



HAL
open science

Rural Service-Learning in Information Sciences

Nives Mikelić Preradović, Marijeta Čalić, Marija Roglić

► **To cite this version:**

Nives Mikelić Preradović, Marijeta Čalić, Marija Roglić. Rural Service-Learning in Information Sciences. Congrès du réseau international de recherche sur les organisations et le développement durable, Oct 2021, Montpellier, France. hal-03538758v1

HAL Id: hal-03538758

<https://hal.science/hal-03538758v1>

Submitted on 21 Jan 2022 (v1), last revised 31 Oct 2022 (v2)

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Rural Service-Learning in Information Sciences

Nives Mikelić Preradović, University of Zagreb, Faculty of Humanities and Social Sciences, Department of Information Sciences, e-mail: nmikelic@ffzg.hr

Marijeta Čalić, Local Action Group “LAG 5”, e-mail: razvoj@lag5.hr

Marija Roglić, University of Montpellier, Montpellier Management, e-mail: marija.roglic@umontpellier.fr

Abstract

The aim of this paper is to represent the implementation of service-learning methodology into Croatia's information sciences which contributed to meeting the needs of the rural population's on two Croatian islands. Those needs defined as a digital skills in rural tourism for adults and STEM education of elementary school children are usually not easily accessible in rural areas. Thirteen students of information sciences from the University of Zagreb have spent a week with rural organization LAG 5 from Korčula implementing robotics workshops for children (Micro:bit and MBot) and teaching web and online advertising for rural entrepreneurs. This kind of collaboration helped develop the rural community's core skills and entrepreneurial capabilities but also motivated students for developing their expertise in teaching, problem-solving, teamwork, taking initiative and innovation. Service-learning proved to be an effective tool for strengthening the partnership and support between universities and rural organizations in which we boost social innovation and explore specific rural development opportunities.

1. Introduction

This paper aims to present the first example of rural service-learning in Croatia's information sciences. University students met the rural population's needs defined as **digital skills in rural tourism - adult education and STEM education of elementary school children**.

Our case unfolded as a part of the "Rural 3.0: Service-Learning for Rural Development project (RURASL)". One of the RURASL project's main goals is to help develop the rural community's core skills and entrepreneurial capabilities (for which such development is not easily

accessible) and improve the quality of education for sustainable development through service-learning university-community partnerships.

As part of the course **Urban and Rural Service-Learning**, within the project RURASL, graduate students of information sciences from the University of Zagreb (Croatia) had the opportunity to apply knowledge and skills gained at the university in solving the real needs of the rural community on the island of Korčula and Pelješac through the experience of service-learning (SL). Thirteen students have spent a week (40 hours) implementing 4 robotics workshops for children (Micro:bit and MBot workshops) and 2 workshops for older adults (Web for Rural Entrepreneurs and Online Advertising for Rural Entrepreneurs). The number of school children who participated in 4 workshops on robotics was 36, while the number of older adults participating in the workshops was 10.

The rural community partner was a multistakeholder organisation devoted to sustainable rural development of the Peljesac peninsula and islands Mljet, Korcula and Lastovo, Local Action Group "LAG 5". It is a local NGO implementing the European Union LEADER approach, LEADER standing for "Links Between Actions for the Development of the Rural Economy." The STEM field (*science, technology, engineering & mathematics*) has recently stood out as necessary for developing the economy both in the world and in Croatia. However, the interest of young people in the STEM field in Croatia is not sufficiently developed, as evidenced by the fact that the Ministry of Science and Education has awarded 3,400 direct state scholarships in recent years to encourage high school pupils to enrol in studies in the STEM field¹. Nevertheless, it needs to be emphasised that the STEM field's interest needs to be nurtured by providing access to technology and education from early school age.

As an innovative approach to teaching and learning that brings students, academics, and the community to develop solutions for challenging issues jointly, service-learning can promote STEM education for elementary school children and serve underrepresented populations (Mikelic Preradovic, 2015). By using service-learning, teachers increasingly work to encourage girls and minorities (Naukkarinen & Bairoh, 2020) traditionally neglected in STEM, to consider STEM as a future career.

However, there are three critical factors for creating a STEM generation: engagement, motivation, and exposure to STEM subjects (De Loof et al, 2019). Each of these factors can be addressed by implementing service-learning in STEM.

¹ <https://mzo.gov.hr/vijesti/tar-ministrice-divjak-sa-studentima-stem-games/1349>

Furthermore, recent research on adults' digital skills in adult training and development programs in Croatia (Pavić, 2019) from open public universities in seven Croatian cities shows a relatively low digital skills level which can be increased through service-learning projects, as demonstrated by Hanks & Icenogle (2001) in their USA experiences. They revealed that university students could help adults over 50 develop work-related skills such as self-esteem, resume development, and computer skills.

Therefore, students in the course *Urban and Rural Service-Learning* have devised solutions that meet the rural needs and have implemented them through service-learning in the rural community on the island of Korcula and Peljesac.

Literature review

1.1. Service-learning and STEM education

According to Mikelic Preradovic (2019), jobs in the natural sciences, technology, engineering and mathematics (STEM jobs) are paid 29% more than jobs in other fields. These statistics have been confirmed in other EU countries as well, where STEM professionals are on average better paid than other professionals (Reynolds & Stryszowski, 2014). Also, in the last ten years, job growth in the STEM area has been three times higher than the growth of other jobs, and it is expected that in the next decade, the number of jobs in the STEM area will continue to 8.0 percent by 2029, compared with 3.7 percent for all occupations (Zilberman & Lindsey, 2021). Despite the demand for STEM graduates, it is difficult for companies to find qualified candidates for many jobs. Two main factors contribute to this problem: (1) insufficient student enrollment in STEM colleges and (2) a lack of qualified teachers in the STEM field (Eurydice, 2021). In addition to the fact that many students never enter the STEM area due to inadequate school preparation and teachers' poor quality training (Ejiwale, 2013), many employees in the STEM area are approaching retirement, suggesting additional demand for this profile.

According to Lemons, Carberry, Swan & Jarvin (2011), expanding the core competencies of engineering students and incorporating skills essential to SL (collaboration, customer awareness, and ethics understanding) could result in a population of gender and ethnically diverse engineering professionals. According to them (ibid.), "the positive effects of SL activities are attributed to the processing of experiences through critical reflection, discussion, and interaction with other students and professors". Intel Corporation's survey (2011) showed

that teenagers' interest in enrolling in one of the STEM colleges increases when they hear how their choice can benefit the world.

Examples of the implementation of service-learning in technology include mobile robots (Bhounsule, Chaney, Claeys & Manteufel, 2017), the Internet of Things (Watson & Ogle, 2013) and intergenerational computing (Wexler, Drury, Coppola, Tschinkel & Thomas, 2011).

1.2. Service-learning and adult education

According to statistics in the Curriculum for the Development of Basic Digital, Mathematical and Reading Skills of Adults (MZO, 2019), 20 to 25% of European adults between the ages of 16 and 65 have a low level of digital literacy (ability to solve problems in technology-rich environments). Furthermore, CEDEFOP (2019) provides data that 37.4% of adults (25 - 64 years) in Croatia have a low digital literacy level. Regarding the adoption of digital skills, the motivation to use lifestyle technologies is emphasised (social networks, watching videos, informal communication, etc.). In contrast, a low level of competence in workplace-related skills was observed (problem-solving in a complex technological environment-related primarily to work tasks, knowledge of technologies such as Excel, PowerPoint, web design, etc.). Research shows us there is a substantial gap to be breached in the adoption of digital skills in problem-solving activities, as well as the computer is rarely used to run a personal website (Pavić, 2019).

2. Approach

Service-learning was used as "a form of experiential education in which students engage in activities that address human and community needs together with structured opportunities intentionally designed to promote student learning and development." (Jacoby, 1996) to meet the rural community's needs of the island of Korcula and Peljesac.

The proof of student "learning" in "service-learning" was specified as the ability to synthesise material adopted from academic literature with real-life experiences to create an effective curriculum for pupils and adult users.

As part of the *Urban and rural service-learning* course, university students planned and conducted service-learning workshops for elementary school pupils and adults. The workshops "**STEM education of school children**" enabled university students' participation in the digital-

literacy education of pupils, teaching them how to use the principles of robotics and automation as tools for transferring STEM competencies to children.

University students (familiar with the basics of robotics and programming) were tasked with introducing elementary school pupils to the micro: bit and MBot educational kits and teaching them to program robots to solve assigned tasks. These activities provided students with an appropriate context for practical learning and teaching and opportunities to synthesise technical and transversal skills. Students were in charge of material development, preparation and implementation of workshops.

At the workshop for adults, "**Web for Rural Entrepreneurs**", students had the task to teach participants what a website is, how it is maintained, what it consists of and finally, how to create it and publish it. The platform they chose was Wix because it is straightforward to use, requires no prior knowledge, and is free of charge.

The other workshop for adults, "**Online Advertising for Rural Entrepreneurs**", aimed to teach online advertising in tourism. Participants were taught to work with tools and platforms such as Facebook, Instagram, Google My Business, Airbnb and Booking.

The specific course conditions and skills that students should have acquired after the *Urban and Rural Service-Learning* course are shown in Table 1.

Table 1. The specific course conditions and skills of students after the Urban and Rural Service-Learning course

Specific condition
<ul style="list-style-type: none"> • Each student participated in at least 40 hours of service learning through workshops for the rural community • The experience of service-learning was connected with the course's academic goals • The course involved critical thinking about the relationship between academic content and community work • Students tried to satisfy the need to introduce the extracurricular program to enrich natural science and technical subjects, develop adults' digital skills, and analyse their contribution to educational and community goals
Student skills
<ul style="list-style-type: none"> • Develop and implement software solutions for micro: bit and mBot robots • Develop and implement websites and solutions for advertising on the web and social networks • Develop an extracurricular plan of robotics for elementary school students • Elaborate curriculum plan for the development of digital skills in adult education • Formulate and prove a hypothesis about how the approach and ability to work with technology affects education • Effectively teach pupils and adult users of different cultural and educational backgrounds

3. Results

Students of information sciences have spent a week (40 hours) implementing their service-learning solutions on-site in a summer school format. The number of school children who participated in 4 workshops on robotics was 36. The number of older adults who participated in workshops on web advertising and web development (acquiring more advanced digital skills that involve solving problems in a complex technological environment related primarily to work tasks) was 10.

The workshops aimed to develop digital skills among older adults who were members of various associations in LAG 5. People who still do not have a website of their association and who (as small entrepreneurs) are engaged in tourism and apartment rental and need to acquire knowledge and advertising skills on various online platforms.

Upon the completion of the workshops, students have supplemented their workshop materials with explanations and comments from rural partner LAG 5 and, as a result, compiled a manual with examples that are applicable to meet similar rural needs in other EU countries and can be used by university students to conduct similar rural service-learning workshops or by rural residents for individual self-paced learning (Figure 1.)

Upon completing the project, each of them completed an open-ended questionnaire that provided them with self-evaluation by analysing the most effective parts of the project and the skills and knowledge acquired by their SL project.

The analysis of the answers identified the components that the students singled out as **the most efficient part of the project** (Table 2.). Furthermore, what students single out as **the most important things they have acquired and learned with this SL project**, and what will serve them in the future as well are shown in Table 2.



RURAL SERVICE-LEARNING IN INFORMATION SCIENCES

SUMMARY	PROJECT DATA
<p>In the course Urban and Rural Service-Learning, 13 graduate students of information sciences from the University of Zagreb (Croatia) had the opportunity to apply academic knowledge and skills to meet the real needs of the rural community on the island of Korčula and Peleješac through the experience of service learning.</p> <p>The rural community partner was LAG5, an NGO founded with the purpose to implement the LEADER approach in south Croatia.</p> <p>The needs of the rural beneficiaries (i.e. local population) defined as: digital skills in rural tourism - adult education (web advertising and web development) and robotics for primary school children were met by university students.</p> <p>In addition, students of museology and archival studies worked on service-learning (SL) projects at the cultural heritage institutions: City Museum in Korčula and Archival collection center Korčula - Lastovo.</p> <p>In total, there were 5 rural organizations that participated as beneficiaries in rural SL projects: LAG 5, 2 primary schools (from Korčula and Peleješac), City Museum in Korčula and Archival collection center Korčula - Lastovo. Students of information sciences have spent 5 days (40 hours on the implementation of their solutions on-site).</p> <p>The number of school children who participated in 4 workshops on robotics was 36, while the number of adults who participated in workshops on web advertising and web development was 10.</p> <p>Students have devised solutions that meet the above listed needs selected by a rural community, implemented them in the rural community on the island of Korčula and Peleješac, supplemented them with explanations and comments from rural partners and, as a result, compiled this manual with examples that are</p>	<p>Country</p> <p>Croatia</p> <p>Name of the course of the academic module designed for RURAL 3.0 related to the activity</p> <p>Urban and Rural Service-Learning</p> <p>Name of the activity</p> <p>Rural service-learning in Information sciences</p> <p>Name of Higher Education Institution</p> <p>University of Zagreb, Croatia, Faculty of Humanities and Social Sciences, https://web2020.ffzg.unizg.hr</p> <p>Person responsible for the project at the Higher Education Institution and email address</p> <p>Nives Mikelić Preradović, full professor, nmikelic@ffzg.hr</p> <p>Name of rural organization</p> <p>LAG5, Croatia</p> <p>Person responsible for the project at the rural organization and email address</p> <p>Marijeta Čalić, razvoj@lag5.hr</p> <p>Number of participating Higher Education students</p> <p>13</p>

RURASL CASE-BASED LEARNING MATERIALS

Figure 1. RURASL case-based learning materials: https://rural.ffzg.unizg.hr/wp-content/uploads/2020/12/Case-base-learning-materials_Croatia_English-version.pdf

Table 2. Main project results and benefits for the students which arose after SL implementation.

Most efficient part of the project
<ul style="list-style-type: none"> • Applying the acquired knowledge in real situations and testing that knowledge in teaching adult users • Increasing children's interest in the STEM area • Students did most of the work when divided the tasks and performed them individually. The principle in which everyone is responsible for their task prevents the diffusion of responsibility that occurs when it is not defined whose task it is • Workshops with children in schools that brought great joy to those children who discovered their passion for STEM • Having fun figuring out how to present robotics to children
Benefits for the students
<ul style="list-style-type: none"> • Respect for others, but also yourself • Knowledge of writing texts for the education of other colleagues • Critical thinking • Organisational work and clear goal setting • Transfer knowledge to children as the most challenging but most important part of the population to educate, • Awareness of the time complexity of the project, • Attitudes towards children and the elderly population, • Awareness of the importance of SL for community development, but also personal development • Awareness of the role of the public in the dissemination of SL projects.

4. Discussion

Rural service-learning enabled university students to understand how STEM and digital competencies can benefit the community they live in and themselves.

In his evaluation, after the course ended, the teacher singled out the following set of crucial skills that students need when engaging in rural service-learning:

- skills for responsibility towards the rural community,
- working with children and/or adult users,
- connecting with professors and superiors in non-teaching situations,
- adapting communication techniques to children,
- communication and presentation skills,
- oral expression and public speaking,
- presentation of STEM topics in a popular science way,
- liberation from fear of public speaking,
- gaining experience working in a team,
- trying and learning something new,
- applying the knowledge acquired at the college in practice more innovatively and excitingly,
- acquiring knowledge about project implementation,
- understanding what it is like to work on a project, what is expected from a student, what his/her tasks are, how to function in group work and apply everything in real life while transferring their knowledge to someone else.

Finally, the following challenges faced by students were identified by the teacher during the implementation of rural service-learning:

- adaptation of materials to different age groups,
- a lot of revision and redesign at each stage,
- reconciling with the fact that good ideas are not always feasible,
- adapting oneself to the new situation,
- accepting that it is not necessary that everyone has to do everything, but that a good division of labour and communication is essential,
- changing plans in collaboration with teammates,
- harmonising the ideas of team members who have different perspectives,
- flexibility and understanding for other people's obligations,

- agreement and adjustment of deadlines to implement activities that suit all team members.

5. Implications and limitations

Educational robotics workshops for rural school children served not only to acquire knowledge in STEM areas but also to develop competencies such as cooperation in group work, communication, learning skills, creativity, curiosity, etc.

Nevertheless, university teacher and LAG 5 community partner evaluations of the rural service-learning described in this paper revealed several challenges, which are in line with the main findings of Visvizi, Lytras and Mudri (2019).

One of the main challenges was students' transportation from the university to the remote rural community (island), which consequently influenced students' time to engage in activities. The other issues were poor Internet access and lack of digital infrastructure in rural area. Finally, the community partner's support for students who were engaged in the summer school also presented a challenge: community partner had to deal not only with issues of student meals, housing and communication with rural residents but also with the requirement to implement service-learning in a much shorter time frame than a traditional semester.

On the positive side, elementary school pupils in this project, using robots, entered the world of programming and robotics by learning how to program a robot to automatically perform actions such as driving in different directions, turning lights on and off, moving along the line, detecting obstacles and more. They have shown an increase in STEM competencies and an affinity for STEM education and careers in the STEM field.

The evaluation results showed that university students felt that SL encouraged them to learn and improve their understanding of the teaching material.

Referring university students to all robots' pedagogical applications helped them become aware that robots are not toys. Solving problems using theoretical concepts enabled them to think about the practical application of theory to other problems. Students also acquired several soft skills such as teaching, problem-solving, teamwork, initiative, innovation.

Students' central challenge was the doubt in their ability to teach robotic and engineering concepts and maintain children's attention.

The workshops' results (and their evaluation) described in this paper show the importance of initiating such trends in rural areas, where access to equipment and extracurricular education is much more limited than in urban areas. However, Croatia represents a country where 42.9%

of the total number of inhabitants lives in a rural area, similar to Estonia, Austria, Slovenia and Romania (Eurostat, 2018) and digital literacy in the rural area is crucial to their social and economic development (ENRD, 2014).

Service-learning proved to be an effective tool for building partnerships between rural community and university that helped to solve developmental problems through the acquisition of skills. It enabled rural inhabitants to develop their skills while producing graduates who are adaptive to change, equipped for their future challenges, who possess a depth of knowledge in their field of study, but also a breadth of knowledge to address social issues in their communities.

6. References

1. Mikelić Preradović, N. (2019). *Implementacija društveno korisnog učenja u STEM području*. Institut za razvoj i inovativnost mladih. Zagreb: Hrvatska. Retrieved from: <https://croatianmakers.hr/wp-content/uploads/2020/09/Implementacija-dru%C5%A1tveno-korisnog-u%C4%8Denja-u-STEM-podrucju.pdf>
2. Pavić, D. (2019). *Digitalne vještine polaznika obrazovanja odraslih*. 7. Međunarodni andragoški simpozij Biograd na moru, Hrvatska,. Keynote lecture.
3. Hanks, R. S., & Icenogle, M. (2001) Preparing for an Age-Diverse Workforce: Intergenerational Service-Learning. *Social Gerontology and Business Curricula. Educational Gerontology* 27(1), 49-70.
4. Visvizi, A., Lytras, M.D. & Mudri, G. (2019). Smart Villages: Relevance, Approaches, Policymaking Implications. In: Visvizi, A., Lytras, M.D. & Mudri, G. (Eds.), *Intelligent Villages in the EU and Beyond (Emerald Studies in Politics and Technology)*, Emerald Publishing Limited, pp. 1-12. <https://doi.org/10.1108/978-1-78769-845-120191002>
5. Eurostat (2018). *Eurostat Regional Yearbook 2018: Section 14 Focus on regional typologies*. Publications Office of the European Union, Luxembourg, 194-196.
6. Jacoby, B. (1996). Service-learning in today's higher education. In: B. Jacoby & Associates, *Service-learning in higher education: concepts and practices*, San Francisco: Jossey-Bass Inc., 3-25.
7. Mikelić Preradović, N. (2015). Service-Learning. In: M. Peters (Ed.), *Encyclopedia of Educational Philosophy and Theory*, Springer Singapore: Springer, pp. 1-6.

8. Lemons, G., Carberry, A., Swan, C. & Jarvin, L. (2011). The Effects of Service-Based Learning on Metacognitive Strategies During an Engineering Design Task. *International Journal of Service-Learning in Engineering*, 6, 1-18.
9. Intel Corporation (2011). *Exposure to Engineering Doubles Teens' Career Interest*. Website: <https://newsroom.intel.com/news-releases/exposure-to-engineering-doubles-teens-career-interest/>
10. Bhounsule, P.A., Chaney, D., Claeys, L. & Manteufel, R.D. (2017). *Robotics service learning for improving learning outcomes and increasing community engagement*. American Society of Engineering Education Gulf-South West Section, Dallas, Texas, USA.
11. Watson, C. E. & Ogle, J. T. (2013). The Pedagogy of Things: Emerging Models of Experiential Learning. *Bulletin of the IEEE Technical Committee on Learning Technology*, 15(3).
12. Wexler, S. S., Drury, L. J., Coppola, J. F., Tschinkel B. J. & Thomas, B. A. (2011). *Service-learning computing courses assist with technology needs in community-based organisations serving older adults*. IEEE Long Island Systems, Applications and Technology Conference, Farmingdale, NY, pp. 1-6.
13. MZO (2019). *Kurikulum za razvoj temeljnih digitalnih, matematičkih i čitalačkih vještina odraslih: Temeljne vještine funkcionalne pismenosti*. Website: http://obrazovanjeodraslih.hr/wpcontent/uploads/2019/11/MZOSKnjizzniBlokBros%CC%8CuraOO_WebOKr.pdf
14. CEDEFOP (2019). *The adult population in potential need of upskilling: Croatia*. Cedefop country factsheet. Retrieved from: https://www.cedefop.europa.eu/files/factsheet_hr.pdf
15. De Loof, H., Struyf, A., Boeve-de Pauw, J. & Van Petegem, P. (2019). Teachers' Motivating Style and Students' Motivation and Engagement in STEM: the Relationship Between Three Key Educational Concepts. *Research in Science Education*. 10.1007/s11165-019-9830-3.
16. Naukkarinen, JK, Bairoh, S. (2020). STEM: A help or a hinderance in attracting more girls to engineering? *J Eng Educ.*, 109, 177– 193. <https://doi.org/10.1002/jee.20320>
17. Zilberman, A., Lindsey I. (2021). Why computer occupations are behind strong STEM employment growth in the 2019–29 decade. *Beyond the Numbers: Employment & Unemployment*, 10(1) <https://www.bls.gov/opub/btn/volume-10/why-computer-occupations-are-behind-strong-stem-employment-growth.htm>

18. Reynolds, T., Strykowski, P. (2014). Skills and Jobs in the Internet Economy. *OECD Digital Economy Papers*. 10.1787/5jxvbrjm9bns-en.
19. European Commission/EACEA/Eurydice. (2021). *Teachers in Europe: Careers, Development and Well-being*. Eurydice report. Luxembourg: Publications Office of the European Union.
20. Ejiwale, J. (2013). Barriers To Successful Implementation of STEM Education. *Journal of Education and Learning (EduLearn)*, 7(63). 10.11591/edulearn.v7i2.220.