the high volume air sampler, there are using some various methods as given in the below.

• Electrostatic Precipitator
• Cyclone separator
• Bag Filter

4. Conclusion

As the results of the existing air quality monitoring, there were obtained 0.0141ppm of PM\(_{10}\) concentration, 0.0214ppm of total suspended particles (TSP) concentration, 0.151 µg/m\(^3\) of NO\(_X\) concentration and 0.015µg Pb/m\(^3\) of lead concentration of ambient air at around Peradeniya junction at the particular time interval on that day and that occasion. When comparing of those results with the relevant environmental norms and standards for the country or regions, it was confirmed that the remaining of non hazardous ambient air at around the relevant location at the certain occasion. The following suggestions are possible to be performed as the
future researches for the same region or any other region around the world.

- Analysis of the PM$_{2.5}$ concentration and PM$_{1.0}$ concentrations of the ambient air using the same methodology or any other alternative method and comparing of the results with the standard norms.
- Analysis of the concentrations of some other heavy metals such as Hg, Cd and Ni.
- Conducting of the same series of experiments or more experiments under the different climatic conditions and considering of climatic variations on the results.

5. Acknowledgement
The laboratory staff of Department of Chemical and Process Engineering, University of Peradeniya will be acknowledged by the authors on behalf of their contribution.

6. References
Regulation and importance of practical education while studying-application on the Higher Vocational College Postojna and Educational Centre of Modern Technologies-Slovenia

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Abstract: The paper deals with importance of practical education and training in system of education, its legal regulation in Higher Vocational Education Act and different regulations in Slovenia. Vocational education and training - VET - is a great way to improve quality and efficiency of study, making students more prepared for working conditions and desirable to employer. EU integration made new possibilities to improve it with programs like Erasmus+ and financing different projects regarding VET. One of the projects is presented in this paper as an example of a good connection between the school and the local economy through the construction and operation of a manufacturing learning laboratory, which seeks to reduce the gap between education and the labour market in one of the Slovenian regions.

Keywords: VOCATIONAL EDUCATION AND TRAINING VET, MANUFACTURING LEARNING LABORATORY, REGULATION

1. Introduction

Besides theoretical lessons, higher vocational schools also organize practical education which represents different aspects of theoretical knowledge. The combination of practical education and training in school is called a dual system.

The dual system is reflected in the duality of educational space (schools which implement vocational education and training, and companies which implement training), which divides the responsibility for ensuring VET, and in the duality of carriers of education (public and private), which divide the responsibility for policy and practice in the field of practical education and training. [1] The following article will present how the dual system is established in Slovenia.

Practical education is obligatory on all higher vocational schools and comprises 800 hours, which is equivalent to around 40% of the study program in Slovenia. During practical training, a student is under supervision by his mentors. They are fundamentally people with a lot of experience on a specific professional field and who try to transfer their knowledge and skills on students and help them in career development. Students can also practise abroad in the European Union by applying for Erasmus+ projects in any member state and will have their training recognized in Slovenia. [2]

2. Importance of practical education

Practical education is one of the main advantages of higher vocational studies, because the student has possibilities to familiarize with work tasks, which he will be performing upon entering the labour market. [2] Work experiences are very desirable and valued, and the lack of them presents an obstacle for first job seekers. A lot of young people get trapped in a vicious circle, when they cannot get their first job, because they do not have work experience. Practical education has proven to have a high impact on encouraging employment of young people and is one of the important reasons for low youth unemployment in some European countries.

Higher vocational schools want their students to have a strong theoretical base, to be professional and to have knowledge about specific disciplines and skills, no matter their field of study. These skills send a signal to employers that a graduate has the competencies, interest and aptitude to work in certain jobs. And for many jobs, a higher education qualification is an essential requirement. Employers often use these qualifications as a first lens to screen individuals for job. [3]

Practical education offers a student a chance to test the knowledge he received in previous semesters on a practical level by solving a defined problem for specific field or subject, which is chosen on practical education with the help of his mentor from the company or by his professor. With VET, the student acquires new knowledge, skills and experiences, which will make his future work more efficient and of higher quality. Having different skills, knowledge, and ability to adjust is crucial for success on labour market. This knowledge (as mentioned before) consists of good theoretical, professional and discipline-specific skills, good generic cognitive and information processing skills in conjunction with understanding, interpretation, analysis and communication for complex information, and the ability to use this information in everyday life. These are the essential skills, for all people in different jobs. [3]

The second advantage of practical education is the socialization of student’s work as a consequence of his integration into the work environment where he engages with the rest of full-time workers, which means that he works 40 hours per week. This way, he is able to learn the characteristics of the operational work in a selected company.

It is essential that the student is able to summarise theoretical knowledge, apply it on specific problems and determine different ways to solve it, and that he is able to manage the devices and the organization of work on which processes and technology are based. This prepares the student for the tasks he will be encountering in the work process.

3. Legal regulation

Practical education is legally regulated in Higher Vocational Educational Act, in statutory instruments, which are arising from the laws and can only regulate details of the rights and obligations, but must not impose new ones.

Because Slovenia is a member of the European Union, we have to consider acts made by institutions of the European Union. We separate regulations, which have a direct effect, directives, which have to be implemented in law system of the member state. Usually through law European Union also issues guidelines, opinions and recommendations. Guidelines in the field of higher vocational education were created within the Council of the European Union due to environmental changes, labour market and the importance of tertiary education. [4]

Higher Vocational Educational Act in Article 50 says that schools must work with employers who provide practical training. The School, the employers and the student conclude a practical training contract according to the study program. In the contract, student’s rights and obligations as well as the duties and responsibilities of the employer and the school are defined. An employer may conclude a contract for the provision of practical training for students, if he has appropriate facilities, his business comprises the activity of the profession for which the student is educated, and has an employee who can be student’s mentor. The detailed conditions for the premises and the equipment and for the mentors to be fulfilled by the employer shall be laid down by the competent chamber of the employers’ association referred to in this Article, which will keep a register of employers who meet the previous conditions referred previously. [5]
Higher vocational Education Act in Article 62 regulates content about control over VET. School inspection is responsible for control over the provisions of this Act. Labor inspection is responsible for the control over practising the right of students, which are on practical education at their employers. [5]

Higher vocational schools are obliged to fulfil the criteria for external evaluation of higher vocational schools of the Slovenian Quality Assurance Agency for Higher Education-SQAA, based on European standards: Standards and Guidelines for Quality Assurance in the European Higher Education Ares (EGS).

Guidelines for higher vocational education were created in 2017 within the EU Council due to environmental changes, including the labour market and the importance of tertiary education. The EU proposal for the European framework for the quality and effectiveness of practical education (European Commission, 2017) called for quality assurance processes to be put in place for practical education. It further sets out seven criteria for the provision of quality practical education: a written contract, a learning outcome, a component of the work environment, payment or compensation, social security and working, health and safety conditions. [6]

The standards were implemented in Slovenian act with title: Legal Act amending the Criteria for the accreditation and external evaluation of higher education institutions and study programmes. SQAA assesses the suitability of companies, institutes, institutes or other organizations to provide practical education, and to link this education with the fields and disciplines from which the study programs are proposed. In standards of performance Criteria ranks also as the fourth standard: “Practical education of students in the work environment is well organized and implemented. Resources are provided for their implementation.”

4. Educational Centre of Modern Technologies in Postojna

Higher vocational school of Postojna wants to offer their students general knowledge and professional expertise, the breadth of spirit, innovativeness and flexibility, to find their place and role in the Slovenian and European area through cooperation with the economy, which enables them to follow all the innovations of their field of study.

Before the foundation of Educational Centre of Modern Technologies the cooperation between school and companies was difficult and employers did not want to train student for full qualification (not only the knowledge and skills which the companies need) partly because they did not see benefit in that kind of education. [8]

In systems, where the VET is only performed in school and does not include external practical education the institutions kept facing problem of outdated schools syllabus, school equipment and teachers qualifications. The main goal of Educational centre of modern technologies is to reduce the gap between education and labour market. [9]

The Centre for Modern Technologies is intended to impart knowledge in the field of high technology, especially at the level of secondary vocational and secondary vocational education and post-secondary vocational education. Emphasis is on technologies specific to the field of mechanical engineering, as mechanical engineering is one of the fastest growing activities in this regional area, which means that there is big interest in new quality educated staffs. The construction of the Centre has contributed to the most up-to-date equipment on which people can acquire the various qualities of practical knowledge they will need in their employment.

In the Centre there are: 5 Axis CNC Mill, 3 Axis CNC Mill, CNC Sinker EDM, CNC Wire EDM, Start-hole drilling EDM, NC Grinding Machine, Industrial 6 Axis Robot with controller and computer classroom equipment.

On them people can developed products by planning the tools and devices, modelling the tools, programming processing strategies, producing individual tool components and starting the production cycle. The person can see the whole product production cycle.

The Centre of Modern Technologies plays an important role in the development of human resources, so it is not only intended for carrying out practical lessons, but with the help of industrial types of machines it also enables the training of staff from the economy and the unemployed who wish to advance in their field of expertise, or to move to the field of advanced meltworking. This facilitates training without disturbing the manufacture process in the company and it can significantly reduce the time required for independent work on modern production equipment. [9]
In 2016 and 2017, the school was awarded the Apple Quality award for the best project at the national level in the category “To Knowledge and Understanding through Mobility” in the field of vocational education and training. They carried out the mobility of mentors from companies, together with teaching staff. The project has contributed a lot of good effects and presents an important step in raising the quality of VET. It has achieved a positive effect on regional economic environment. [8]

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Online learning instruments as a way of cross-cultural communication

Инструменты онлайн-обучения как способ межкультурной коммуникации

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Abstract: Massive open online courses have a significant impact on the cross-cultural communication. More and more online courses become a part of modern university curriculum. This creates a way to share knowledge not only between different scientific facilities but provide an opportunity for students to take courses from top rated universities free of charge. Our research deals with the way to bring massive open online courses into cross-cultural educational field. The article deals with the translation’s editor work features in preparation for massive open online technical course to voice over and broadcasting on the example of the most popular programming course in the world “CS50 2019” (Harvard University). The main problems faced by the translation’s editor are highlighted. A step-by-step plan for the translation’s editor is suggested.

KEYWORDS: ADAPTATION, AUDIOVISUAL EDUCATIONAL PRODUCT, MASSIVE OPEN ONLINE COURSE, VOICE OVER, TRANSLATION, TRANSLATION’S EDITING.

1. Introduction

The modern world is globalized, digitalized, and innovative. New technologies not only implemented in all spheres of human life but also can create new communication and interrelations form for further development of our species. Massive open online courses’ development and introduction to the classical educational process has changed the way of educations’ representation. For centuries education was only for those who chosen by their role in society, money, or special talents. Now education is available to everyone despite social status, gender, health conditions, income, and so on.

Online courses in Ukraine appeared with the first Ukrainian platform Prometheus in 2014. It hosts over 120 online courses by Ukrainian scientists, lecturers, enterprises, international and local organizations. Localization and adaptation of Ukrainian language carried out during the week with the authors of the course.

Cross-cultural communication has become the most prominent way to spread knowledge. Now students do not have to go halfway across the world to get in touch with the specialist in their field or have first-hand experience in the particular scientific field. Massive open inline courses have opened a new way to create a learning environment suited for everyone despite all the differences.

2. Preconditions and means for resolving the problem

Modern communicational studies are considering two ways in the cross-cultural communication process – direct and indirect [1]. Within the direct communication, the information is addressed to the recipient directly from the message producer and can be made both orally and in writing. When using the oral form, a greater communicative influence is achieved, because it allows you to use both verbal and nonverbal elements. In such an exchange of information between people of different cultural backgrounds, it is essential that one of them speaks a language that is native to the other or that the recipient and the producer choose to speak. Under the conditions of using written direct communication, the creation of an adequate secondary text is important, but under the conditions of using the oral version, non-verbal components become auxiliary – facial expressions, gestures, tone of voice, etc. The use of nonverbal components can be considered both a positive and a negative phenomenon, as the recipient’s ignorance of the peculiarities of nonverbal communication inherent in the culture of a particular ethnic group can lead to distortions in the perception of information and its further processing.

In the case of indirect communication, which is almost always one-sided, works of literature, art, online publications, works of cinematography, etc. become carriers. This type of communication requires the direct participation of the translation’s editor, because the communication process takes place not simultaneously, but sequentially and under the conditions or knowledge of the recipient of the language in which the original text is created, or with the translator who acts as the recipient of the secondary message. In the process of creating a translated text, the translator due to lack of knowledge or with the involvement of other objective and subjective factors (personal attitude to the original text, stylistic features of the translated text, etc.) may make mistakes that will affect the further perception of the secondary text by the recipient and lead to catastrophic consequences in the case of, for example, medical texts, information from which will be used by future doctors in the treatment of a disease.

Indirect and direct types of cross-cultural communication are characterized by the presence and absence of a mediator. Such an intermediary can be both a person and a technical means. Technically mediated communication may remain direct (for example, by telephone, Internet, etc.), but such conditions exclude the use of non-verbal means of communication that are available in direct contact between participants in the communication process. In the case of indirect cross-communication with the help of another person or technical means, the participation of the translation editor is also extremely important, because the quality of the received message will depend on it. This is especially important in the online learning process. We can use both direct and indirect communication to conduct online courses. This way is the most unique to spread knowledge and information in education’s organization all over the world.

In 2016, Prometheus platform has been launching a pilot project to introduce blended learning technology during the online bachelor’s learning season [2]. Four top-rated national universities were involved in the project, including the National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute”, the Ivan Franko National University, Lviv Polytechnic National University, Ukrainian Catholic University. Top-rated massive open online course in the programming field “CS50: Introduction to Computer Science 2019” by Professor David Malan at Harvard University was implemented in different university in the United States in a blended format. After successful implementation in 2019 Prometheus platform in cooperation with National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute” has developed Ukrainian adaptation and further voice-over for video lectures, translation for all the texts and subtitles [3]. This course was introduced into the curriculum at 13 universities in Ukraine. This experiment is one of the first successful cross-cultural educational experiences that lead to new ways of teaching and further international connections in the future. This makes the Ukrainian educational system open for the best world practices and lecturers.

This study and experiment purpose is to create an algorithm for the communication’s organization and translation’s editing in preparation for the broadcast of a massive open online course. The aim is to analyze the available Ukrainian translations as a part of
The massive open online course “CS50: Introduction to Computer Science 2019” can be used as a model for further guidance for the translation editor as it contains all the components of a massive open online course (video lectures, abstracts, presentations, graphics, code tests) and it is on the example of this course created most of the modern massive open online courses of leading universities, including Harvard, Yale, Princeton, Massachusetts Institute of Technology, etc. Among the main features are the specifics of processing the terminological apparatus and other realities present in the texts, the preparation of the translation of the audiovisual educational work for the further voice-over. The translation developed stages processing by the editor can be further used for other massive open online courses during adaptation and for methodical instructions creation for editors of translations of educational audiovisual products.
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Tream – the strategy – basis for summative assessment and acquisition of competences

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„Criticizing is easy. Assessing is difficult”
Luc Vauvenargues

Annotation: Emerging technologies in the global world are posing new challenges to education in all degrees. Especially relevant is the challenge posed by the competency approach. The development presents an understanding of the dependency summative-competencies underlying the TREAM strategy.

KEY WORDS: COMPETENCY APPROACH, COMPETENCES, SUMMATIVE ASSESSMENT

In the recent couple of decades, strategies for improving the quality of educational-training (mostly the educational) work in school (including higher education) are sought for. A philosophy about education different from the former one emerged, where the focus is moved from learning facts to acquiring competences. As result, there are not only Ministry of Education’s requirements available, but also prosperous theories directed towards changes in the entire pedagogic interaction as well as in certain structural elements of studying and teaching (methods, organizational forms, tools). Part of them reflected directly on the style of a great part of the Bulgarian teachers – respectively, on the school life (saturating the interaction with interactive practices, with visualization improvement, with considering the principle of environment friendliness, etc.). Results are positive but not satisfying enough. There are reserves existing in the docimology procedures as one of the factors of motivation, not only of students but for teachers, too. One of them is in the summative approach.

In the present presentation, the traditional understanding of that approach as an option for objectifying the assessment¹, is not in its just traditional sense. Also, here the subject of commentary is not to what an extent the knowledge is assessed, but the attention is rather focused on its use on the grounds of the TREAM-strategy regarding accenting in the dialogue learner-trainer on the ways of managing with tasks, on the understanding and the sense and their connection with acquiring competences.² In this line of thinking, the suggested goal for a different summative assessment emerges – result of joint discussion of the results and their positive effect on the learner. Such a philosophy of multi-component (summative) assessment moves the entire learner’s view towards himself as a progressing personality. The meaning set in a study within two-years time is synthesized in the following hypotheses, if the approach is applied in practice, the following expectations exist, with reflection on:

- Regulation of the Self as an active subject concentrated on the particular aspects of its own brain activity, in the pedagogic process.
- Relief of the tension connected with the presenting and the digital assessment.
- Enhancing cooperation as a result of assessment of the others’ strong aspects and the lack of necessity to compare with them.
- Building respect for the leader as far as he appears to be rather a moderator and/or assistant, not assessor.

Strategy’s presenting is visualized schematically by a five-element structure

It premises productive teacher’s strategy regarding the goals in the process of pedagogic interaction – forming competencies. Approved with 580 students from the pedagogic specialties, in the course of school year 2018/ 19 and 2019/ 20 during seminar and practice exercises, and also during examination procedures – current and final, the strategy has been analyzed on the grounds of the results from the following applied research procedure:

- Pedagogic observation (held at first stage, focused on the competences and barriers).
- Locus of control (held at second stage – in the beginning and in the end).
- Analysis of documents from individual and joint activities connected with completion of given tasks and with freely chosen by the students tasks (held at the second stage – in the beginning and in the end).
- Study of the status of the person in the group (held at first and at third stage).

The research’s design is to a great extent dependent on time (on the curriculum) and is conformance to the experience of the studied persons from various courses – 1, 2, 4. It was structured at three stages:

- Getting acquainted with the philosophy of studying, directed towards self-improvement connected with future professional activity. Here the focus was put on assessing the activeness and the freedom from creativity.
- Practical activities connected with completion and analysis of tasks, where alongside with setting them up, the following has been clarified: variants and approaches for individual or work in the conditions of cooperation – group, team; criteria for assessment – different from the digital one, which directs the learners’ attention towards the elements of the TREAM-strategy as it turns them operative in a criteria way. Special attention was paid to the effectiveness and accompanying motivation, defined in the goals stated by the participants.
- Assessment – includes grounded self-assessment, assessment of individual and group work of various types (preparation of a project, setting up a task with certain goal, planning activities for coping with the pedagogic situation and others) – on exchange grounds (preliminary criteria are preset for it and explanation connected with: reflection, activeness, creative decisions were given.

¹ See in details, the studies financed by the Nuffield Foundation and the Information and Coordination Center „Data for the policies and the practice“, http://eppi.ioe.ac.uk
² Note under competences, the interpretation of D. Lefterov for the relation competences-competence is accepted (particularly towards general).
The locus of control understood in interrelation with motivation “is strongly dependent on the assessment about the rest (about the others)" [10, 29], considering their activity as dependent on the particular person or other factors, studied through a standard procedure, showed significant changes in the course of time. It is clearly seen on figure 1 that in the end of the period there is a significant preponderance of internal control and data for close values according to the interval evaluations of the average values of percentages for the beginning and the end of the research period. They directly correspond with the data from the held pedagogic study and prove stability of results.

The summarized analysis from both research procedures gives grounds for the following conclusions:

In the beginning:

- Students are rather uncertain; they think that mostly external factors influence the educational process quality.
- There is relatively great number of individuals that are lead by their emotions and act impulsively as result.
- There is lack of skills for making plans and prognosis.
- Great percentage of participants tends to reject acting.

The summarized opinion is that relatively bigger share of participants have external locus of control. In the end there are significant differences in the following directions:

- The number of students, who demonstrate persistence and confidence, is great.
- Emotional intelligence advances.
- There are competences for planning.
- The results are mainly connected with the own efforts.

The locus of control is considerably changed and stable – from external to internal one.

The results of the status change, according to the data, received while studying the group dynamics (by periods, series according the statistic procession and the summary assessments), in the beginning – series 1 and at the end - series 2 of the study for all groups is showed graphically on fig 2.
There is a range of percentages relevant to the comparative analysis of the stability indexes (\(X^2\)). They clearly show that in the end of the work period the group of the outcast individuals is insignificant, while the one of the accepted has grown and manifests sustainability.

As it became clear, the empiric work efforts aimed to prove the inconsistency of traditional assessing in relation to the needs of acquiring professional competences. At the same time, they were directing regarding approbating an adequate docimologic approach based on target strategy directed not towards certifying at academic level but towards a socially adequate number of goals connected to establishing the following:

- Indicators for successful competences of national significance in the context of the profession that serve for real change in the assessing practices with view to optimizing studying in personal aspect, through assessing.
- Change in the relations in the studying groups from individualism to community.
- Humanization of study environment through clearing the sense for accumulation of many facts and focusing on the personal growth according the student’s individuality and the needs claimed by the profession.

The concrete results justified to a great extent the efforts and can be synthesized the following way:

- There is change in The Self as an active subject – developed skills for analysis, synthesis, planning and making prognosis.
- Creative thinking and personal motivation for acquiring professional competences are fact in the process of work – this is another reason for the dropping out the focusing on assessment and the tension connected with it.
- There is available extended formal and informal dialogue, in which center are: discussing the goal of studying and the ways for improving the studying process, assessment of the progress in it for each of the learners, its steps, the possible and necessary cooperation.
- The self-assessing procedures have improved as well as the overall evaluation of the studying process, which leads to change in the relation student-teacher in the direction of respect, looking for support and cooperation.

Recently, we witness new needs connected with studying and teaching – organizing technologies for synchronous and asynchronous interaction and use of variety of technologic competences – work with interactive tools, combining interests, groups and individuals for performing organizational and educational tasks, etc. There are more and more components of the suggested strategy coming with them – mainly: activeness, motivation, creativity, effectiveness. Results prove the effectiveness of the held research and direct to new searches connected with developing the general professional skills as: assessment of fake information, keeping virtual space from unwanted interference, preserving and transmitting data of various access (off-line and on-line), web-services with wider publicity, blogs, forums, etc. Work on the following is forthcoming:

- on-line and off-line consulting;
- practical convincing about the sense of educational goals and the personal aspect;
- change in the learners’ values connected with studying;
- building various structures in teachers’ professional interactions – respectively, processes.

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3 Note „outcast“ in this case is a criterion that includes three indicators for acceptance in the group
From cognitive dissonance overcoming to developing creativity

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"I sometimes think that creativity is matter of recognizing, or stumbling in non-obvious similarities between things-like coming up with a fresh metaphor, but in quite a complicated dimension.”

David Mitchell

Annotation: The present work tries to present possible variants for developing the creative beginning through overcoming the cognitive dissonance. It looks for balance between the traditional pedagogic interaction aiming academic achievements in certain strict framings and achieving creative manifestations. There are accents not on following algorithms and rules but rather on human behaviour in school environment, modeled according to the learner’s abilities in order the cognitive dissonance to be overcome.

KEY WORDS: COGNITIVE DISSONANCE, CREATIVITY

We are piled with rules, norms, requirements, prohibitions, standards in the pedagogic process. The so defined reality does not pay attention to the cognitive dissonance, in the learner’s subjective world. The result is not good – lack of motivation (according to some of the authors, the cognitive dissonance is „theory about human motivation”) for studying, dropping off school or in the best case – memorizing not rationalized facts, objective laws without personalized rationalizing.

The great sense of the philosophy of education is not in memorizing but in standardizing. It is in the development of potential creativity through understanding yourself, of your strong sides. For that reason, cognitive dissonance should be overcome. Leon Festinger (Festinger, L., 1954) describes it as feeling for „psychological discomfort, provoked by the combined presence of two thoughts that do not derive from each other. According to him, there is directly proportional dependence between discomfort and the desire for dissonance reduction of both cognitive elements.

Accepting the cognitive dissonance theory, according which people’s beliefs change if they act in contradiction with them, we think the activity approach is good base for the goals we set – achieving creativity through cognitive dissonance overcoming.

What a dissonance is meant in this case? The dissonance between the necessity to keep exact steps, rules and standards during the pedagogic interaction and/or individual studying and the wondering, asking itself and making out the world child in each one of us, the desire for insight and a unique manifestation of the self”. One of the most often seen dissonances is whether to learn the algorithm for solving for example equations or to copy the homework. Another one – shall I follow the steps and to achieve result that would bring me approval or to go beyond the obvious because it is interesting, i.e. to allow myself to think critically! People rather choose the successful alternative because of the illusory success. Illusory, because in life, creators ate the really successful, not the ones who just memorize knowledge. But the learners from the very primary education are persuaded they should not make mistakes and thus they get addicted to confirmations¹. Such consequences have negative social reflection – withdrawal into self, lack of interest, going down to the level of mediocrity in order not to be rejected, occurrence of doubt regarding the own strivings…. Something more – all this is in the base of taking decisions and outlining perspectives before the own self. Despite Matz (Matz, 2008) and other psychologists put a dividing line between the cognitive dissonance influence with extroverts and introverts, nobody denies it upon the various typologies, which defines the actuality of the issue’s review.

Adding the docimologic procedures that accompany learning, it becomes clear that cognitive dissonance is a significant factor in learners’ life at all ages. Then the question of can we and how to turn cognitive dissonance into a helper in therapeutic practice and how to do it emerge?

The first step is to stop competing with the others, to allow ourselves being ourselves and doing the things our way, to accept we can make a mistake. And to continue competing but with ourselves. The stages are:

• Rationalizing the goals;
• Knowing ourselves – strong and weak sides;
• Accepting plan and defining concrete practices for changing of mindsets and beliefs;
• Building criteria for self-assessment.
• Creating psychological mindset for grounding and protecting of a point of view;
• Deriving the positive sides of the experience;
• Creating balance in the understanding between the internal and external locus of control.

• The next step is associated with:
• Getting acquainted with new information, understanding about its essence regarding change of own beliefs as base for future activities;
• Analysis of our beliefs aiming confirming or rejecting part of them being reason for the dissonance;
• Review of people’s statute (authorities and power), with which dissonance and their influence is associated with, as reason for the dissonance occurring, connected with the cognitive sphere; Analysis of the personal characteristics possessed by the ones, who have influence upon us – physical and intellectual, and building strategy for preserving stability, having in mind the own understandings, goals and values;
• Analysis of the tasks, where the dissonance comes from.

In a generalize view, the steps aim improving the understanding about: yourself, the others and the tasks aiming overcoming the dissonance. The means and approaches for practical realization regarding the creativity typology vary in a wide range. The art-therapeutic’ means’ role is significant. The reasons are:

• Proved positive effect on ill people in clinical practice, through improving indicators for the immunity.
• Help reducing anxiety, i.e. deactivate the brain centers that activate also at strong physical pain.

¹ See the more detailed accepted combination of words „addiction to confirmations “, derived by psychologists

² Author’s note Art-therapy comes from: „art” (art) and „therapy” and as of now, has gained the meaning of „part of medicine that deals with defining the ways for treating the various diseases “. At the same time, it has been introduced as psychological-pedagogical practice.
Visualization through single and massive visual compositions and models.

The technique suggests individual use of a variety of materials and their combining. This fact, on its own, contains potential for creativity manifestation.

The specific of the art-therapeutic means broadens communication adding to visual to the speech one.

The use of art-therapy for improving various components of behaviour (aesthetic, musical, etc.) incites thinking activity to side and alternative thinking.

Interactive model

A productive approach, with possibilities for stressing on creativity through overcoming the cognitive dissonance is the interactive one. In the process of learning through experience, the growing ups deepen their interests because of negative assessing fear dropping off. The work with comicses and collages could be uniting element in the process of the interaction between art-therapy. Considering that according to the French origin of the term „collage“ it is meant: „application, combination of various elements, attaching“ and the essence of the term „comics“ as „type of creativity“ (Wechsler, A., 2011) and the essence of collage as „Fairy tale of adventure’s story, delivered with series of pictures and short texts“, it becomes clear that a good directions could take the learners to an emotionally positive way of learning, for achieving creativity, through overcoming the cognitive dissonance. Each of these techniques is to be well chosen and taken into consideration with:

- The age of learners and their experience.
- The possibilities for composite presenting according to the contents.
- The right materials for each single task.

Standing behind the idea for the described possibilities for reaching creativity through overcoming cognitive dissonance, we do not stand that there aren’t any others. Fairly tale therapy could successfully be one of the practices, but it occupies special place in the work with individuals and groups of various age and possibilities, so it deserves special attention. At the same time, it could combine with the pointed means and to be their natural logic extension.

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1. Introduction

It is natural and normal to identify from time to time the disputability or doubtfulness of certain knowledge, which objectively confirm its transient nature. The truth is that we have the ability not only to approach the reality as such, but also to master it to a great extent. In that context, the statement made by the UN SDG that the importance of "personal fulfillment is objectively even more important than the sustainability of the global economic growth, taking into account the preservation of natural factors of the human society (environment, climate, etc.)" and is of a universal nature, represents an outstanding event [Report on Human Development in the Russian Federation, 2016. Sustainable Development Goals of the UN and Russia].

All the more so as with the exponential distribution of INDUSTRY 4.0 achievements in the world, which are becoming part of our daily routine at an incredible speed, personal fulfillment will be probably comparable to overcoming the sound barrier in the atmosphere, enabling us to escape at an incredible speed from the "trap" of the economic slavery of the Kingdom of Necessity, explored by K. Marx, to a different social space being the supra-economic environment developing under the fundamentally different social laws. The UN Report describes how the most important areas of the human life may change by 2030 in accordance with the set sustainable development goals and how our "common" home on this planet should look like.

However, we have only very rough information about those, who will live in this world and effectively use their spiritual, moral and physical potential representing, in fact, an infinite ocean of the human wisdom, knowledge and abilities, which the society will master to achieve the goals set by the UN SDG and even see new horizons, more monumental and dramatic goals: about the "human" society (environment, climate, etc.) and is of a universal nature.

In addition, his nature, designation, self-consciousness and, of course, the goals of his evolutionary and cyclic development should be undoubtedly consistent with the fundamental existential goal! In the end, it is about the way a person uses this unique tool (his own potential) in his "journey" through the fields of space and time. Its components in combination with the internal and external world in the "apartments" of our future "common" home. After all, seventeen sustainable development goals of the UN are only the basis, the "foundation" of the house, the beginning of the way, if you like, which starting point lies in more and more complete satisfaction of continuously growing and steadily rising "human" needs!

The upcoming studies of the human potential and identification of the ways for its effective use, which is still a very rough idea, will hopefully reveal the secrets of our present and, to some extent, our future! The human consciousness being the spirit, sense and will of each person, is inaccessible to physical experiments and mathematical calculations. Its investigation lies beyond the limits of physiological and mathematical paradigms. In the infinite objective reality there are cognitive objects inaccessible to physical experiments and mathematical calculations, as the physical, experimental studies cannot even cover the material substance of the existence, let alone its fundamental spiritual nature. Moreover, "Exact experimental science has nothing to do with public morals, virtue, philanthropy... It is an even-handed classification of facts outside of the human, existing before and after him..." [1. Mahatmas: Legends and Reality. M., "Sphere", 2001, p. 277]. That is why, we first need to study and understand not the physical phenomena, but noumena. In order to understand the former, we must first understand the latter. This is a "very old principle: "Ideas rule the world" and "no matter how wonderful a physical phenomenon is, it cannot explain to a human his origins, the relation of the mortal to the immortal, the temporal to the eternal, the finite to the infinite." [2. Mahatmas: Legends and Reality // M., "Sphere", 2001, pp. 242, 273].

2. Results and Discussion

The HUMAN being the great mystery of the infinite cosmos and nature is "the product of cosmic deities and spiritual entities (beings), and each such deity or spiritual being expresses itself through the human, who is a temporary home that they have built." [3. Mahatmas: Legends and Reality // M., "Sphere", 2001, p. 370]. Due to his dual (spiritual and material) nature the human first manifests the abilities of his material, carnal nature being the repository and conductor of his instinctive "animal soul" of the human, his "lower Self". The instinctive "animal soul" refers exclusively to the lower psychic mind, which develops into intelligence as a result of the quantitative growth and improvement of brain cells, their enhanced sensitivity." [4. E. Blavatskaya - Black Magic in Science. Amrita-Ural. Magnitogorsk, 1996, pp. 104-105]. At the same time, only the drivers of the conscious human activity can make any use of these abilities beneficial or harmful. That is, the powers and abilities of the animal (instinctive and psychic, "lower Self") nature of a human can be used with equal success by honest, unselfish, upright people, whose consciousness is dominated by their SPIRITUAL HIGHER "SELF", and by people, who fail to have sufficient will to fight against their desires and lust of their "lower Self".

But what is the "Higher Self", its role and importance in our life? This is the presence in each person of an immortal "Divine Mind", a principle designated by the dedicated as the Higher Manas or House (Supreme Intelligence or Ego) "with its pale and often distorted reflection being called "the Mind" and intelligence of a human: Kama-Manas meaning a rational, but earthly (physical) intelligence enclosed in the material shell of our body and constantly experiencing its influence. Whereas the Higher Self is the source, the "guide" of the intellectual element, the lower self is the source of the psychic, or earthly "wisdom" exposed to "carnal desires always inherent in the living body." [5. E. Blavatskaya Black Magic in Science. Amrita-Ural. Magnitogorsk, 1996, pp. 127-128]. A curious reader will certainly ask about the essence of these components of the human, and then many questions arise: "self" and "Self" are united, but what is this uniformity about? Is it the unity of soul and body? But what is the body and what is the soul? What are their origin and purpose? How do they interact? Who or what directs the human action and what is the meaning of human relationships?

For example, the structural "Self" is believed to be a very complex notion common to all people in both psychological and ontological dimensions, enabling us to speak about the "psycho-physiological "Self" and the "ontological "Self": while the former is rather "that...
In the search of the answer to these and many other questions our inquiring "Self" is wandering in the maze of its own consciousness, somehow reflecting the reality, eager to learn about itself: who am I, why do I live as a man, as an element of one or another socioeconomic system, and what has determined my presence, position, role in the system, in this country, in the family, where I was born, where I live, suffer and will eventually end my life? Doesn't that patient, irresistible impulse for knowledge, light, justice, and DIVINE love originate from the sources of the DIVINE SPIRIT? Why are we not in a hurry to apply the DIVINE SPARK given to us, the drive for knowledge (light), sympathy, and finally philanthropy in opposition to our own animal-material, selfish nature, obediently yielding to the "animal" inside the man? It is hardly possible to give any reasonable arguments to doubt that the repository (the nest) of carnal desires that overwhelm the man is, quoting Elena Petrovna Blavatskaya, the human body (their carrier), the instinctive "animal Soul", (1) or the "lower Self". [Fig.1] The latter is certainly opposed to the individual or Human Soul, (2) completely determined by the Mind (4) blessed by the divine spirit - the "Higher Self" (3) of the man. (2) "... in its highest aspect (5) [it] consists of spiritual aspiration, will and divine love"; whereas "... in its lowest aspect (6) [it] is comprised of animal desires and carnal passions perceived from its carrier, who is the repository of all these desires and passions" describing its "psyche" (7). [9. E. Blavatskaya Black Magic in Science. Amrita-Ural. Magnitogorsk, 1996. pp. 30-31]. "Being in the middle, (2) in its desire to reconnect with the higher divine spiritual nature it always approximates it when it manages to overcome (under the influence of its "Higher "Self") the "animal" inside the man" that is its "lower "Self"."

![Figure 1](image)

**Figure 1**

The Figure of the CHARIOT shows the ratio of all human guides in the Platonic and general ancient Vedic thought: the chariot itself is the body, the horses harnessed to it mean the senses, the driver is the mind, the passenger is the Higher "SELF" of the man participating in the conduct of higher energies (inner man) through the manifestation levels.

In the search of the answer to these and many other questions our inquiring "Self" is wandering in the maze of its own consciousness, somehow reflecting the reality, eager to learn about itself: who am I, why do I live as a man, as an element of one or another socioeconomic system, and what has determined my presence, position, role in the system, in this country, in the family, where I was born, where I live, suffer and will eventually end my life? It is impossible to solve the mystery of the human mind in its highest, spiritual manifestation or rather in its dual aspect (the psychic and intellectual (manasic)) or to understand even the issues associated with it on the material level and its exposure to the
intellectual principle of the man until the existence of this duality, that is the presence of the lower, psychic mind (6) or the thing, which develops into the intelligence in the man, (8) along with the supreme (or divine) intelligence (5) is accepted and assimilated. [10. E. Blavatskaya Black Magic in Science. Amrita-Ural. Magnitogors, 1996, pp. 104,106].

A synthesizing mind, the mystery of human choice and behavior cannot be explained or justified by the unique thinking ability of the human based only on his physiological characteristics and brain activity, which develops and functions together with the body primarily under the laws of the material world, which has no spontaneity and where everything depends on the needs. [11. Physiological Psychology, G. T. Ladd, Philosophy Professor at the Yale University].

Our mind is "a rational spiritual principle of a human in its highest aspect striving for the spirit, will and divine love" [12. E. Blavatskaya Black Magic in Science. Amrita-Ural. Magnitogors, 1996, pp. 30-31, pp. 30, 31, 123, 124] guided by the "teacher" to the sanctuary of our soul: our "HIGHER SELF", where it interacts with its material carrier (the human brain) and, quoting Professor J. T. Ladd "...acts and develops according to its own laws, but is tightly bound with the material molecules and masses making up the substance of the Brain." [13. G. T. Ladd]. Although its nature is immaterial, it can be identified and studied through a set of acts (phenomena) representing the result of its interaction with the material molecules of the brain. "...The synthesizing action [of the Mind] cannot be explained by any physiological process, and the description of any of these processes cannot be even reasonably associated with this unique thinking ability." While temporarily separated from its material carrier (the human brain), in the process of their interaction, the Mind, in turn, becomes the carrier of its higher mental abilities: the source (organ) of the will of the physical, earthly man. [14. G. T. Ladd.]

The use of the unique technical and technological achievements of INDUSTRY 4.0 is obviously under the control of the Mind, which determines and has always determined the direction and strength, tools and scale of impact on the world around to achieve its own goals. This exceptional phenomenon cannot be explained only by the presence, configuration and functioning of the individual nervous system, including the brain, but it brings us closer to the inevitable awareness of the activity of our own actual "Self", which unites and guides all our perceptions, experiences and activities in the right direction, according to each of us, through the Mind, blessed by the "TEACHER" in the sanctuary of our soul: our "HIGHER SELF". Since the driver at the car wheel does not produce the fuel for the engine, can we declare that he does not control the car movement? The mind captured by the fluids emanating from the "Teacher" in the sanctuary of our soul is the only intermediary between the physical, earthly man and his SPIRITUAL HIGHER "SELF" and the only tool, the key to solving the mystery of the intelligent (mental) activity of the human guiding his energy to achieve its own goals. Even if we take into account that our daily, hourly thoughts and actions are driven by a lust for property and power and persistently follow the range of temporal problems (prisoners of animal instincts, vanity and other "worth" earthly duties). Since the source of mental phenomena is far beyond the activity of the brain molecules, the "TEACHER" in the sanctuary of our soul, or the "divine spirit, whose consciousness is based on and entirely determined by the Mind", [15. E. Blavatskaya pp. 30-31] saves it (our mind) from the risk of being dragged down into the world of animal desires and carnal passions and swallowed by the gulf of the material "kingdom" of necessity.

3. Conclusion

The era of socio-economic formations of K. Marx, which is coming to its end, lacks the mechanism of automatic coordination between economic and other social values and sustainable satisfaction of human and social needs.

In the era of the dominant and, quoting K. Marx, predetermined (by whom?) "material-economic social factors and relations", our self-consciousness forms and supports some kind of semi-human existence imposed by the despot and master of the majority: the lower "mind" or our "lower "Self".

This disease of our consciousness, CORONAVIRUS, if you like, nestled in the human and public consciousness hundreds of millions of years ago, at the dawn of modern civilization, but only nowadays it has manifested once again in such a devastating manner here on the physical level in our bodies.

Only a RADICAL turn of the self-CONSCIOUSNESS and the MIND granted to us towards the true and comprehensive definition of the HUMAN not limited only by his "animal" nature, will be the beginning of salvation (overcoming) from the disease that is killing us.

The foundation has already been laid. Sympathy, cooperation, unity in overcoming the terrible disease, the desire of all segments of the population to be useful, sacrificing their financial fortunes, their health and the lives of our dedicated medical professionals to recover and protect ourselves from the virus: all these are the real life-giving sprouts of the recovering self-consciousness of every individual and the society.

After the victory over the CORONAVIRUS we have no moral right to get back to the "creeping economism": bank interests, profits, financial conditions and "pyramids" of speculative and oligarchic nature, various funds and savings, both "necessary" and disappearing at yesterday's news, along with endless and dead-end rhetoric of concern for the welfare of the human and the whole country, fading without any visible positive changes in the people's daily life.

At this critical moment of the objectively required historical turn of our civilization to knowledge, light, sincere love to people and all living beings as a result of dedicated spiritual aspiration, recollection and testing of our moral priorities, our spiritual maturity and historical willingness to make this monumental turn, to step into a different, hard-fought and necessary social space is being verified. To make this step to the space, where the HUMAN is the GREATEST VALUE, while the economy is just a tool transformed long time ago into the social reproduction goal, where the HUMAN as the main productive force seeking for the economic profit "trapped" himself in the economic slavery, which he had personally created.

The extension of the dedicated, inspired aspirations to their "Higher "Self" in the consciousness of people, and most importantly of the ruling elite, will certainly strengthen the material base in the struggle against coronavirus and not only against it, will save many from premature death, and what is even more important, will release the human heart, the human mind from "the golden calf", which nestled there, and from the "lower" human, who fell down before it! The MIND blessed by the DIVINE SPIRIT representing our "HIGHER SELF" is the only tool capable to make an inevitable and reasonably required radical turn of the entire system of reproductive relations under the modern conditions. This would be the turn of all social institutions: health and social security, upbringing and education, training and retraining of the manpower, physical education and public services, cultural and educational services, etc., but above all the spiritual, moral and intellectual potential of a person in their consistency with the fundamental social reproduction goal. After all, our historical retrospective is well known for an infinite number of sad examples, when even ignorance and poor awareness of a HUMAN as the main productive force of the society "are better than mental knowledge without Spiritual Wisdom to illuminate and guide it." [16. E. Blavatskaya The Voice of Silence. M., "Sphere", 2001, p. 47].

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Engineering ethic – course at University of Montenegro

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Abstract: This paper gives the presentation of the engineering ethic course at The University of Montenegro. Several events that as engineering, but not only as engineering, solutions had catastrophic consequences influenced the popularization and more and more frequent considerations of the engineering ethic, hence it forced the engineering profession to face with deficiencies in technical and executing practice, as well as the standards of ethic. There are few universities in the world in the area of technical faculties where an engineering ethic is studied. The syllabus of engineering ethic at The Faculty of Mechanical Engineering in Podgorica has been divided into six parts, according to the principles and standards of traditional ways of the studying engineering ethic.

KEYWORDS: ENGINEERING ETHICS, ENGINEERING ETHIC COURSE, SCOPE OF ENGINEERING ETHICS

1. Introduction

Former president of the USA, Herbert Clark Hoover, argued that an engineer’s responsibility is higher in comparison to the members of other professions because his works are highlighted, placed on an open field and everyone can see them. An engineer cannot simply hide his deficiencies by attacking his opponents, hoping that people will soon forget them. An engineer cannot simply negate that he had done something [1]

Samuel Florman argues that a conscience is the basis of the engineering ethic. This theoretician doubly considers an engineer’s conscience. On one side, conscious engineers, for him, are professional engineers. Florman estimates that 98% of engineers’ mistakes were caused by their inexperience, while remaining 2% include greed, fraud, dishonesty and negligence. [2]

Everyone makes mistakes, but no one is not paid to repeat his mistakes. Hence, the measures taken for observed non-concordances tend not to repeat these mistakes.

Everything is easy when mistakes are small, and consequences minimal.

Problems always rest on bigger misses. They are visible, although they are often tried to be hidden.

Profession must be respected. The occupation’s professionalism must dominate.

Such type of professionalism must comprise an ethic.

This was the main reason for introducing ethics onto the engineering field. Everything that engineers do, poses its effects on others. Since the subject of professional ethics is the way on which members of any profession should influence others during executing their professional tasks, engineering ethic is one of the engineering aspects, hence the education of engineers should have a course of engineering ethic. [3]

This paper presents the need for studying of engineering ethics and presents the standards valid for engineering ethic. The traditional approach is the basic guideline and course taught at The university of Montenegro.

2. Historic observation

Based on papers [3], [4] and [5], historic development of engineering and the inclusiveness of ethic in this process can be expressed through five phases:

Phase one: The creation of specialized schools of technical engineering education such as the École Nationale des Ponts et Chaussées (founded 1747), the École Polytechnique (1795). In Britain in 1812, a special Royal Engineering School was set up at Chatham as a result of the experience in the Peninsular War that revealed the importance to the outcome of the war, of fortifications. The University of Karlsruhe was formed as a polytechnic school in October 1825. The basic role of responsibility of soldiers is to obey orders; together with technical engineering competency this role responsibility is inherited by the engineering corps.

Phase two: The creation of professional engineering societies independent on the military. Examples include the British Institution of Civil Engineers (granted a royal charter in 1828) and Institution of Mechanical Engineers (1847), the American Society of Civil Engineers (ASCE, in 1852) and American Society of Mechanical Engineers (ASME, in 1880).

Phase three: Formulation of the first explicit codes of conduct. The explicit adoption of codes of conduct by professional engineering societies did not take place until early in the 20th century. Such obligations are, for instance, the primary obligations of the 1912 code of the AIEE and the 1914 codes of both the ASCE and ASME.

Phase four: Ethics code revision. In response both to further changes in the profession itself and to transformations of the societal context within which engineers work, revisions and reformulations of ethics codes began to take place in the middle of the 20th century

Phase five: New engineering challenges. Rapid development of new technologies, demands of Industry 4.0 and fast spending resources, drastic endangerment of the environment and alienation of a man, ask and should establish new ethical principles demanding a total management of responsibility and specific forms of societal responsibility that cannot bypass even engineering profession. In the 1980s, intensive campaign for the inclusion of ethic in the process of engineers’ education began.

Several events influenced the popularization and more frequent thinking about engineering ethic; that, as engineering, but not the only exclusively engineering solutions, had a catastrophic consequences, hence this forced the engineering profession to face with deficiencies in technical and executing practices, as well as in the standards of ethics. Only some of them are listed:

1. Chernobyl – nuclear catastrophe [6], [7]
2. Ford Pinto - cost benefit analysis [8], [9]
3. Challenger and Roger Biosloy (first whistle [9], [10]
5. Pad DC-10 – opening doors of a storage space. [12], [13]
6. Earthquake in Fukushima [14]

It all had lead to defining 5 crucial reasons for the studying engineering ethics in the education of engineers, and these are the following:

1. Argument of ambivalence. Contemporary technology is twofold, and its effects are ambivalent, namely the basic knowledge is used for good or bad purposes
2. Argument of use. New technologies and new technical skills are not ethically neutral, because each of them influence the nature and acts inside a society, hence an engineer must have an opportunity to prove each his activity taking ethics into consideration.
3. Global argument. Contemporary technology and technologies are omnipresent and thus represent global dimensions both in space and time. Far-reaching consequences of some of new technologies are not possible to be foreseen.

4. Argument of solidarity. Present activity of technologies must respect the principles of ecologic etc. Hence, it is reasonably to warn of natural values, saving resources and ownership rights and discuss about the development of global ethics and total management of responsibility.

5. Metaphysical argument. Apocalyptic potential of technology can jeopardize a man’s existence, hence ethics reasonably faces with the metaphysical question if and why the mankind should exist? [16]

A significant impact on the development of an engineering ethic are the changes in accreditation criteria for US engineering schools. Accreditation Board for Engineering and Technology (ABET) recommends the study of ethics so that students acquire ‘an understanding of professional and ethical responsibility’, will potentially elevate the prominence of instruction in engineering ethics and the societal context of engineering. [17], [18]

UK STANDARD FOR PROFESSIONAL ENGINEERING COMPETENCE indicate five generic areas of competence:

A. Knowledge and understanding
B. Design and development of processes, systems, services and products
C. Responsibility, management or leadership
D. Communication and inter-personal skills
E. Professional commitment

It is recommended for a part of area E that the professional review involves the demonstration of, or discussion of, your position on typical ethical challenges [19]

Based on papers [20], [21], [22], it can be stated that the scope of engineering ethics comprises the following;

1. Ethical Theory & Moral Reasoning
2. Profession and societal role
3. Engineering responsibility
4. Global issues
5. Engineers’ rights
6. Engineering & Business (figure 1)

Figure 1. The scope of engineering ethics

The application of new scientific achievements, development of new technologies, more and more highlighted demands for unavoidable use of Industry 4.0 indicate new engineering challenges, as well as ethical problems. Today, engineering knowledge becomes out-of-date within four years, hence it places a constant need for innovation of knowledge, and engineering ethic as well. (Figure 2) [23]

Figure 2. Outdating of knowledge in the engineering ethic.

Therefore, new dilemmas have already been placed in front of engineering ethic which should take into account a total management of a profession’s responsible activity, and eliminate traditional ways of studying. [24]

3. Engineering ethic – general

Like all other professions, engineering ethic develops itself as a group of values and norms that engineers should respect while doing their professional work. [25]

Engineering ethic belongs to the professional ethics and it researches and sets standards for engineering obligations towards the public, ordering parties, employees and their profession. As it is obvious according to the Figure 3, engineering ethic belongs to professional ethics, while informatics, ecological and business ethics are separately treated due to their social importance. [26]

Figure 3. The division of ethics

An engineer in a professional sense should offer solutions based on his competence and knowledge, but he cannot act morally though he is constantly pressed by a tendency to constantly find the most economical solution.

During demanding education process, engineering skills must be initiated (a little bit of it is present in practice).

The most comprehensive value in engineering is a responsible professionalism. This topmost value implies to four categories:

1. Virtues of concern for a public good – focused on a client’s and the public’s benefits. A minimal virtue is benevolence, namely a tendency not to make damage to other people. As Hypocrite once concluded saying about medicine: „Above all, do not make damage”. Engineering code of ethic professional behaviour rest on benevolence, prevention and removal damages made to others.

2. Virtue of knowledge – means management of technical skills characterising good engineers. Therefore an engineer in his education phase must posses both practical and theoretical knowledge, and thus well prepared for the jobs he executes. Within
his activities, an engineer, especially today within the technological society with a higher rate of changes, must be creative.

3. Virtues of team work – are very important because they enable engineers to work with others from his and other professions. They include collegiality, readiness to cooperation, loyalty and respect for legitimate authorities. A team, of course, must be managed by leader quality in responsible use of power and skills to motivate team members to follow set goals.

4. Virtues of self control – represents a virtue that means calmness and thinking based on facts, enabling thus affection and transition from thinking into an action. Therefore, this virtue assumes; self control, perseverance, loyalty to principles, self-respect and integrity.

A practical use of ethical principles in engineering activities is a key problem of engineering ethic. Engineering ethic can be equalized with no one theory of ethic, because the field of its activity is the tendency to achieve a solution which is adjusted to technological achievements and clear ethical principles such as dedication to truths, objectivity, security and similar.

Within such an ambient, an engineer makes decisions based on his knowledge that means the respect for laws and standards of his profession, based on engineering methods and skills as well as the use of scientific discoveries and mathematics, what is related to quality, security, health, the environment ... (Figure 4)

**Figure 4. The impact of engineers' decisions**

Of course, engineering task is almost always creative, hence an engineering decision itself is based not only on this given knowledge, but also must respect moral principles expressed in engineering ethic, to respect legal norms, all accepted standards, more and more, but it is impossible for it not to be often in a sandwich of power and culture. (Figure 5)

**Figure 5. The dimension of engineering decision**

Engineering ethic indicate three following key engineering duties: legal, professional and moral. This relation is presented in Figure 6.

As presented in Figure 6, the first quadrant is the only one of eight in total where the condition of professional, moral and legal is satisfied.

The way on which such choices are determined, analysed and retained, or given up, makes the basis for the research of engineering ethic. The assessment of engineering ethic, regardless of the fact that this term is very unpopular, is the way to prove that in this area there are choices that basically contain moral elements in itself.

4. Engineering ethic – The University of Montenegro

The most frequent causes of engineering solutions, leading to a nonconformity are [26]:

- Insufficiently wide sights, which in the form of very narrow sights oriented to traditional ways, cannot see convenient alternatives, and in form of a group thinking promote a conformity against a critical thinking.
- Incompetence of an engineer who perform technical tasks.
- Shortage of time or shortage of adequate material, what can be assigned to bad management.
- Introvert mentality keeping information inside individual chambers, instead to share them with others.
- Idea that there are engineers for security somewhere along a hierarchy line, who will care about possible problems.
- Improper use or disposal of products by unconscious owners or users.
- Dishonesty and pressure from management to bypass rules.
- Neglect of the functioning of products after being sold and during their use.

Therefore an engineer, in constant consideration of his solutions, must also respect ethical issues and to treat permanently his process.

Engineering ethic should be today studied at all technical faculties.

Thence this course has been established at the University of Montenegro since 2016.

This course, as compulsory, is attended by the students of study subject mechanical engineering, while the students of study subject Road transportation (The faculty of mechanical engineering), as well as the programs of Energetics and automation and Electronics, Telecommunications and computers (The faculty of electrical engineering) attend this course as optional.

About 350 students at the first term of their first academic year attend this course annually.
The first part that is related to the historic development and societal role of engineers, profession and engineering profession is studied in order that students understand the importance of their profession, its characteristics, and the way of defining profession. Since this subject is positioned in the first term, engineering is supported on the profession. The basic characteristics of engineering activities, activities most frequently performed by engineers with the historic development of engineering profession in the context of four industrial revolutions are given. The separate part is given by the relation of the engineers’ competence once and today.

The division of ethics is presented in the second unit. The stress is on the relation between ethics and moral. Ethical principles also belong to this part. Of course, five ethical tests are indicated. A separate part is dedicated to a moral reasoning.

The third chapter is crucial for engineering ethics. The biggest part of learning is related to an engineer’s duties, ethical problems with which an engineer faces and the ways of problem solving. Since the responsibilities and competences are the assumptions for successful functions of engineers, these occupy special place in the studying. This part comprises engineers rights, engineer’s virtues, privacy, corruption etc. Since a profession is recognised through ethical codes, codes of ethics in: Engineers chamber of Montenegro, the university of Montenegro, ASME, IEEE...are presented.

Learning is a complex process, it occurs when an engineer himself experiences any situation or see others facing a situation. Learning by mistakes is very fine teaching techniques or teaching method generally speaking. [27] From this reason, case studies of internationally known (12 examples) in the fourth part and Montenegrin specific (6 examples) in the fifth part are studied.

As engineering ethics must be observed in the context of its environment, globally as well, the basic ethics of business, ethics of the protection of the environment and information ethics are studied. Hence, the final part of the syllabus is related to short overview of these ethics and their interdependencies with engineering ethic.

5. Instead of conclusion

Engineering ethic today should be taught at all technical faculties.

Several events that as engineering, but not only engineering, solutions, had catastrophic consequences influenced the popularization and more frequent thinking about engineering ethic, and it forced engineering profession to face with the deficiencies in the technical and executing practice, as well as standards of ethic.

The recommendations of accreditation bodies for high education obviously have important impact on the inclusion of the course from Engineering ethic at all technical faculties.

Key arguments for inclusion of engineering ethic are: ambivalence, applicability, solidarity, globalism and metaphysics of engineering activities.

The majority of authors agree that six key areas present the determinations of the engineering ethic course, and these are: profession & societal role, ethic theories & moral reasoning, engineers’ rights, responsibility, global impact and engineering & business.

All these assumptions were the basis for the establishment of the engineering ethic course at The University of Montenegro that has been taught there since the academic year of 2016.

Since this course has been traditionally taught based on the examples that had undesired consequences, separate part of the course is dedicated to the studying of such internationally known cases, as well as the specific, less known, Montenegrin cases.

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Analysis of mcgregor, aldelfer and murray’s motivation theories and their applicability in the military

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Abstract: The article discusses some of the content motivational theories, examining their applicability in military organisation. The purpose of the report is to analyse the theories of McGregor, Aldelfer and Murray rather than indicate the best approach for motivation. The results of the analysis will contribute to a clearer understanding of military motivation and provide guidance that commanders and chiefs could use to enhance their own motivational style.

Keywords: MOTIVATION, THEORIES, MILITARY.

1. Introduction

In scientific literature, there is a large number of theories of motivation which reflect the views of their authors. Each of them aims to explain why people behave in a certain way, but nevertheless, none of them provides a generally accepted explanation of human behaviour due to the complexity of human nature. Our goal is to look at some of the most popular content theories, rather than point out the best approach to motivation, by refracting them through the prism of military organisation. This would contribute to a clearer understanding of military motivation and provide guidance that commanders and chiefs will be able to use to improve their own motivational style.

Different classifications of theories of motivation can be found in literature depending on the author's point of view. The most popular of them is developed by L. Mullins [1], who divides theories into two basic groups: content and process. Content theories are aimed at determining what in the individual or environment stimulates and maintains a certain behaviour. This behaviour is seen as a result of the influence of external environment, which encourages certain actions. This group of theories explains what specific things motivate people.

On the other hand, process theories try to explain and describe the essence of motivation as a process. The process of stimulating, directing, maintaining and finally stopping certain behaviour. Process theories first attempt to describe the underlying changing needs to explain choice, effort, and persistence.

The authors of content theories consider motivation in terms of its content characteristics. Hence, the name of this group of theories. It is assumed that from a content point of view, motivation is associated with the mechanism of action of human needs.

In this report, we will examine the content motivational theories of McGregor, Alderfer, and Murray through the prism of their applicability in military organisation.

2. Content theories of motivation of McGregor, Alderfer and Murray

2.1. McGregor’s theory of X and Y

Douglas McGregor is a representative of content motivational theories. He was influenced by the ideas of humanistic psychology and the theory of human needs of his predecessor Maslow. Based on them, McGregor developed and presented his theory X and Y for the first time in 1957 in his article The Human Side of Enterprise [2], and later expanded and published it as a book with the same title in 1960. [2] In it, he examines the shortcomings of the then-traditional concept of management, presenting its characteristics and calling it Theory X.

Theory X is based on the assumptions that people are by nature lazy, unambitious and frivolous. They do not like to take responsibility and prefer to be guided. In addition, they are self-centred and indifferent to organisational needs. They usually resist change by being gullible and willing to be manipulated. Therefore, they must be persuaded, rewarded, punished, controlled and their activities must be directed by managers. [2] For their part, managers are responsible for providing money, materials, equipment, directing staff with the intention of achieving economic goals. Without the active intervention of management, employees would be passive and not sharing organisational goals. Therefore, managers need to manage, motivate and control employees in order to change their behaviour in a direction that meets organisational needs.

After describing the characteristics of Theory X, McGregor presents his arguments refuting its adequacy to the changed organisational environment. Like Maslow, he believes that when a person satisfies his lower-level needs, they are no longer able to motivate him. Once managers have met physiological needs as well as protection and security needs, motivation shifts to social and selfish needs. However, if the job does not provide opportunities to satisfy them, then employees will experience deprivation that will affect their behaviour. Under such conditions, if managers continue to focus their attention on physiological needs, their efforts will be ineffective. [2]

When people cannot meet their higher-level needs, they tend to fill the vacuum of their lack with more money. They will demand more money, making it more important than ever to buy material goods and services that provide limited satisfaction of frustrated needs. And although money has only a limited ability to meet many higher-level needs, if it is the only means available, it can become a centre of interest.

McGregor's theory consistently argues for the effectiveness of the ‘hard and soft approach’ and the carrot-and-stick approach, arguing that once a person reaches an adequate level of subsistence, he is motivated primarily by higher needs. But the leader could not provide a person with respect, self-respect or self-realisation. The leader can only create conditions that encourage and facilitate their occurrence or prevent and prohibit their occurrence. Therefore, the author is of the opinion that the philosophy of management through guidance and control, regardless of its nature (hard or soft), is inadequate to motivate the needs of a higher order, and this requires the use of a new approach that he calls Theory Y.

Theory Y is based on the assumptions that people are by nature active, self-managing, and sharing organisational needs as a result of working in an organisation. They are motivated, seeking development, ready to take responsibility and pursue organisational goals. These attitudes are not a consequence of managerial pressure, but a result of the opportunity provided by management for employees themselves to recognise and develop their own abilities. [2] The managers’ main responsibility is to provide such conditions and way of working that employees achieve maximum performance of their own goals while directing their efforts to achieve organisational ones. In other words, managers need to ensure maximum integration of personal to organisational goals.
McGregor offers some guidelines for implementing Theory Y. Among them is the granting of a certain freedom of action and delegation of powers, which stimulates taking responsibility. Another way is to enrich the work, making it more challenging and interesting and providing opportunities to meet social and selfish needs. In addition, providing opportunities for participation and consultation in decision-making would help to develop employees' creative thinking and their involvement in organisational goals.

McGregor’s Theory X and Y makes a significant contribution to understanding how leaders need to think and act in order to motivate their employees. For this reason, Theory Y remains largely relevant today, even in the military. Many examples of high financial results can be found in civil practice, but the same cannot be said for satisfied employees. In military circles, the situation is no different. In the search for people to fill the vacancies in the army and to keep those who want to leave it, the leaders at the Ministry of Defence are looking for the right formula for motivating servicemen. An attempt to do this is to improve the financial situation of the military by increasing salaries. However, it seems to be insufficient to attract new staff and retain mostly young people. An attempt to do this is to improve the financial situation of the military by increasing salaries. However, it seems to be insufficient to attract new staff and retain mostly young people. As McGregor shares, after satisfying the lower needs, it becomes necessary to satisfy the higher ones. That is, it is necessary to pay attention to the enrichment of the work itself. To look for options to provoke creative thinking by providing some freedom of action, delegation of responsibilities and integration of staff to organisational goals, not in a violent way but in a way that provokes the individual to do it voluntarily. This could be achieved by examining the needs and abilities of the particular military, and subsequently set him such tasks that best fit his individual profile and bring him satisfaction with their implementation.

2.2. Alderfer’s E.R.G. theory

Another well-known content theory was developed by Alderfer under the name E. R. G. (Existence, Relatedness, Growth). Unlike Maslow, but in a similar way to McClelland, Alderfer divides needs into three groups [3]:

E. – existence needs: these include all material and physiological needs, such as food, water, air, clothing, safety, physical love and affection. They cover the first two levels in Maslow's hierarchy.

R. – relatedness needs: these cover social communication, respect from others, and relationships with family, friends, colleagues and employers. It means being respected and feeling secure as part of a group or family. These are the needs of the third and part of the fourth level of Maslow.

G. – growth needs: these include self-esteem and self-actualisation. They encourage a person to have a creative and productive behaviour, to search for the ideal self. They correspond to the rest of Maslow's fourth and fifth levels.

Alderfer is aware of the differences in the needs of individual people and therefore gives a different degree of specificity for each group, which decreases in ascending order. Thus, the needs of existence are the most specific and the easiest to identify. The needs for connectivity are less specific than those for existence and depend on the relationships between people. Finally, growth needs are the least specific, as their specific goals depend on the uniqueness of each person.

It should be noted that the author of the theory places three fundamental relationships between the different categories in his theory.

Satisfaction – progress. This is the connection showing the transition to higher-level needs based on satisfied needs. According to Maslow, the progress of satisfaction plays an important role, and people move up the hierarchy of needs as a result of satisfying lower-level needs. According to Alderfer’s theory of E.R.G., this is not mandatory. Moving upwards from commitment to the pursuit of growth does not presuppose the satisfaction of the individual's needs for existence.

Frustration – regression. If the need for a higher level remains unmet, one can return to lower-level needs that seem easier to satisfy. This connection suggests that the already satisfied need can become active again when the higher-level need is not met. Thus, if one fails in one's attempts to satisfy growth, the need for commitment may reappear as a key motivator.

Satisfaction – strengthening. This connection shows the active strengthening of the satisfied needs at the current level. This happens when there is a failure to meet the needs at a higher level. Then the already satisfied need can maintain the satisfaction or actively strengthen the needs of a lower level.

Although the theory of E.R.G. considers needs like Maslow's theory, there are differences between them in many respects. In Alderfer’s theory, it is not required to meet the needs of a lower level in order to move to a higher level. Another difference between the theories is that if a relatively larger need is not met, the desire to satisfy a less significant one will increase (i.e., dissatisfaction with meeting high-order needs can lead a person to regress to more specific ones). The theory of E.R.G. allows the order of needs to differ from person to person. For example, a starving artist may place the needs of growth above those of existence.

In the process of work, managers need to recognise simultaneously the emerging needs of their subordinates. According to Alderfer's theory, focusing on satisfying only one need at a time will not motivate people. In addition, the frustration-regression relationship affects workplace motivation. For example, if employees are not given opportunities for growth, they can return to the needs of commitment and socialise more with colleagues. This example justifies managers trying to identify the needs of their subordinates in a timely manner in order to take steps to meet unmet/frustrated needs until the employee is able to pursue growth again.

Financial incentives can satisfy the need for growth and recognition from others. In this theory, it can be clearly seen that financial incentives can be used indirectly to meet other human needs through their perceived value and effect on other people. Providing financial incentives alone is not a guarantee that the remaining needs of employees will be met, and if this happens, according to the theory of E.R.G., employees will not be motivated.

Aldlerfer's theory is easy to understand and apply primarily because of its simplicity. In the context of a military organisational unit, it could be useful for commanders and chiefs in terms of better recognizing and understanding the needs of their subordinates, and in particular those of growth. In the new concept for the development of servicemen, the development from the lowest to the highest level in the military career is theoretically possible. Although in practice this is difficult to achieve, even with the increasing length of military service, the opportunities for development in the military remain relatively large compared to those in other civilian professions. For this reason, military leaders need to help meet the need for growth. In case of impossibility to satisfy it, it is necessary to provide compensation for the failed need by strengthening the importance of the last one satisfied, with empathy and connection to the team, until a new opportunity appears to realise the higher need. Besides, progress needs to be fairly stimulated, not simply supported arbitrarily or by lobbyists. The unjust progress of some servicemen, aided by their superiors and commanders, plays the role of an exceptional demotivator for others. This necessitates the elaboration and implementation of clear rules for career development.
2.3. Henry Murray's system of needs

At the heart of his theory, Henry Murray [4] puts the understanding that man is motivated by a system of diverse needs. He believes that human development is accompanied by a change in his needs, through which he shows and realises himself. The difference between the theories of Murray and Maslow is that Murray does not rank needs in a hierarchical order, and according to him they number twenty, individually or in combination predetermined human behaviour. The classification of needs according to Murray is as follows:

- Achievement – overcoming difficulties on the way to success;
- Humiliation – power over someone else in a manipulative or other way;
- Bonding – establishing significant social connections to connect with someone as a result of the desire to be loved;
- Aggression – physical and mental harm to someone;
- Counteraction – protection of someone's honour and the feeling of pride in it;
- Respect – willingness to follow someone and a sense of pride in it;
- Defence – defence of one's own personality by apologizing and giving explanations;
- Domination – leadership of others, control over them;
- Show – attracting other people's attention to yourself;
- Challenge – causing an activity or situation that poses danger to others or to the person himself;
- Autonomy – protection of one's own personality and one's own field of expression;
- Avoidance – an attempt to avoid a funny or confusing situation;
- Order – the need to be accurate, neat, precise;
- Growing – helping someone in need, taking constant care of someone;
- Game – relaxation, joking;
- Refusal – underestimation, exclusion of someone from an activity;
- Sensuality – desire for satisfaction;
- Sex – desire for erotic and sexual relationship;
- Support – help for others, support;
- Understanding – protection of connections, abstract ideas, concepts. [4]

Murray's system is a successful attempt to cover extremely comprehensively all the needs that elicit a purposeful human effort. According to Murray, every need consists of two components – direction and strength.

Direction represents what the need is directed to and can be an object, action, individual, etc.

The power of need is the energy that a person puts into satisfying that need. This power is determined by the specific meaning and significance of the need for the individual.

The author believes that only the most important needs of a person can motivate him and make him act so that they are satisfied.

Murray's theory does not specify an algorithm for how to satisfy a need, but it puts human needs into separate groups, which gives a starting point for further research.

In military terms, Murray's theory is of interest and is applicable in terms of changing needs as a result of human development. Studying the changing needs as well as their diversity is important for any commander. Having information about the range of abilities of his subordinates, he could use them as an effective incentive to dictate certain behaviour that will contribute to the implementation of organisational goals. Military leaders need to continually identify the key needs of their subordinates and help meet them. Moreover, they need to influence the strength and direction of the specific needs related to organisational goals, helping to meet them, thereby seeking to obtain a loyal performance of duties by their subordinates.

3. Conclusion

The considered content theories of motivation reflect the views of their authors, contributing to a more complete and comprehensive understanding of human motivation. Each of them has similarities with the others, but also its own characteristics.

McGregor's Theory X and Y emphasises the higher needs and the encouraging and facilitating role of managers their employees to recognise and develop their own abilities. This can be achieved by giving some leeway, delegating powers, enriching work and involving subordinates in the decision-making process.

Alderfer’s theory of E.R.G. considers needs in three groups, but it does not require one to satisfy the needs of a lower level in order to move to a higher one, while allowing the order of needs to differ from person to person. The author places three fundamental interrelations between the different categories in his theory, thus allowing a two-way vertical movement of the individual’s needs. From a military point of view, it directs commanders to focus on the needs of subordinates, especially those of growth, in order to motivate them in the performance of their duties.

Murray's theory classifies needs without arranging them in a hierarchical order. An important point in it is that human development is accompanied by a change in individual needs. This requires military leaders to constantly identify, guide, and meet the changing palette of needs of their subordinates, integrating them with organisational goals.

4. References