

Experimental Learning with Questionnaire Distribution for the Economic Evaluation of Industrial Pollution

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Abstract: During the 2016-2017 academic year, 3rd grade Gymnasium students from the Hellenic College of Thessaloniki received experiential training for the subject of Technology. For the needs of the course, students conducted research regarding the economic assessment of industrial pollution. A questionnaire was designed and distributed in order for students to collect information from individuals and households in the vicinity which the project of interest could potentially affect. The questionnaire aimed at identifying the maximum willingness to make a financial contribution with the use of assessing Hypothetical Scenario Methodology, which precisely assesses the economic value of an environmental good, since value is directly linked to the respondents' expressed preferences.

Key words: Experimental economics, environmental education, questionnaire, environmental good.

1. Introduction

Having mapped out the imperatives of society for further technological development, it becomes apparent that more and more young people are interested in studying in the field of Science and Technology. However, conventional teaching methods in the domain of science have been proved poor, a fact which justifies the gradual transition to a more student-centred educational system, as shown in the school curriculum and syllabus. The alternative teaching methods along with active experiential learning are expected to escalate students' interest and passion for science. Simultaneously, students' teamwork cultivates a number of social skills maximizing the benefits of technology through the use of it [1].

The subject of Technology in the Secondary School constitutes a prime example of how this trend can be realized in practice. Students in order to gain hands-on experience are practicing more and more on how to construct and discover knowledge. As a result, the school curriculum dictates for first graders to carry out individual assignments, for second graders group

work and as for third graders, their training is developed through the "Research and Experiment" method. The experimental method actively involves students in the educational process and since it is also an experiential method, it is expected to maximize learning outcomes. Finally, the numerous and diverse thematic units which are suggested, make it possible to discover a number of different fields for research able to meet each student's personal preference [2].

The educational process implemented combines the following domains of inquiry: "The cultural, social, economic and political impacts of technology" (Unit 4), "The effects of technology on the environment" (Unit 5), "The role of society in the development and use of technology" (Unit 6), as stated in the curriculum. The combination of the above mentioned fields contributes to the development of critical thinking while simultaneously it is a great stimulus to cultivate the idea of what the role of an active citizen really is [3].

2. The Educational Process

At the beginning of the course a series of seminars and lectures were held by the educators aiming at informing the students on: (a) the research method in

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order to familiarize themselves with it as well as raise their interest by linking the research to real-life situations and (b) the technological areas from which students could draw information and choose a topic of interest. As a second step, students were asked to decide and divide themselves into five groups of five. This study analyses the research conducted by one of these five groups [4].

3. Methodology

The number of five students in each group makes sure that majority decisions are possible. As the project continued, the research was divided further into five sub-stages and at each of them the role of the team-leader/co-coordinator was taken by different students. After assessing relevant literature on industrial pollution, which was a topic of interest to the group, it has also been selected as a topic for research. "Economic assessment of the industrial pollution in the area of Elefsina" [4, 5]. This area raises particular interest as it is both an industrial and historical site. Consequently, industrial pollution causes a number of implications for both local residents and Greek citizens. The research question was defined as follows: "How much does the public good of clean environment cost to the respondent? [6]"

The stages of the research are described as follows:

- (1) Bibliographic review of the Assessing Hypothetical Scenario Methodology;
- (2) Questionnaire making process;
- (3) Distribution of questionnaire-data collection;
- (4) Data processing (in excel) ;
- (5) Writing and presenting research findings.

The Hypothetical Scenario Method directly assesses the economic value of an environmental good because value is directly linked to the respondents' expressed preferences. It is also referred to as CVM (Contingent Valuation Method). The valuation for non-market goods comprises of empirical approaches and does not constitute a real science. Much of the criticism that the method receives is about how different the prices of

such a survey are compared to the prices in a real market. The major weakness of the method is the hypothetical nature of the scenario created by the researcher [6].

The method is based on an individual's intentions to pay rather than on a real life situation. As a result, various types of bias may occur at different stages of the research. The "WTP (Willingness to Pay)" approach involves lack of precision and reliability, because in an effort to determine the value of the risk of error, interviewees often feel personally involved and they think their responds are somehow interconnected with or influence the specific evaluation [7].

The main advantage of the approach lies in the almost absolute control on the part of the researcher in the designing process. This approach can evaluate any good, whether there are market prices for it or not.

The assessment of the economic value of the environmental quality in the working environment or place of residence was based on two main criteria: (a) the estimated impact of the environmental quality on property value, which in turn reflects use values; (b) the will of the local residents to contribute financially to the relocation of the plant.

For the needs of the data collection a questionnaire was created with a view to gather information from individuals and households which lie within the area of interest. The survey ventured to discover residents' maximum willingness to make a financial contribution in order to completely avoid or reverse the effects and restore an environmental damage (WTP). Maximum WTA (Willingness to Accept) stands for the people's willingness to compensate in case of a new environmental damage. The preparation of the questionnaire was made after having taken into consideration the fundamental principles that guide scientific research along with the use of practical experience in the domain of environmental economics, taking into account the peculiarities of the particular case as well [7].

The questionnaire consists of sixteen questions, six of which refer to respondents' personal data. The number of questions was determined based on the collection of all necessary information within a reasonable time limit. The questions asked were posed in the simplest way possible, were multiple-choice questions with simple select or multi select answer and can be classified into the following categories:

- (1) Closed-ended question measured on an ordinal and nominal scale;
- (2) Open-ended question; and
- (3) Semi-open question in combination with a nominal scale.

The three initial questions aimed at introducing the respondent to the research topic and the collection of qualitative data related to the degree of awareness of the problem as well as the potential benefits of creating job opportunities or any damage to the property value. The following questions addressed the core of the research, since they focused on the respondents' WTP or WTA to be compensated in order for them to relocate or tolerate the existence of the factory. The sum of money was to be determined with an open-ended question. In the last section, the main demographic data were collected.

The target group of the research consisted of inhabitants in the wider area of Elefsina. The sample size (150 people) meets the requirements of the research and conforms to the rules of the Statistical Science.

The survey was conducted in the industrial zone of Elefsina in March 2017, sampling a diverse sample of population. Additionally, questionnaires were distributed to factory workers of the area. The data collected were processed in Excel (students had the required knowledge from Descriptive Statistics courses).

4. Results

According to the findings of the survey, owners of property and tenants who live near the factory

responded that the value of their estate was higher (about 64%). Approximately 8% reported that the value is not influenced by the presence of the plant, while about 28% answered that they did not know if the value of their house is affected. The majority (about 80%) who responded that their estate is undervalued due to the factory in their area, estimated the increase of their property value should be between 10%-50% (either as purchase or rental cost) while 20% of them claimed that the increase should be even greater. Interestingly, 7.5% of the respondents believe that their property value is eliminated (100%), because of the presence of the factory.

Based on the findings of all respondents who live near a factory, the average estimated decline in the value of housing is 37.3% and the median is 30%. The standard deviation was calculated to be 26.2%. Subsequently, the values of the house along with other variables (factory, distance, gender, income) were all examined in order for the researchers to identify whether there was a difference between the average obtained or not.

The presentation of the final project (with the units as defined by the syllabus) took place at the end of the school year. Each group presented their assignment first in the classroom, so as to take into account all comments made by the class assembly and work all necessary presentation skills. Then, all five groups presented their projects to the whole school at an arranged school event.

5. Conclusions

It is safe to conclude that students, through the role of the researcher, gained an insight and reaped multiple benefits from the whole process. Firstly, they were given the opportunity to examine the concept of Environmental Education and attempt to value, using Experimental Economics tools, the benefits and drawbacks of any factory for the neighboring area. They also came into contact with economics terminology and the Hypothetical scenario

methodology. The economic valuation of use and non-use values was based on two main criteria.

The students were asked to do research on an environmental problem away from their place of residence. Consequently, they had to enrich their knowledge with information (geographical, historical, cultural, financial) of the new area. The students involved had also to observe and admit the psychological pressure that the problem poses on them, since the Greek heritage is also undermined. Moreover, students were given the chance to relate their research to the living standards and development of a certain community and discover the benefits which technological research brings as well as the subsequent discovery of environmentally compatible production processes. During the research time, students mobilized their empathy, which positively contributes to initiatives and action in the area of interest. Such a thinking process inevitably leads to consideration of what an active citizen is meant to do, a concept that is a real challenge for modern education today.

The research method employed did not only add to students' knowledge but produced new knowledge per se. Students gradually understood why research promotes knowledge and creates new data and realized the citizen's responsibility towards examining the credibility of research findings.

What is more, students with the use of certain research tools made an effort to quantify qualitative data and even evaluate it in money. Inevitably, because of the difficulties they faced the students came to realize how hard it is to measure the invaluable value of public goods.

It is also worth-mentioning that cognitive benefits were gained from the IT, Statistics and Economics sector. The communication benefits were also invaluable since students came in contact with research participants and afterwards were asked to edit and disseminate outcomes and findings. Through team-work, leadership that changed in every stage,

redistribution of roles and responsibilities, the students acquired strong social skills.

This whole process led students to familiarize themselves with the research process which made possible such a demanding task. Students became more and more autonomous within time and the fact that they knew since the beginning that the findings and outcomes of their project would be presented to a large audience, seemed to have had a positive effect on their engagement and commitment to the project.

Teamwork through students' interaction and collaboration appeared to maximize not only the final group outcome but also served individual objectives such as the personal achievement of a learning goal. The impact of experiential learning proved to be significant to the creation of a positive attitude for science learning too. Finally, even students' temporary relocation to the city of Athens, an urban environment quite different from their hometown (different place and population, environmental pollution, commuting with Tube/Tram they probably had never used before, etc.) adds to their learning and life experience.

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