

Using Practical ERM Methodology for Modernization of Higher Education (HE) in the Field of Sustainable Development

Nina Globovnik

International ecoremediation Centre (ERM Centre) University of Maribor, Faculty of Arts, MSc, Koroška cesta 160, 2000 Maribor, Slovenia.

Received: November 03, 2014 / Accepted: December 01, 2015 / Published: March 25, 2016

Abstract: Paradigm of sustainable development has become a bigger challenge for university, which during the last years more and more include these contents into the educational process. Since the understanding of sustainable development is complex, many high educational (HE) programs will have to be modernized and instead of theoretical knowledge practical experiences will have to be included. Those will enable long-term knowledge, holistic understanding and will include not only technical point of view of environment protection, like is often nowadays, but practical as well. The higher education system (HEIs) lately demonstrates needs relevant in particular in the practical training, which is based on individual experience and direct inclusion of individuals during the educational process. A need to transform the higher education curriculum especially with the inclusion of innovative learning content and methods that allow direct individual experience, long-term process, holistic thinking and interdisciplinary cooperation will be therefore presented in a future. The modernization of HEIs should therefore base on the development of green competence which includes development of new ecoremediation (ERM) approaches which equally addressing ecosystemic, social and economic field, innovative ERM methodologies that implement practical work, international HEIs integration and cooperation with aims to strengthen student's competitiveness, employment and the involvement in the labor market through their experiences. In this way we include the youth into the current environmental problems to ensure sustainable development in future and also may contribute to solve the key socio-economic challenges in reducing unemployment of young people.

Keywords: HEIs modernization, ERM university network, sustainable development, practical ERM education, ecoremediation.

Corresponding author:

Nina Globovnik, International ecoremediation Centre (ERM Centre) University of Maribor, Faculty of Arts, MSc, Koroška cesta 160, 2000 Maribor, Slovenia. E-mail: nina.globovnik@gmail.com.

1. Introduction

Even from the first official and most frequently quoted definition of the Sustainable development (Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs) in the Brundtland Report [7] has passed almost 30 years we realized that in practice unfortunately the idea of sustainable development as a priority European development strategy Europa 2020 flourish [3]. We have a lot of regulations, conferences and norms considering sustainability but in practice we can see, that pollution and environmental pressures has been rising, we are still witnessing interests of capital against society and nature. Unfortunately there are no visible positive effects in a field of sustainable development in s practice (the pressures on natural resources are increasing, climate changes require adjustments, the soil is getting less fertile, water resources are limited etc.). Higher education (HE) does not have sustainable development education systematically included and therefore students most often understand sustainable development in narrow variety (mostly environmental point of view), which can slow down general development of ecological literacy [5]. Many existing HE programs are too much specialized and deal only with one discipline, which causes too narrowly educated experts [1]. If the sustainable development wants to become a part of higher education institutions system (HEIs) must belong enough performed in practice and many employed are needed to cooperate, that widespread performance is done [6]. Students often recognize themselves as a huge lack of knowledge in the area of sustainability. Consequently graduates on tertiary level do not gain practical experiences for everyday life, nor do they gain professional experiences for planning and solving of complex problems in the environment. Since only theoretical knowledge about sustainable development is not sufficient and our experience so far shows that practical forms of research and practical learning bring wise better impact for students and also for the wider community. In order to effectively adaptation to climate change and a shift towards more sustainable behavior is certainly necessary make great emphasis in the field of higher education in terms of promoting inter-university cooperation and an international university networking in the field of sustainable development. On that way they will able to sharing the latest scientific knowledge, methodologies and experience and will also be able to resolve concrete environmental problems in certain environment. Learning trends in recent years has therefore shown a variety of different innovative methods and approaches for teaching which mainly based on learning useful knowledge through the experiences [8]. Sustainability can be achieved inside the frames of the already existing curricula with the use of various innovative approaches. University can include sustainable development into existing programs so that the sustainable contents become part of it, they can offer optional subjects or new study programs that involve

students into practical research work on real environment. On this way universities gain the role of development partner on local, regional and national level and include the youth into the current environmental problems what is one of the priorities of ERM methodology and also one of the key objectives in the European Strategy [3].

Our individual research in International ecoremediation Centre at the University of Maribor, Faculty of Arts shows, that students get the most practical experience during the study time when they enroll fieldwork or when is method of learning by doing included. In this way students are also more employable after graduation and local environments get new solutions for a care of natural resources, development opportunities and new knowledge based on concrete environment situation. Therefore in ERM Centre we develop practical ERM educational methodology on Learning polygon for self-sufficiency in Dole which based on ecoremediation as a natural approach to prevent or restore the natural environment and also to ensure sustainable development [13]. The main emphasis is on cooperation between different sectors (civil engineering, agriculture and environment) in a real environment with actual environmental problems such as water purification, erosion prevention, effects on soil fertility, adapting to climate change, becoming self-sufficient etc. and also in cooperation between universities. Therefore we also established ERM University network for practical HE where the main emphasis is on education about sustainable development with the help of ecoremediation (ERM). In ERM University network so far participate nine universities, mainly from Former Yugoslavia countries, but in a future we are planning to expand it also on other universities and countries.

2. Materials and Methods

Evans old civilization like Egyptians and Maya civilizations were aware about the great self-cleaning ability of water and Egyptians drank water from the river just from the vegetated riverbeds while Mayas had their own sewage system led to the swamps, where it got cleaned. They know that plants could clean the water. In scientific language are mentioned processes and ecosystem services known as ecoremediation (ERM) as an effective system for ensuring the sustainability and environmental protection and means natural protecting or cleaning the environment by natural way [15]. The concept of ecoremediations considers the use of sustainable processes for rehabilitation or protection environment. Remediation technologies include principles of buffering capacity, phytoremediation (soil or water cleaning by using plants) and bioremediation (soil or water cleaning by using organisms) for environment pollution. Sustainable (green) approaches increase biodiversity and help to returning the ecosystem in balance [2]. Remediation methods have the potential for the reduction, prevention and elimination of natural disasters (floods, droughts and

landslides), nonpoint sources of pollution (agriculture, transport) and point sources of pollution (municipal, industrial effluent). ERM technology including constructed wetlands for sewage, landfill leachate, industrial wastewater, drinking water, highway runoff, ponds/wetlands, vegetated drainage ditches for agricultural runoff, landfill restoration, and river revitalization. A further aim is promotion the idea of unifying different kinds of “green technologies” that are based on nature’s self-cleaning mechanisms in the search for sustainable solutions that understand human–environmental relations [4]. High performance can be achieved by protecting habitat, particularly water sources like streams, rivers, lakes, groundwater and the sea. Basic functions of ecoremediations are a high buffering capacity, self-cleaning ability, enhancing biodiversity and water retention [10]. With their use we can reduce or completely eliminate the effects of agricultural pollution, tourism, transport, industry etc. ERM therefore brings in the additional goal of achieving wider ecosystem functions and forms, as well as eliminate long-term environmental impacts [16]. The main purpose of using ecoremediation methodology is the multi-functional and sustainable management of natural ecosystems. It actually represents a bridge between nature and environment and establishes everyday practice for cleaning water, protecting soil, preventing the spreading of dust particles and erosion, accumulating sediments and improving life quality what is shown on *Figure 1* [14]. Because Preserved nature is one of main European strategic advantage compared to other world’s areas which are heavily polluted and therefore is important that we also preserve this advantage in future. With a well-organized and practical oriented sustainable education, which may affect the creation of individual norms and values, it certainly can be done. Better educated people contribute not only to better sustainable development of certain area but have also tend to migrate from degraded areas (environmental refugees) what is not positive for European exit. From the World economic crisis are educated people crucial and for this reason is important to hold them in the territory of the EU.



(N. Globovnik, adapted from Vovk Korže, Vrhovšek, 2008).

Fig. 1. Ecoremediation for restoration and protection of natural environment.

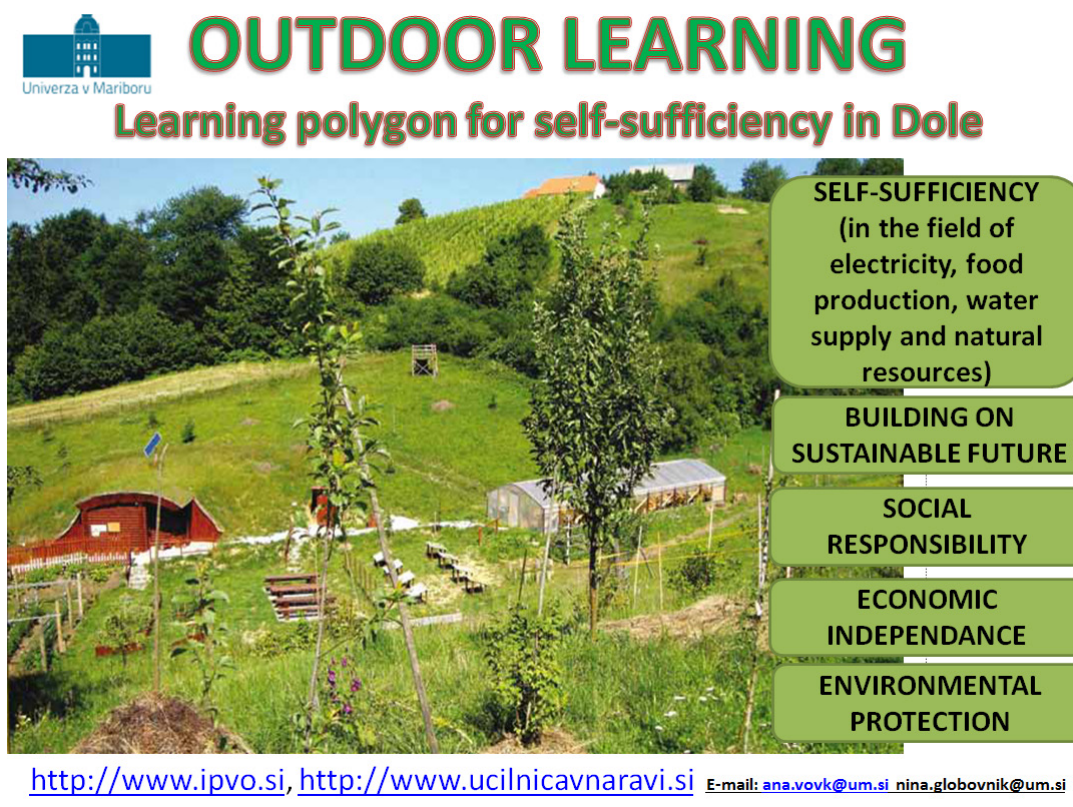
Figure 1 represents the word Ecoremediations (ERM) which is actually composed by three parts: noun mediation - which means a consensus between a man and nature where men respects the limits of nature and nature gives him some benefits to raise the quality of his life, the adjective eco means that this consensus should be acceptable on ecological and economical way. They address everyone to life in harmony with nature. The word re means to restore, so this relationship had already existed in past (our grandparents lived that way). By using ecoremediations we just want to re-activate the natural process and create a normal communication with nature, just as our grandparents used to have just because there were no other options. ERM motivate participants to develop their own responsibilities to respect the ecosystem services based on a comprehensive understanding of the fatal relationship between man and nature [11].

2.1 Learning polygon for self-sufficiency in Dole

Learning polygon was created in 2010 as a response to a vicious circle that we are witnessed in the modern world. During our individual research in a field of HEIs we found out that practical education motivates about sustainable development students the most and that they showed a big motivation and interest even for the “dull theory” about food production, building sustainable house and renovation

degraded areas. Therefore in ERM Centre we developed Learning polygon for self-sufficiency in Dole as a support for sustainable development, protecting the nature by the use of ecoremediations and encouraging for being self-sufficient as a practical research fieldwork. We started to develop new opportunities for development of rural areas, such as eco-village, ecoremediation and green tourism, which is based on learning-educational tourism which is also a good opportunity to raise the economic level of the local community as well as new job opportunities for young people [9].

Polygon was established in municipality Poljčane (Slovenia) which has approximately 38 square kilometers and around 4,500 inhabitants [18]. Its development is focused at protecting the environment. More than 50% of the municipality falls as protected areas with Natura 2000 with a lot of rare plant and animal species and some of them are rare or endangered [19]. We found that condition as a perfect area for creation a research conditions for practical outdoor education for sustainable development where students have an opportunity to gain practical experiences from ecoremediation and use them in everyday life, especially by planning activities in the space, learning about self-sufficiency in the field of renewable energy, healthy food production and utilization of rainwater, spring and ground water (using water retention systems and evaporation prevention). Experiential education programs on learning polygon includes active thematic workshops, educational tours, independent researches, analytical measurements, laboratory analysis, individual counselling, inventories and cooperation with the local environment, based on the level of prior knowledge and experience of the user. It motivates participants to develop their own responsibilities to respect the ecosystem services based on a comprehensive understanding of the fatal relationship between man and nature. During educational process on polygon students transfer their theoretical knowledge into practice and are able to solving complex current environmental problems such as water supply, right treatment with the soil, erosion prevention, high quality food production by using permaculture methodology, critical thinking, social responsibility etc. The goal of polygon is to motivate all students to act more environmentally friendly, to be more sustainable and to become self-sufficient [13].



(N. Globovnik, A. Vovk Korže, 2015).

Fig. 2. Learning polygon for self-sufficiency in Dole.

Learning polygon for self-sufficiency in Dole represents excellent conditions to achieve a higher level of knowledge based on the integration of schools, municipalities, universities, and local environment. Students are actively present at all stages of learning and on this way they can also remember better. It is educational-research center, where a participant can see, smell, plans, cooperates with the environment and understands the relationship between the animate and the inanimate world, made by their own experience, solves real environmental problems around us. Based on their own experience of real-living circumstances they develop values, attitudes and responsibility to our society and nature and are also able to critically evaluate irregular behavior in nature.

During education on polygon we use The Real World Learning model known as well as a Hand model which offers a holistic and flexible approach to outdoor learning for sustainability; a way of thinking, reflecting and being. Each element on its own is important, but when delivered as a coherent whole offers a much deeper and more meaningful learning experience [17]. The educational process is focused on interdisciplinary, problem-based learning, practical work and experiential learning and follows five main phases:

58 Using Practical ERM Methodology for Modernization of Higher Education (HE) in the Field of Sustainable Development

- understanding such as a scientific concept but also in terms of experiences had, actions taken or values held and understanding a scientific approach with emotions, values and humanity. In the first phase is so focus on observation, knowing and thinking about natural process,
- transferability where students transfer the knowledge not only in terms of understanding such as a scientific concept but also in terms of experiences had, actions taken or values held. In the second phase is so focus on planning, testing and cooperation in certain environment,
- experience a real life with their head, heart and hand. In the third phase is focused on making, comparing and feeling,
- empowerment that brings the learners to the center of the learning experience. In the fourth phase is focused on critical thinking, reflection, recognizing and realizing their humanity and their ability to take action for positive change,
- values that represent our guiding principles develops thinking and action for sustainability. In the fifth phase is focused on self-assessment.



<http://www.rwlnetwork.org/rwl-model.aspx>

Fig. 3. Using Hand model for practical ERM educational methodology.

3. Results and Discussion

Considering last two years have left millions especially young unemployed people and the economic interdependence increasing we are aware that just on holistic approach is possible to rise up a new generation

of students who will have practical experiences in the field of environmental protection. Some protected areas are under-developed, because there is no knowledge and innovative approaches for development [12]. Classic jobs are disappearing and a need for completely new skills is raising, stemming from regional specialties and resource-based areas and include research and innovation. Therefore in ERM Centre new practical programs and outdoor fieldworks for students, which will help them to adapt these different circumstances in time and to deliver their knowledge to local area, are developed. Learning polygon have crucial role in motivating young people for changing life style trout sustainable future and also have great potential to transform societies for a sustainable future. Environment pressures have been increasing recently and therefore five educational programs with the sustainable focus were developed: **Self-sufficiency, Building on sustainable future, Social responsibility, Economic independence and Environmental protection** [13]. Learning-educational processes on polygon based on innovative approaches where students create their own opinion based on experience and understand natural processes in different ecosystems. It encourages students to develop common, comprehensive and sustainable solutions for future generations. The emphasis is on learning through experience; problem based learning of concrete environmental issues, transfer of knowledge into the local environment, cooperation with business and industry in particular for the developing competencies for green jobs. On that way participants of ERM practical education are able to identify inappropriate behavior in the environment and to identify possible solutions for the remediation of environmental pollution. Innovative methodologies are especially because it can be transferred to all areas; so they are suitable for all countries, irrespective of whether is rural or urban landscape. Among the privileged educational innovative methods are observation, comparison, research, planning, fitting into the environment, evaluation, using the available resources and exploring new possibilities of an economical relationship between nature and environment. During the process some innovative competences are promoted that empower students to shape a sustainable future: 1. cooperation, participation, take responsibility and learn in a self-directed way, 2. dealing with their own feelings and the feelings of others, 3. reflective and critical thinking – considering different perspectives to reach informed opinions and decisions, 4. becoming conscious of interconnectedness – you, me and the world around us, 5. taking ownership of their learning and reflect on what and how they have learned, 6. empowering them to be creative, flexible and able to take positive action to deal with change [13].

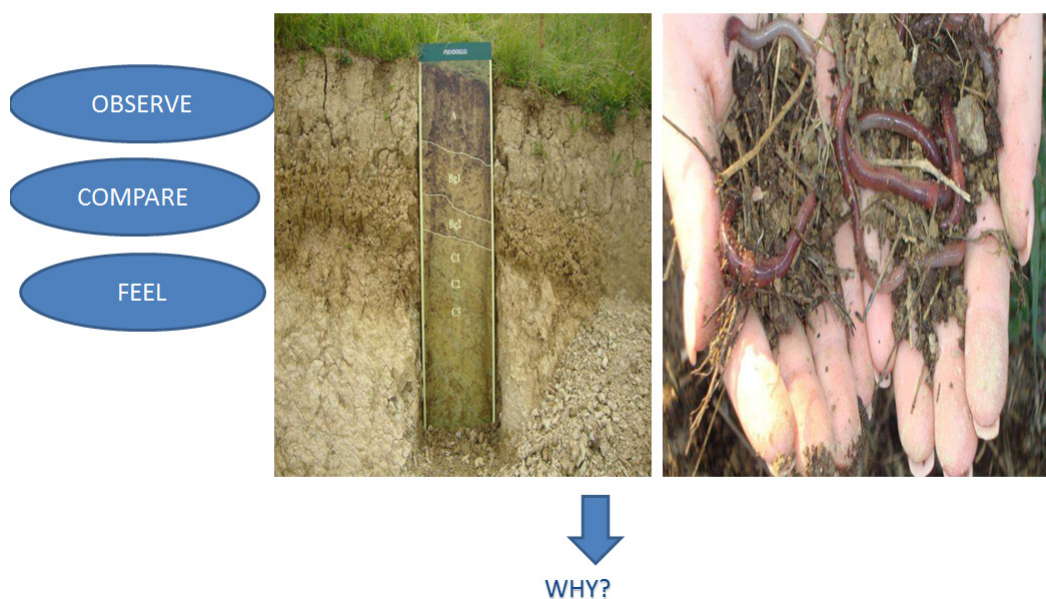
Considering Hand model [17] we encourage students to learn trough research work and for example there are two tips of fieldwork for students:

Research and compare the soil environment: Pseudogley and Anthropogenic soil (FAO Unesco classification) [22].

Students are going to provide some physical properties of two soil samples (Pseudogley and Anthropogenic soil) through the Scheme for soil analysis, which are extremely important regarding tillage (color, humidity, root system, skelet size, skelet proportion and soil structure). We compare the results and find out which one is appropriate for cultivating the land and also what types of vegetation can be found on each type of soil. Consider the results of analyses we figure out why the Pseudogley is affected to drought and erosion as well as how to properly handle with such soil. During the research we also get to know ERM methods which can be used for the protection against drought and erosion. Due to the fact, that in Slovenia have more than 60% areas with Pseudogley, we should know the right way of dealing with such soil and also methods for cultivation it. In two years is possible with natural methods change barren Pseudogley into good fertile Anthropogenic soil and students during mention fieldwork get to know all natural process how to do that. By mention fieldwork we encourage students to use natural methods that are environmentally friendly and also to greater self-sufficiency, which is the main objective of this fieldwork.

1. The problem of poorly fertile soil

Pseudogley and Anthropogenic soil



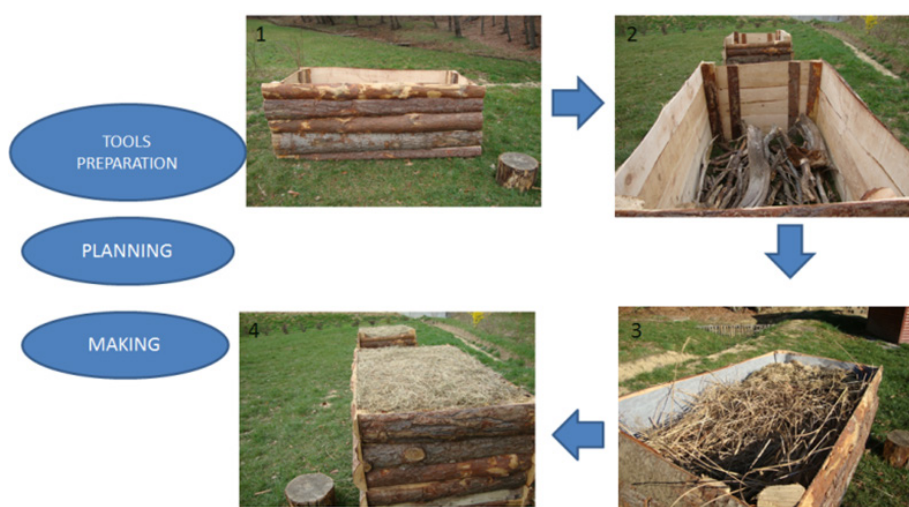
(N. Globovnik, 2015).

Fig. 4. Comparison of two soil samples.

Understanding the works of nature through the ERM - the ecosystem goods and services

When students analyze soil they know get to know a lot of properties and are able to know what kind of food is it possible to grow on given type of soil. We are considering permaculture methodology which is known as a “sustainable farming” and encourages cooperation with nature [20]. It is based on the natural cycles in ecosystems and combines the benefits of different plants. By permaculture gardening we do not damage the soil, we do not use artificial pesticides and fertilizers, we do not use machines and we use mulch (hay or straw) to protect of sunscreen, to retain water and also as natural fertilizer [21]. Students during practical work of making a permaculture bed put on the bottom twigs as drainage and then add the sheep's wool as containment and insulation material and soil on the top. Considering the legality of Permaculture we planted edible plants according to the principle of good and bad neighbors.

2. The problem of low self-sufficiency - Making of permacultural raised beds

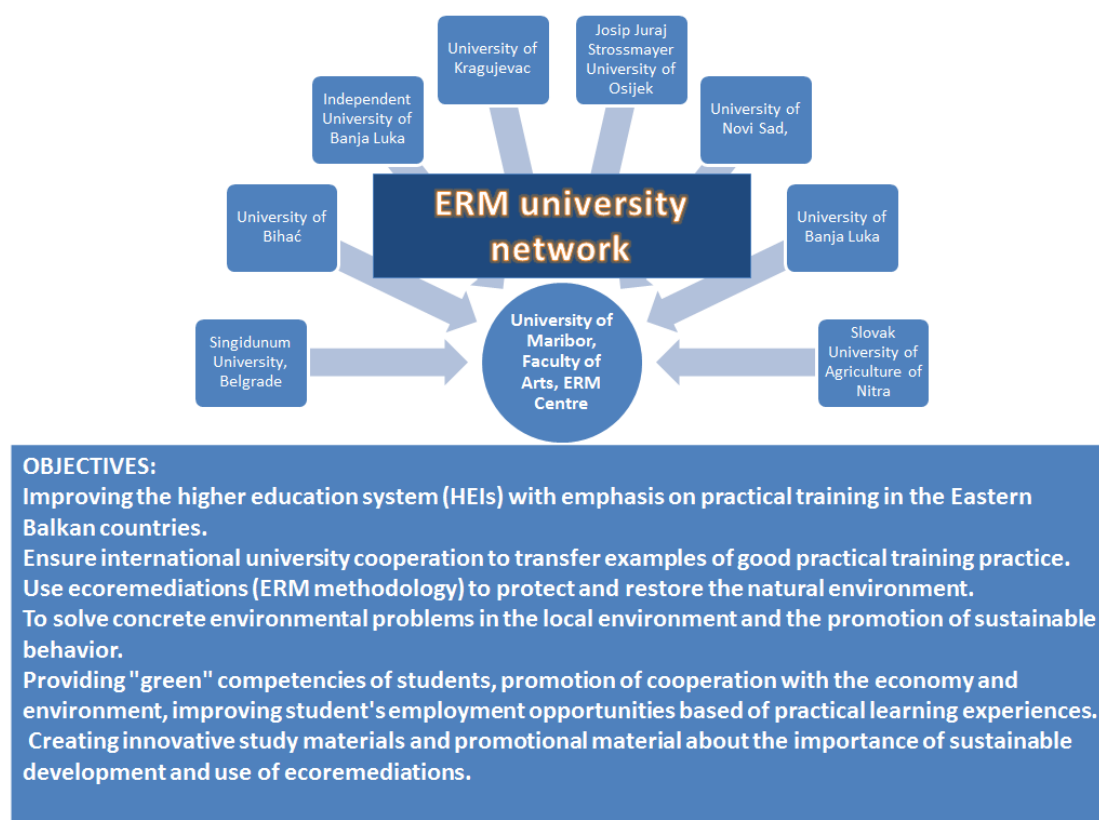


(N. Globovnik, 2015).

Fig. 5. Making permacultural raised bed.

European strategy 2020 called after good examples of good educational practices for sustainable development and emphasized the importance of cooperation between educational programs and enable wider holistic approach in the area of sustainable development [3]. It is necessary to keep and connect already existing practical research and knowledge and transfer them to other universities and therefore we also established ERM University network for practical HE which based on idea of urgency university cooperation especially in Former Yugoslavia countries (West Balkan countries) which are facing with an inflexible HEIs. Our goal is transform theoretical knowledge into practice and give to students' opportunity for connecting

with the labor market in the field on green job. Only the openness of the university organization can help to create and encourage the beginning of new, more sustainable educational direction [6]. The establishment of the ERM international university cooperation between EU universities and West Balkan universities encourage university cooperation practical in the field of students' practical education, transfer of good practices, contribute to the global approach to the environmental protection and environmental problems prevention and also promote awareness about the importance of sustainable development. A creation of ERM university network is therefore important step towards ensuring better sustainability. Due to ERM university network we have got options for international cooperation in HEIs and enterprises. Especially Former Yugoslavian country will have a chance for modernization HEIs and transformation a practical ERM education. Not just development of sustainable solutions for environment but also transformation innovative knowledge to other institutions and people is therefore crucial for the successful global adaptation of green technologies and green thinking.



(N. Globovnik, 2015).

Fig. 6. ERM university network.

4. Conclusion

The existing technical solutions do not allow for the elimination of environmental problems, so the ERM as a collaborative approach with the nature is necessary to ensure sustainability. The emphasis is on solving specific environmental problems such as climate change adaptation, water supply, rational use of water, erosion prevention, etc. All these issues have been identified as key guidelines of the Europe 2020 strategy [3], where consideration of sustainable development is one of the priority objectives and ensuring this, it is possible to achieve with a flexible and innovative way of education that includes practical work as the foundation of the entire education system. European Union Strategy for Sustainable Development delivers sustainable development, promotion of alternatives and use of best available knowledge or environmentally friendly technology what ERM definitely are. During practical ERM education students have chance to work with enterprises and have better employment chances after finishing study and also local community get through the cooperation with young students new ideas for environmental solutions. It is important to have that kind of HEIs education and it is important, that in ERM Centre we also cooperate on national level which means we have support from government (Ministry of Higher Education, Science and Technology, Ministry of Education, Science and Sport and with Ministry of Environment and Space). We are in process of systemic change in the HE learning process in Slovenia, which will be based on practical education at all age levels of education. In a future can therefore be expected a great changes that will contribute to the development of a sustainable relationship with the environment.

Acknowledgments

We thank International ecoremediation Centre, especially PhD Ana Vovk Korže, who provided insight and expertise that greatly assisted the research and for comments that greatly improved the manuscript. We also thank Real World Learning project team from Slovenia (CŠOD) who choose us as a best Slovenian practice for outdoor education and gave us a chance to try Hand model in practice and introduce internationally.

References

- [1]. Cortese, A. D. The critical role of higher education in creating a sustainable development. Planning for higher education, 7(2), 2003. 158-175.
- [2]. Dražić, G. Ekoremediacije. Fakultet za primenjenu ekologiju Futura. 2010. Belgrade.

- [3]. Europe 2020. A strategy for smart, sustainable and inclusive growth. European Commission. 2010. Brussels.
<http://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf>
- [4]. Griessler Bulc, T., Šajn Slak, A., 2009: Ecoremediations – a new concept in multifunctional ecosystem technologies for environmental protection. *Desalination*. Volume 246, Issues 1–3, 3, 30 September 2009, Pages 2-10.
- [5]. Kagawa, F. Dissonance in students' perceptions of sustainable development and sustainability. *International journal of sustainability in higher education*, 8(3), 2007. 317-338.
- [6]. Lozano, R. Incorporation and institutionalization of SD into universities: breaking through barriers to change. *Journal of cleaner production*, 18(7), 2006. 367-644.
- [7]. Our common future, UN. Brundtland Commission. 1987. <http://www.un-documents.net/our-common-future.pdf>.
- [8]. Richter, T., Schumacher, K. P. Who really cares about higher education for sustainable development? *Journal of social sciences*, 7(1), 2011. 24-32.
- [9]. Vovk Korže, A., Križan, J., Kokot M., Globovnik, N., 2011: Learning about ecoremediations and sustainability on the new education polygon in Modraže, Slovenia. V: *International Conference The future of education*, Florence, Italy, 16-17, 2011. Conference proceedings. Prima ed. Milano: Simonelli, 2011, vol. 1, str. 338-342.
- [10]. Vovk Korže, A., Vrhovšek, D. *Ecoremediacije za učinkovito delovanje okolja*. 2006. Maribor. 10-23.
- [11]. Vovk Korže A. *Naravni čistilni sistemi*. Mednarodni center za ecoremediacije. 2014. Nazarje.
- [12]. Vovk Korže, A. *Lokalni in regionalni trajnostni razvoj*. Mednarodni center za ecoremediacije. 2014. Maribor.
- [13]. Vovk Korže, A. *Učni polygon za samooskrbo Dole*. Mednarodni center za ecoremediacije. 2014. Maribor
- [14]. Vovk Korže, A. 2013: Ecoremediation (ERM) as a Sustainable Approach to Environmental Protection. V: *Proceeding The economic dimension of land degradation, desertification and increasing the resilience of affected areas in the region of Central and Eastern Europe (EDLDIR-2013)*. In Brno: Mendel University, 2013, str. 1-7, ilustr. <http://user.mendelu.cz/xvleck1/rrc/edldir13/Korze.pdf>.
- [15]. Vrhovšek, D., Vovk Korže, A. *Ecoremediacije*. Mednarodni center za ecoremediacije. 2009. Maribor.
- [16]. Vrhovšek, D., Vovk Korže, A. *Ecoremediacije kanaliziranih vodotokov*. Mednarodni center za ecoremediacije. Maribor. 2008.
- [17]. <http://www.rwlnetwork.org/rwl-model.aspx>
- [18]. <http://www.poljcane.si/obcina/predstavitev/>
- [19]. http://www.itr.si/uploads/Gw/iu/GwuiqMoUj8DHSKk9Vrjm9g/delez_Natura2000_po_obcinah.pdf
- [20]. [http://www.permaculture.orgnm/index.php/site/key concepts/#sthash.N0sg7NIc.dpuf](http://www.permaculture.orgnm/index.php/site/key%20concepts/#sthash.N0sg7NIc.dpuf)
- [21]. <http://permaculturefreepress.com/?p=401>

[22]. <http://www.fao.org/soils-portal/soil-survey/soil-maps-and-databases/faounesco-soil-map-of-the-world/en/>