

Effective Pro-Environmental Education as an Important Element of Economic Infrastructure and Sustainable Development

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ABSTRACT

The study presents the “EREJ” project tested with students at the University of Rzeszów. The project is important for the development of the ability to search for materials for work. It improves the ability to prepare a PPT presentation and write an essay, skills in oral and written communication, the ability to work individually and in a group, the ability to discuss, transmit feedback, and present work publically. The project is also important for increasing the knowledge in the field of environmental issues.

Keywords: pro-environmental education, active learning, survey, evaluation.

INTRODUCTION

Climate change is becoming more and more visible, the increasing amount of pollutants emitted to the environment and the alarming amount of waste produced lead to irreversible degradation of the environment, which poses an increasingly greater threat to Europe and the rest of the world. In view of the current situation, an action plan has been developed to transform the European Union into a modern, resource-efficient and competitive economy. The European Green Deal shows the benefits of complying with the new principles of caring for the environment. The described initiative concerns the improvement of the well-being and health of citizens as well as future generations, and this is why young people should be sensitive to the needs of the environment in which they live [The European Green Deal, European Commission 2019; Claeys et al., 2019; Siddi, 2020; Fetting, 2020].

Young people living in today's dynamically developing world, in order to be able to meet its requirements, are obliged to raise the level of education, constantly expand their competences and use

various opportunities provided by modern technologies. Therefore, the Lifelong learning (LLL) concept, i.e. the concept of lifelong learning, indicating the need for activity aimed at the development of knowledge and skills in a personal, civic, social and employment-oriented perspective, becomes increasingly popular. It assumes the continuation of raising qualifications and training after completing formal education through participation in training, workshops, courses, postgraduate studies or completely independently [Guven et al., 2016; Mikołajczyk, 2020]. When deciding to come to study in a specific field of study, young people undertake the activities aimed at self-development, broadening their knowledge as well as acquiring new qualifications and skills. An academic teacher helps them in the learning process by conducting teaching activities. Searching for efficiency for his activities, he often decides to depart from the typical pedagogical model – in which the people subjected to the didactic process play the role of obedient recipients; in order to treat learners as conscious individuals who make their own decisions. A university student, although he is a young person, is also an adult and has a significant potential

for intellectual development. Being aware of the need for development and constant adaptation to socio-economic changes, he usually wants to use his mind actively.

According to the theory of Kolb [Kazimierska et al., 2014; Kolb and Kolb, 2017], adult learning is a process in which knowledge is created by transforming experience. The learning process takes place in four stages:

- Experience – using one’s own experience and previously acquired knowledge;
- Reflection – drawing conclusions from the previously acquired information;
- Generalization – confronting the theory with the beliefs gained during one’s own experiences and reflections;
- Application – testing the previously acquired knowledge in everyday life and future professional work.

According to the assumptions of the Kolb model, an adult learning should go through all four phases of the above-mentioned cycle to make education effective. It is true that the cycle can be started at any point; however, it will not be most efficient for everyone to read the theory first and then refer to one’s own experience. John Hattie [Hattie, 2015] ranked them on one scale based on meta-analyses of educational research on the effectiveness of teaching methods. He stated that the greatest impact on improving learning outcomes was made by the following:

- reciprocal teaching,
- feedback,
- problem-solving teaching,
- self-verbalization,
- self-evaluation,
- metacognitive strategies.

Testing one’s own needs in the area of effective learning enables students to participate in active forms of education [Kostecka et al., 2018]. The aim of the study was to present the “EREJ” project, which was found useful and tested during the implementation of an engineering seminar in the field of study programme of Renewable Energy Sources and Waste Management at the University of Rzeszów.

MATERIAL AND METHODS

The publication is based on the study of the problem and analysis of selected literature. It

presents an outline of the “EREJ” project (*Enter the Role of an Ecological Journalist*), which was used during the implementation of an engineering seminar in the field of study programme of Renewable Energy Sources and Waste Management on the University of Rzeszów. Its elements were described as well as the assessment was made by the students. The evaluation was carried out on the basis of a questionnaire that was to be filled in by those students who implemented the project. The questionnaire was completed by the students of the engineering seminar group, in the third year of studies (47% women and 53% men). All questions asked in the survey, along with possible answers, are shown in the results chapter when describing the evaluation of the first part of the study. The second part of the students’ answers is demonstrated in Table 2, characterizing the grading by students from 1 to 5 (according to the scale: 1 poor, not satisfactory to me; 2, 3, 4, 5 – essential, I consider it is very important) for each proposed feature of the “EREJ” project.

RESULTS

The basics of the “EREJ” project

The project was explained to the students and carried out at the first meeting of the first of three semesters during the presentation of the topic of the seminars. The first semester consists of 20 hours of classes, the next semester involves 30 hours.

“EREJ” project goals

Student:

1. Extends the knowledge in the field of environmental issues in connection with RES (Renewable Energy Sources) and / or WM (Waste Management).
2. Develops the ability to search for materials for work.
3. Improves the ability to prepare a PPT presentation and write an essay.
4. Acquires and improves skills in oral and written communication:
 - improves the ability to work independently and in a group,
 - improves discussion skills,
 - gives feedback,
 - trains the ability to present work on the forum.

Stages of the project

Stages of the project are included in Table 1. The implementation of the project creates an opportunity for active discussion several times. It includes both the substantive part and comments on the correct distribution of the content of the study (broken down into introduction, purpose, problem development, keywords, summary, etc.). The correctness of the entry of bibliographic items and their citation is also assessed. The future graduate of the course thus acquires soft and hard oral and written communication skills. It is important not only for the proper preparation of engineering work, but also for its professional suitability: it improves the ability to work individually and in a group, as well as the ability to discuss and provide feedback. It is also important to have in-depth knowledge of environmental issues in connection with RES and / or WM.

Project evaluation by students

As the surveyed seminar group implemented the project in the previous academic year, and the survey recalled its outlines, 80% of students remembered its basics. A large proportion of students (47%) who chose the answer “yes” confirmed that they considered it an interesting form

of mobilization to work on their own. The rest (40%) chose no, and 13% did not have an opinion on this feature of the project. When asked “Do you find the project useful?” 54% said yes, 6% chose no, and 40% did not have an opinion. Students were asked about the effectiveness of the project; 67% of them answered yes, 20% no, 13% no opinion. The vast majority of students (80%) believed that it was worth repeating the project for students of subsequent years (13% of them said no; 6% had no opinion).

The next questions in the survey were related to assigning numbers from 1 to 5 by students according to the scale: 1 poor, I was not satisfied with it, 2, 3, 4, 5 – essential, I consider it very important; for each proposed feature of the “EREJ” project (Table 2). As it can be seen from the data sheet, the students appreciated the project the most as mobilizing to search for current environmental problems and participate in finding solutions (61% of the highest scores 4 and 5), although at the same time a large group (33%) lowered this role to only 2 points. It seems that the respondents valued lower another opportunity to consolidate knowledge in the field of ecological issues as one of the foundations of sustainable development (80% of those implementing the program lowered the assessment of this aspect,

Table 1. Stages of the project

No.	Stage	Activities and notes
1.	Organization of work in groups	Students form pairs
2.	Selection of the subject of activities	Each pair prepares 3 proposals for topics related to ecology in connection with RES and / or WM to be developed
3.	Presentation of topics on the forum	Students justify why the topics are important and propose issues that they plan to explore more deeply
4.	Discussion of topics on the forum	Selection of 1/3 of the topics
5.	Assigning topics to each group	Determining the completion date
6.	Work on the preparation of the PPT presentation	Requirements for the presentation: proper selection of materials, substantive correctness, diligence, consistency in the selection of resources, correct writing of literature, appropriate legibility of the text, etc.
7.	Students present their work from PPT orally on the forum	Seminar participants make notes and prepare for discussion
8.	Discussion on the substantive and formal issues specified in the requirements on the forum	Assessment of the participants' activity and content by the project leader / teacher
9.	Students transfer the content of the PPT to the essay form	Requirements for the essay: text division into introduction, purpose, problem development, summary, key words, sources, correct writing of the literature, text formatting, etc.
10.	Students prepare two copies of the printed essay	Establishing printout features that facilitate reading and recording reviews
11.	Draw of reviewers for individual essays	Each essay is reviewed by two students individually
12.	Reviewers provide written feedback to the authors of the work	Rules of feedback: highlights the strengths and weaknesses of the study, indicates what needs to be improved and indicates directions for further development

Note: RES and / or WM renewable energy sources and/or waste management.

Table 2. Answers to survey questions for project “EREJ” project evaluation

Project is:	1*	2*	3*	4*	5*
Important for acquiring skills for writing future engineering work	6%	27%	20%	47%	-
Effective for acquiring skills that are important to me as a future graduate	6%	20%	60%	14%	-
Motivates to independent learning	-	6%	27%	47%	20%
Important for consolidating knowledge and skills that determine competitiveness when looking for a future job	13%	13%	34%	20%	20%
Consolidating knowledge of ecological issues as one of the basis of sustainable development	-	6%	40%	40%	14%
Mobilizing to search for current problems and participate in solving them	-	33%	6%	47%	14%

Note: *rating scale: assign a number from 1 to 5 for the selected feature according to the scale: 1 poor (I was not satisfied) – 5 essential (I consider it very important).

giving it mainly points 3 and 4). They also did not treat the consolidation of knowledge in the field of ecological issues as an opportunity to acquire skills determining competitiveness when looking for a future job (a feature rated mainly at 3 points).

The opportunity to mobilize for self-study was appreciated by a total of 47% of people in the project (the highest points 4 and 5), with a similarly numerous grade assigned only to 3 points (47%). Although in the comments to the seminar leader, some students emphasized at the end of the questionnaire that the project helped to identify the structure of scientific work, correct literature citation and notation of bibliographic sources, the program was important for acquiring the skills important for writing future engineering work, 47% of students assessed 3 and 4 and 47% gave a low score of 2 points. Likewise, students rated the program as effective in gaining the skills that are important to them as a future graduate (60% of the grades out of 3). Unfortunately, from this short list it can be concluded that not all of the surveyed students appreciate the opportunity to act independently, not understanding how it translates into the durability of knowledge and the improvement of skills.

Meanwhile, a graduate of the first degree studies in the field of Renewable Energy Sources and Waste Management in general academic profile at the University of Rzeszów is to have up-to-date engineering knowledge in the field of agricultural sciences with a base in the field of engineering and technical sciences, use specialist terminology in the field of renewable energy sources and waste management. He is also to have an interdisciplinary education, which is to allow him to perform engineering tasks of a design, investment and operational nature regarding devices, installations and facilities for obtaining energy from renewable sources and in the field

of waste management, as well as starting work in a wide base of enterprises, in administration and consulting in positions related to energy issues or waste management. Currently, it is very important that the graduate be prepared to use and shape the potential of nature in accordance with the concept of sustainable development, be aware of the importance of environmental issues as an important element of this concept. Repeated confrontation with environmental issues during all years of study is therefore desirable here and, in accordance with the program, undertaken on the occasion of various educational modules [The program of studies in the field of Renewable Energy Sources and Waste Management at the University of Rzeszów, 2020].

DISCUSSION

The issue of the effectiveness and attractiveness of teaching forms is still an open problem and raised by various authors. Furmanek [2012] undertakes considerations in this regard in relation to information and IT education. He argues that it is necessary to reinterpret the entire terminological convention. This also emphasizes the need to distinguish between internal and external effectiveness, which may allow the development of a catalog of new indicators, and thus the selection of appropriate measurement methods and tools. It raises the importance of assessing external effectiveness, *inter alia*, by examining the fate and professional suitability of graduates, assessing the effectiveness of various forms of professional development, including the so-called external exams allowing for certification. According to this author, it is also necessary to evaluate education for the development of the information society. The present study discusses

some of the performance features of the “EREJ” project, measured by students’ assessment. It is worth emphasizing that the project directed them towards actively acquiring knowledge in the field of ecological issues, which, given the current state of ecosystems all over the planet, seems to be very important and applies to everyone, regardless of the field of education. It is commonly observed that not only the transmission of knowledge is important. In school institutions at different levels of education, the most important thing is the effect. The easiest way to obtain it with work is through activating methods, introducing elements of emotions and fun, which makes knowledge faster, easier and, what is equally important, absorbed by all participants of the process for a longer time. Introducing work using the project method is also useful for the academic teacher himself, who obtains from students the opportunity to learn about their current interests and problems in the form of feedback.

The aim of the article was to join the discussion on the evaluation of the effectiveness of teaching activities in higher education. It is important not only in the context of demographic changes, but also deep and multifaceted challenges faced by this education in terms of implementing the conditions for sustainable development [Brundtland, 1987; Kielczewski, 2003; Rogers et al., 2007; Colglazier, 2015; Klarin, 2018; Batorczak and Klimska, 2020; Klimska, 2022], as well as operating in an on-line environment. The task of education with activating methods is to stimulate all the senses, such as sight, hearing, speech, mental and memory operations, emotions and behaviors to acquire knowledge more efficiently. The wide range of activities imposed by the “EREJ” project gives many opportunities for group discussions, both for the students and the teacher. It encourages systematic work. The project also allows for additions while adjusting to the needs of the pupils, the needs of the moment and the changing situation. Properly conducted discussion and mobilization of all students to participate in it makes the program more attractive and has an impact on equalizing the opportunities between students. The use of a multimedia presentation of their project by each student strengthens these skills, without which it is difficult to imagine the society of the 21st century.

The presented educational project, like the others [Rozenbajger and Kostecka, 2012; Kostecka et al., 2015; Kostecka and Mazur-Pączka, 2015] can be an inspiration for the readers of the publication and be used in other institutions, with

social benefit, according to the proverb: “it is better to lose with the wise than with the foolish to find”. Employees of some universities have long seen in such and similar activities an opportunity to obtain additional funding, because the Ministry of National Education supports the winning projects participating in relevant competitions.

Higher education currently plays an important role in education for sustainable development [Grodzińska-Jurczak and Jamka, 2000; Grodzińska-Jurczak et al., 2010], and a key role in creating a knowledge-based economy. The constantly decreasing number of the Polish population aged 19–24 and the further unfavorable demographic forecast until 2035 [Julkowski, 2014], as well as the lower number of applicants to study at Polish universities, mean that the overall number of potential candidates for studies and then taking up responsible tasks of adjusting the socio-economic situation of Poland to global changes. According to Legocki [2020], the average life span of mammal species is 500 thousand years. This may sound optimistic for *Homo sapiens*, only if we are going to implement a knowledge-based economy in accordance with the principles of sustainable development from the very near future. Since in 2010–2015 there was a decrease in the gross enrollment rate from 53.8% to 48.1% and this rate is a measure of the universality of education [Brzezicki, 2017], universities should do everything to make the methods of education more attractive and increase their effectiveness.

The action-based methods provide a greater and better quality of acquired knowledge than the methods that do not inspire the listener to action or do so to a small extent. The choice of the teaching method depends on the goals, age of the listener, level of knowledge and didactic base, but as shown above, one can and should always look for a way to depart from monotony, but also the possibility of leaving the mentees passive. The chosen method largely determines the amount of permanently acquired knowledge. This is represented by Dale’s Learning Pyramid [Dale, 1969; Masters, 2013]. The use of active methods leads to: () increasing the effectiveness of teaching and learning, () the ability to motivate students to act, () the ability to develop creative thinking, students’ creativity, () integration of knowledge from various subjects, () cooperation and communication skills in group, () the ability to organize own and other work. Active methods arouse interest, give the opportunity to participate in the teaching

process, facilitate the acquisition of knowledge, and support the pursuit of success. The question of what to do to teach better and more effectively has been and is one of the factors in the development of didactics. Individual pedagogical schools have been trying to answer them for a long time. Jasińska-Maciążek [2017] offers an interesting and detailed historical outline of the method of assessing the effectiveness of teaching in Poland and in the world. In her study, she describes the system of traditional schools created at the beginning of the 19th century, which, adopting a psychological perspective, determined the formal grades according to which effective teaching was to take place. She also presents the views of John Dewey, who took them out of pragmatism, giving action and discovery a key role in the cognition process. He derived the principles of teaching from the laws of thinking, listing five stages that a student goes through when solving a problem. Jasińska-Maciążek [2017] recalls the fact that in various directions of the “new upbringing” it was always emphasized that good teaching must take into account the needs and interests of the student, refer to his activity, experience and give him a chance for creative activity. She states that acquiring knowledge and skills requires breaking the material down into a large number of small steps followed by reinforcement.

CONCLUSIONS

The depletion of the resources needed for life is now at a dizzying pace. Anthropogenic pressure is growing exponentially, but fortunately it is also accompanied by an increase in awareness of the dangers of this. The knowledge-based economy is developing, which even more significantly emphasizes the need for universal and effective education of the society. The future is in the hands of young people, they must constantly keep up with learning about new scientific achievements, as well as adapt to the surrounding socio-economic changes. Thus, effective education appears to be an important element of economic infrastructure.

Constant improvement of students' competences important from the point of view of the needs of the economy, labor market and society, through the implementation of activities aimed at increasing professional, communication, IT and analytical competences, high-quality internship programs and adapting education programs and

methods to the natural, socio-economic needs of the country and region are currently an urgent need. All methods of activating the emotions and actions of a student are worth their weight in gold here. Various forms of active education turn out to be helpful in achieving the above-mentioned goals. It also seems that regardless of the main field of study, the most frequent opportunities should be sought to direct students' attention towards environmental issues.

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