

## Service-learning by PhD students to aid socially neglected people

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### **Abstract**

*In recent years, there have been calls for change in higher education to meet the needs of today's society. A higher education that enables our students to offer solutions to struggling areas of our society. Innovative and differentiating solutions from what we have been used to until now. In view of these needs, it is necessary to unite the society, which reveals its main needs, and the university community, which offers solutions on the knowledge acquired. One of the ways to carry out this integration is based on developing a methodology called "Service-Learning" (SL). This learning method is based on a strategy of collaboration between educational centers and society itself. At present, this methodology is spreading within higher education institutions worldwide. This learning strategy emerged as a learning methodology in America, to be later extended to Europe, from the United Kingdom to the rest of the continent, and from there, reaching a global impact. Throughout this long road, this methodology has been improving, encouraging the creation of increasingly strong links between educational institutions and universities, and society, by promoting the improvement of student training as well as the development of certain areas of society. This paper presents a SL project where two apparently disparate areas are related, such as doctoral students in the area of chemical engineering and sectors of society at risk of exclusion. Specifically, the objective is for the students to present some of the technological developments they have achieved to a neglected sector of society, which should participate not only in the developments, but also learning about the technical base of such technologies.*

**Keywords:** *Service-Learning; Infrared Thermography; Teaching; Social Integration.*

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## **1. Introduction**

Many of society's advances are marked by the need to reach solutions to problems found in society itself. The field of learning is not unconnected with this improvement procedure; indeed, many of the problems affecting our society serve to mark the lines of development in the training of our technicians and researchers of the future (Martínez, 2007). Today, the union of the educational community and society makes it possible for trained students to offer innovative answers that solve deficiencies in society itself, receiving in turn vital values for the development of their skills in working environments (Annette, 2000; Rodríguez Gallego, 2014). Values such as effort, ethical and civic values, social responsibility, solidarity, among others, are features that in some cases are difficult to acquire within the educational environment and by communicating with society, it facilitates their acquisition. This integration between society and educational centers is attained with an educational project or proposal that combines learning and service to society as a whole. A project in which its members learn to work in a real community environment in which their needs are present and whose main objective is to improve existing deficiencies.

In recent years, this integration has been carried out with the help of a methodology called Service-Learning (SL). It is based on a form of experience-based education, in which students spend their time helping society by presenting their acquired knowledge in certain subjects. Some authors describe SL as a non-profit program of activities led by the students themselves, oriented to satisfy the needs of a certain community, and planned in an integrated manner combining the curricular content and the student's learning objectives (Tapia, 2008). In other words, SL is the union of content learning and skills with the performance of real tasks that solve problems in society (Tinkler and Col., 2019), thus generating learning that extends from the classroom to society itself. The methodology, unlike other activities such as community service or volunteer activities, presents characteristics in areas of learning and aspects of integrity (Rodríguez Gallego, 2014). Specifically, SL is one that presents positive aspects in areas related to the training of students. Among these, it should be noted that SL promotes learning or understanding human values, without forgetting academic development, by making the skills applicable to society within the professional environment. The link between learning and society is also noteworthy, since the activities of an SL project respond to the intervention of a professional nature in a problem of society (Rodríguez Gallego, 2014; Manzano, 2010). In short, the main difference between SL and other activities are the training aspects that are integrated within a project within the academic and social fields (Butin 2006; Manzano, 2010). So much so that some authors believe that quality university education cannot be separated from social education (Martínez, 2007; Rodríguez Gallego, 2014). Along these lines, in recent years, a large number of American and European universities are actively

implementing SL methodologies into their educational programs. This has even led to the execution of institutional programs and networks that facilitate the implementation of these SL methodologies (Duffy et al., 2011; Rodríguez Gallego, 2014; Elsafty et al., 2020). The use of a methodology based on SL represents a great step forward in the pedagogical field, since the advantages mentioned will be incorporated into educational centers, including universities (Dillabaugh, 2019; Sewry and Paphitis, 2018) and doctoral studies (Sewry and Paphitis, 2018; Saitta et al., 2011). All of this will undoubtedly generate more knowledge as communities can focus the lines of work on their needs (Ching, 2018).

The main objective of the work presented is to use SL activities to train potential researchers during their doctoral period. To this end, the results obtained in various research projects that are serving as the main topics for doctoral students linked to this SL project will be used. Among the specific objectives to be achieved are: (i) to bring the main technological developments to society; (ii) for society to help transmit values to potential researchers; (iii) to foster the union between the university and society. These SL activities will focus on a part of society at risk of social exclusion located in centers belonging to the Madrid City Council, Spain. Specifically, in different centers within the Department of Social Inclusion for Integration in the Community and Social Emergency belonging to the aforementioned City Council.

## **2. Service-Learning Methodology Applied**

This article presents a model of SL that has been developed within the doctoral studies in the Chemical Engineering program of the Chemistry Division of the Complutense University of Madrid (UCM) (Spain). This project has been carried out during two academic years 2018-19 and 2019-20. This development is focused on the design of a plan to integrate SL activities into the training of doctoral students. The team is made up of four university professors, six doctoral students, and 120 students from day centers with a significantly lower level of training than the doctoral students linked to the project. With this whole team collaborating in this project, the total number of 130 people were actively involved. In addition to the values that the doctoral students will receive, this project will significantly improve their ability to present ideas. Within the development stages of the project that is presented, different phases are contemplated and will be carried out in a sequential way (Rodríguez Gallego, 2014):

- a) **Diagnosis:** in this first phase, not only the available human resources will be known, but also the situation and the specific problems of the community to which the model is addressed. It must be considered that almost all the people addressed by the project are in a situation of social disadvantage/exclusion, have suffered

from alcohol and/or drug addiction, and/or are under psychiatric treatment that hinders their cognitive abilities.

- b) Initial coordination: a program of activities has been drawn up by the teachers in the consortium for the development of the project. This project established the guidelines for the collaboration between the professors and the SL students (PhD students). Before starting, it was necessary to contact the Madrid City Council and make a series of visits to find out in detail where the SL model was to be applied.
- c) Design: different coordination meetings were held in which each of the postgraduate students organized their schedules to adapt them to the centers where the project was to be applied. They also had to start working on common strategies to carry out the activities. The total dedication of each student to these activities was two ECTS credits.
- d) Implementation: two activities were carried out for different communities. The events began on 7 March 2019, with the first one, entitled "From Heart to Stroke - Food and Innovation". In this first activity a workshop/conference was held related to the application of the technologies developed by the AlgoReach research group in the prevention of cardiovascular diseases. Subsequently, on 13 March 2019, the second event was held, entitled "Thermography, a Photograph of the Human Body". This event took place at the Faculty of Chemical Sciences of the UCM. In this event, the research group AlgoReach presented several developments in the field of infrared thermography. Also, they developed a workshop where they brought the technology closer to the assistants. Besides these activities, they have planned an additional series of them within the scope of the work areas that AlgoReach is developing. Currently, the last group of events that are contemplated within the SL project "Learning-Service in the transfer of technological results", financed by the UCM.
- e) Reflection: in this phase, the information gathered will help to improve and facilitate other SL students in the search and design of new events. Likewise, after each event, meetings will be held with all the parties involved in the project to know the relevant aspects and improve its quality.
- f) Evaluation: to carry out the evaluation of the events, interviews were conducted among all the members of the project. Also, surveys have been carried out among those attending the event in order to know their opinion. These surveys will also inform about whether the specifications marked for the SL event have been reached in their eyes. The evaluation of the main results of this SL project is based on interviews with all the groups involved. The interview conducted is based on the structure shown in table 1.

**Table 1. Interview stages planned in relation to the SL activity.**

Point	Interview Stage
1	Is it linked to significant learning?
2	Is it designed to make individuals reflect on what was done during the event?
3	Does it promote understanding values?
4	Does it promote personal growth?
5	Does it promote and strengthen social ties with the community?

### 3. Results

At present, two events are still to be held to finalize the results shown in this project. That is why in this section the results shown are preliminary. However, the results are representative of all the results that will be obtained at the end of the project. The system for processing the surveys has been arranged on the basis of transcriptions of recorded texts, identifying complete sets. The analysis of the content has been carried out with Statgraphics 18. The analysis has been revealing, so the task of categorization and coding of the information collected was carried out. For the validation of the system of categories, it has been the teachers linked to the project that is being developed and also a group of three more teachers not linked to it. The kappa index is being calculated to reflect inter-observer agreement (Rodríguez Gallego et al., 2014). This coefficient, in all cases, has exceeded the value of 0.80, it can be considered as good coefficient value (Rodríguez Gallego et al., 2014). The results were captured through surveys of both students and teachers.

**At the student level**, the categories addressed focused on the three areas of student training during the development of the SL methodology, specifically: (i) in principle, the results will be approached considering the academic requirements, where mastering the contents, the positive attitudes towards work, knowing the options of presentation, and recognizing realistic ideas in the world of work among others will be considered; (ii) then, the characteristics implicit in the formation of values will be analyzed, including aspects such as self-esteem, teamwork, self-improvement, motivation, creativity, communication, responsibility, and more; (iii) and finally, relevant aspects in the area of community relations will be considered, such as social development, community intervention, diversity and values, coexistence and interaction, among others.

Among the results of the interviews, it is important to highlight the importance of problem solving by the PhD students directly from the students trying to satisfy their curiosity (point

2, **table 1**). Also, the complementarity and the teamwork among the teachers (point. 3, **table 1**). In addition to seeing more real problem solving through the union of different knowledge, not only linked to the research that is presented (point 4, **table 1**). Another characteristic that most impacted the teachers is the possibility of defending their theories and techniques in other forums different from the technical approach, responding to different types of questions (**point 5**, table 1). In practice, in all cases, the return to work in the laboratory made them see their tasks and objectives from other points of view, considering the advantages of the application of what they are doing (point 1, **table 1**). In general, one of the most generalized results is the pleasure caused by helping people that have or are suffering (point 5, **table 1**).

Considering that the students belonging to the centers, apart from allowing them to learn about new applications, in appreciation of this activity, they have proposed the creation of equipment for collaboration by helping in the design of the sensors presented at the events in which they have participated (point. 5, **table 1**).

**In the field of the teachers**, the categories that were addressed are distributed in the same areas considered although they do not contemplate the same points, specifically (i) within the scope of the academic curriculum, the articulation of contents, the quality of learning, the didactic strategies, and the active participation, among others, will be considered; (ii) afterwards, the implicit characteristics of the formation in values will be analyzed, including aspects such as teamwork, motivation, etc. Leadership, responsibility, among other aspects; (iii) and finally, in the area of community linkage to social development where diversity and values, pro-socialization, community intervention, among others, will be taken into account.

In general, the teachers who have participated in this project consider this methodology to be tremendously positive in order to present the potential researcher with a new scenario in which to promote and share his or her technological developments. The teachers in charge of preparing the events have also considered that based on the opinions received in the previous section, it has been worthwhile to complete the training of the teachers involved. It also complements one of the aspects that always gives great importance to the development of research projects concerning the influence on society of the results obtained.

#### **4. Conclusions**

This paper presents a service-learning (SL) project through which communities at risk of exclusion are integrated with doctoral students from the chemical engineering program at the Universidad Complutense de Madrid in Spain. Although this project is not yet finished, the results are very promising, both for the SL students and for the communities where the activities have been applied. It should be noted that the PhD students (SL students) have

acquired social skills regarding community work and collaboration. This synergy has greatly promoted not only knowledge but also value formation and community service. So much so that the activities developed, and the pleasing results obtained, open up the possibility of periodically establishing new activities based on presenting currently active technological projects.

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## **References**

- Annette, J (2000). Civic participation and education for citizenship. Political Studies Association, UK, 50th Annual Conference, London.
- Butin, D.W. (2006). The limits of service-learning in higher education. *The review of Higher Education*, 29, 473-498.
- Ching, SH Turning a Service Learning Experience into a Model of Student Engagement: The Lighthouse Heritage Research Connections (LHRC) Project in Hong Kong. *Journal of Academic Librarianship* 44(2), 2018, 196-206.
- Dillabaugh, J. Liberating Service Learning and the Rest of Higher Education Civic Engagement. *Journal of Experiential Education* 42(1), 2019. 93-94
- Duffy J; Barrington L; West C.; Heredia M.; Barry C. Service-Learning Integrated throughout a College of Engineering (SLICE) *Advances in Engineering Education*. Summer 2011.
- Elsafty, A.; Elsayad, H.I.; Shaaban, I Educating engineering students in Egypt: recommendations for improvement. *International Journal of Higher Education*, 9(3), 2020, 1-14.
- Manzano, V (2010). El modelo de Aprendizaje Servicio y su potencial para la educación superior. VI Jornadas de docencia en Psicología. Universidad de Sevilla.
- Martínez, M. (2007) Formación para la ciudadanía y educación social. *Revista iberoamericana de Educación*, 42, 5.
- Rodríguez Gallego M. R. (2014). El aprendizaje-servicio como estrategia metodológica en la universidad. *Revista Complutense de Educación* Vol. 25, 95-113.
- Saitta, E.K.H.; Bowdon, M.A.; Geiger, C.L. Incorporating Service-Learning, Technology, and Research Supportive Teaching Techniques into the University Chemistry Classroom. *Journal of Science Education and Technology*, 20(6), 2011, 790-795.
- Sewry, J.D., Paphitis, S.A. Meeting important educational goals for chemistry through service-learning. *Chemistry Education Research and Practice*, 19(3), 2018, 973-982.
- Tapia, M. (2008). *Aprendizaje y servicio solidario*. Buenos aires: Ciudad nueva
- Tinkler, A; Tinkler, B; Reyes, C; Elkin, S. Critical Service-Learning: Learning Through Experience to Advance Teacher Education. *Journal of Experiential Education*, 42(1), 2019, 65-78.