Articles

Youth empowerment through technical training in welding: the Esmeraldas case

Empoderamiento Juvenil Mediante Capacitación Técnica en Soldadura: Caso Esmeraldas

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ABSTRACT

Structural violence and the lack of economic opportunities in cities such as Esmeraldas, Ecuador, constitute a systemic problem that disproportionately affects young people. This article documents the experience of the community engagement project "Strengthening Technical Skills for Community Development," implemented during the first academic term of 2025 by the Faculty of Engineering at the "Luis Vargas Torres" Technical University of Esmeraldas (UTLVTE). The initiative included technical training in electric arc welding for 52 at-risk youth, selected through a participatory assessment in the rural parish of 5 de Agosto, Codesa sector (Youth Center). Using a mixed-methods approach, the quantitative assessment of technical skills was combined with a qualitative analysis of perceptions using satisfaction surveys (Likert scale) and participant observation. The results showed 100% satisfaction regarding the clarity of the content, the instructor's skill, and the practical relevance of the knowledge. From a qualitative perspective, a significant improvement was observed in the young people's self-esteem and outlook on the future; as a final outcome, they created 50 pieces of office furniture (chairs) for the community. The discussion examines these results in light

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of empowerment theory and the guidelines on community engagement established by the Council for Higher Education and the UTLVTE. It is concluded that the transfer of technical and scientific knowledge, when accompanied by a needs assessment, socio-emotional support, and a quality-focused approach, not only produces human capital but also acts as a catalyst for rebuilding the social fabric, thereby fulfilling the purpose of higher Education, which is to serve society, and contributing directly to the objectives of university engagement.
Keywords: Youth empowerment, welding, community engagement, substantive functions, quality management, technical training, Esmeraldas.

RESUMEN

La violencia estructural y la falta de oportunidades económicas en ciudades como Esmeraldas, Ecuador, configuran un problema sistémico que afecta desproporcionadamente a la juventud. Este artículo sistematiza la experiencia del proyecto de vinculación con la sociedad "Fortalecimiento de Habilidades Técnicas para el Desarrollo Comunitario", ejecutado durante el primer periodo académico 2025 por la Facultad de Ingenierías de la Universidad Técnica "Luis Vargas Torres" de Esmeraldas (UTLVTE). La iniciativa incluyó una formación técnica en soldadura eléctrica por arco voltaico dirigida a 52 jóvenes en riesgo, elegidos a través de un diagnóstico participativo en la parroquia rural 5 de Agosto, sector Codesa (Casa de la Juventud). A través de un enfoque metodológico mixto, se unió la evaluación cuantitativa de habilidades técnicas con un análisis cualitativo de percepciones utilizando encuestas de satisfacción (escala Likert) y observación participante. Los resultados evidenciaron un 100% de satisfacción respecto a la claridad de los contenidos, la habilidad del instructor y la relevancia práctica de los conocimientos. De manera cualitativa, se notó una valiosa evolución en la autoestima y la visión de futuro de los jóvenes, quienes como resultado final crearon 50 muebles de oficina (sillas) para la comunidad. La discusión enfrenta estos resultados con la teoría del empoderamiento y la normativa de vinculación con la sociedad del Consejo de

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Educación Superior y de la UTLVTE. Se concluye que la transferencia de conocimiento técnico-científico, al estar acompañada de un diagnóstico de necesidades, un apoyo socioemocional y un enfoque de calidad, no solo produce capital humano, sino que también funciona como un catalizador para reconstruir el tejido social, cumpliendo así con el fin que persigue la educación superior el cual es servir a la sociedad, y contribuyendo de manera directa a los objetivos de la vinculación universitaria.
Palabras clave: Empoderamiento juvenil, soldadura, vinculación con la sociedad, funciones sustantivas, gestión de calidad, formación técnica, Esmeraldas.

INTRODUCTION

Latin American port cities, such as Esmeraldas in Ecuador, are experiencing a very complex crisis of youth violence. A lack of educational and employment opportunities is compounded by problems of social exclusion. Many experts, such as Aisyah et al., believe that youth unemployment is the root cause of social problems like crime. To address this, a comprehensive approach is needed that combines technical training with occupational safety and health, while also capitalizing on local opportunities. There are concrete examples in the region that support this perspective. Vincent Samuel, an instructor with 26 years of experience at the Boys Training Center in Santa Lucía, stated that welding programs are very important because they offer a "second chance" to vulnerable youth. These programs allow them to learn a trade and reintegrate into their communities.

In this context, young people not only suffer from this situation but are also drawn into illegal economies, which traps them in a cycle of poverty and violence. The UTLVTE has the arduous task of making a significant contribution to countering this problem, drawing on all the activities it carries out through its engagement with the community. The Council for Higher Education defines the overarching activities that allow Institutions of Higher Education (HEIs) to engage with society in Article 4 of the Academic Regulations, which states that an HEI is an entity that "develops capacities and facilitates the exchange of knowledge in accordance with academic disciplines to ensure the development of effective responses to the needs and challenges of its environment."

At the institutional level, UTLVTE has explicitly embraced this commitment, as evidenced in Article 7 of the University Charter, which establishes as one of its purposes "to develop proposals and approaches to address the problems of the province, region, and country." To achieve this objective, Article 2 of the UTLVTE Regulations on Community Engagement prioritizes "ongoing attention to the needs of the social environment, especially those of vulnerable sectors of the population and Historically Excluded Groups (HEGs)." In relation to this provision, the Policies on Research

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Management, Community Engagement, and Graduate Studies reinforce that "community engagement must address the priority needs of the community and support sustainable territorial development."

These guidelines led us to conduct a needs assessment for this project, which revealed that in the sector of interest (Codesa), only 65% of the population has completed secondary education. This makes it difficult for them to access jobs requiring specialized skills and contributes to the persistence of socioeconomic disparities. This conclusion was reached after engaging in dialogue with the community, which also helped quantify the benefits that would result from offering welding training—a trade in high demand in the area's productive sectors, such as agriculture, construction, and metalworking.

However, the truth is that training alone is not enough. A study linked to the "Jóvenes Productivos" program in Puno found that only 46.3% of the young participants managed to enter the labor market, demonstrating that having skills alone is not enough to find employment.

On the other hand, the evaluation of the project in Tarma showed that job placement is often limited by external factors, leading to feelings of failure among the beneficiaries. These findings indicate that it is important to look beyond simply finding a job as a measure of success; it is also important to focus on strengthening one's position and taking control of one's life, which means that empowerment is a process that goes beyond mere job placement. Alcántara explains that empowerment is "having the ability to decide, as well as the effective capacity to carry out what I have decided"—in other words, this is not something that happens on its own, but always involves a group of people.

To achieve lasting and meaningful change in the labor market through collective empowerment, it is essential that training in trades such as welding meet certain quality standards—that is, that it involves developing the skills necessary to succeed in this field. The Ecuadorian standard NEC-SE-C and international codes such as AWS D1.1 require rigorous procedures and quality controls to ensure structural integrity. Training young people in welding means teaching them to do things right and to work safely from the very beginning. In this context, immersive technologies such as virtual reality are new and useful teaching tools. These tools could enhance the project in the future.

MATERIALS AND METHODS

The study employed an approach that combined different methods. On the one hand, the project documentation was reviewed. On the other hand, the numerical and descriptive data obtained while the project was underway were analyzed. The design is classified as non-experimental because the variables were not deliberately manipulated; the researchers did not create an artificial situation, but rather observed and measured the phenomena as they occurred naturally within the context of the project. The study is descriptive and evaluative in nature, and its design is cross-sectional

The target population was determined through a participatory needs assessment conducted in March 2025. This assessment identified the Tabiazo Parish and the Codesa sector (Youth Center) as the most important areas for intervention. A group of 52 young people was selected from a target population of 70. The selection was made randomly. The young people were between the ages of 18 and 35. Regarding their education, 65% had completed high school, 27% had technical training, and 8% had pursued a college degree. This group is representative and is 95% reliable. The margin of error is 5.8%, which is acceptable. The method used to select these young people follows UTLVTE policies, specifically the provisions of Article 2 of the Regulations on Community Engagement. These regulations prioritize attention to "Historically Excluded Groups" (HEGs) and "vulnerable sectors."

The "Strengthening Technical Skills for Community Development" program, implemented by the UTLVTE School of Engineering during the IS-2025 academic period (September through December 2025), falls under Article 5, under the operational lines of "specialized projects and services" and "implementation of community or social service projects." The intervention was structured into three components:

a. Outreach and Assessment: Outreach campaign for the course and administration of needs assessments.
b. Theoretical and Practical Training: Training in electric arc welding, with an emphasis on safety standards, welding techniques, and supervised practice.
c. Evaluation and Closure: Administration of satisfaction surveys, statistical analysis, drafting of reports and a scientific article, and the creation of a tangible product for the community.

Quantitative: An impact assessment survey (Appendix 1) was administered at the end of the training, using a 5-point Likert scale (1 = Very dissatisfied, 5 = Very satisfied) to evaluate five dimensions: technical content, instructor, resources and materials, practical applicability, and overall organization.

Qualitative: Participant observation was conducted during the practical sessions, and the project's monthly and semiannual reports—which contain observations and conclusions from the implementing team—were analyzed. The tangible final product (50 chairs manufactured) served as evidence of knowledge transfer.

Quantitative survey data (n=52) were processed using descriptive statistics (frequencies and percentages) and are presented in tables and graphs. Qualitative data were analyzed using thematic content analysis, identifying emerging categories related to empowerment.

RESULTS

The impact survey administered to the 52 participants yielded the following results:

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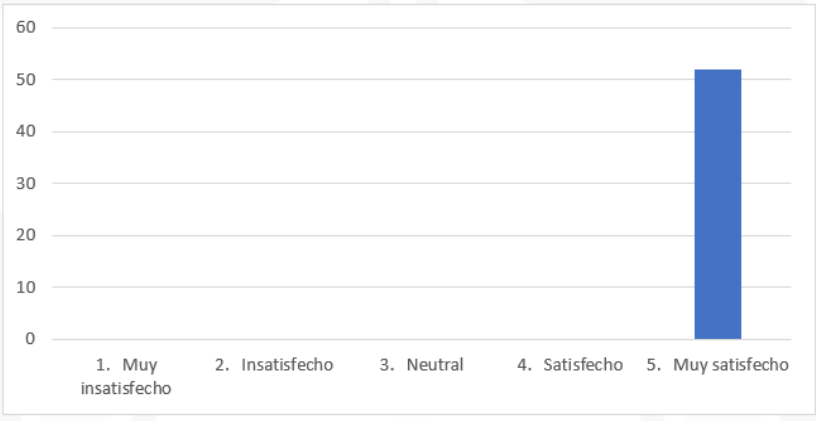
a. Technical content: 100% of the participants reported being "Very satisfied" with the clarity and depth of the theoretical and practical content, including explanations of techniques, safety standards, and types of welding.

Figure 1. Level of satisfaction with the technical content

Source: Annex 10 of the "Strengthening Technical Skills for Community Development" Project.

b. Instructor: All (100%) of those who received welding training said they were very satisfied with the way the instructor answered questions, explained techniques, and adapted to the participants' varying skill levels.

Figure 2. Instructor's teaching ability



Source: Appendix 10 of the "Strengthening Technical Skills for Community Development" project.

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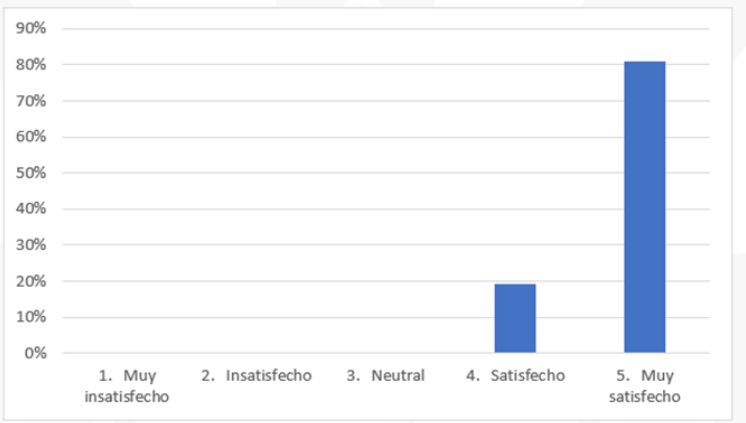
c. Resources and materials: 80.76% of the training participants stated that they were very satisfied with the equipment and tools provided to them, such as welding machines and materials, as well as personal protective equipment. 19.24% stated that they were satisfied. There were no complaints.

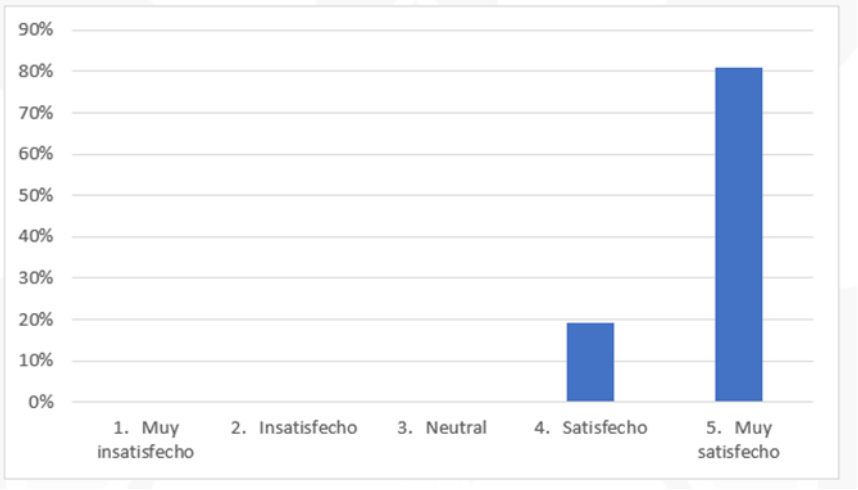
Figure 3. Efficiency of materials used.



Source: Annex 10 of the "Strengthening Technical Skills for Community Development" Project.

d. Practical applicability: All participants—that is, 100%—reported being "Very satisfied" with the direct applicability of what they learned to their jobs or personal projects.

Figure 4. Practical applicability of the knowledge transferred.



Source: Appendix 10 of the "Strengthening Technical Skills for Community Development" Project.

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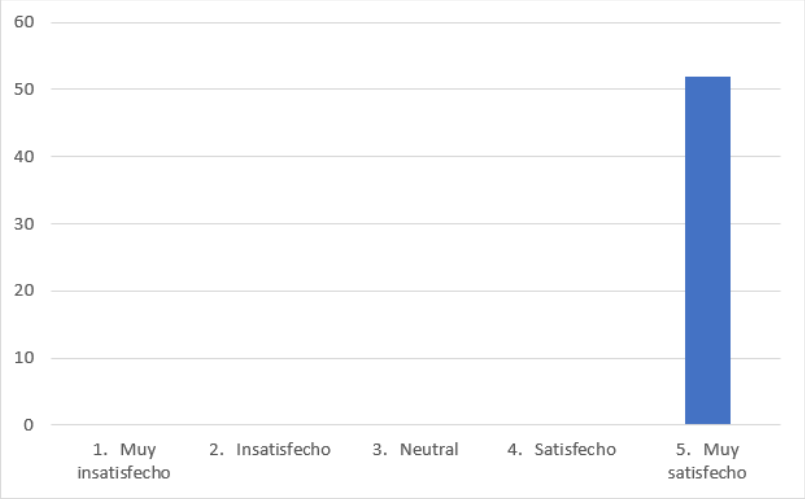
e. Overall organization: All participants—that is, 100%—reported being "Very satisfied" with the training logistics. This includes the duration, schedule, and facilities.

Figure 5. Overall organization of the training.



Source: Appendix 10 of the "Strengthening Technical Skills for Community Development" Project.

The results show that most participants were very satisfied with the training they received; this was because the training was of high quality and tailored to their needs.

From the analysis of the monthly reports and the semiannual report submitted to the university's Office of Community Engagement, as well as from what was observed and documented, three main categories emerged:

1. Self-efficacy and Perceived Benefit: Fifty office chairs were manufactured as the final project for the course. This was a tangible experience that allowed us to realize what we had accomplished. The young people were able to see the result of their work and feel that they were capable of creating something valuable. Comments from participants such as, "I never thought I could make something like this with my own hands; seeing the finished chair makes me feel that I can achieve whatever I set my mind to," are clear demonstrations of the impact achieved.
2. Life Outlook and Entrepreneurship: The midterm report prepared following the training concludes that the young people not only acquired knowledge but are also able to apply their welding skills in their work or academic settings, which will increase their productivity and employment opportunities.

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Likewise, a high degree of empowerment was observed, evidenced by unanimous satisfaction and greater confidence in launching their own projects or pursuing further technical training.

3. Social Recognition and Strengthening of Community Ties: The donation of furniture (chairs) to the community (through the Youth Center) helped establish the institution as a leader in quality education, strengthening the bond between the university, partner organizations, and the youth of Esmeraldas. This demonstrates how community engagement initiatives transcend individual training to generate a collective impact.

This study shows that the project "Strengthening Technical Skills for Community Development" is an example of how mechanical engineering can help the community. The success of this project was due to three key aspects: conducting a preliminary study of the community's needs, providing excellent technical training, and creating a final product that truly helped the community. The impact generated was multidimensional, as the project not only taught new skills but also aligned with internationally recognized best practices.

Regarding the technical and pedagogical dimensions of the success, the quantitative finding of 100% satisfaction in key areas such as technical content, instructor performance, and practical applicability validates the program's relevance and the effectiveness of the methodology used. This result is consistent with previous welding training experiences that highlight the importance of combining theory and practice with a rigorous focus on industrial safety. Likewise, the high level of satisfaction with the resources and materials (80.76% "Very satisfied") confirms the project's proper planning and execution, in line with the quality management standards required by the sector.

Regarding youth empowerment and its manifestation in the local context, the most relevant finding of this study is, without a doubt, the qualitative dimension of empowerment. The production of the 50 chairs was not merely a training exercise; rather, it sought to turn learning into a real-world experience. This process supports Alcántara's vision, which conceives of empowerment as "having the ability to decide, as well as the effective capacity to carry out what I have decided." In our case, this capacity was achieved thanks to the collective effort of everyone involved: young people, instructors, and the community. This demonstrates that we successfully combined teaching with community engagement, as established in Article 4 of the Higher Education Council Regulations and the university's institutional policies

The impact on well-being and personal growth resonates with findings from a wide variety of contexts. The CWB Welding Foundation in Canada documents that "hands-on learning does more than teach technical skills. It builds confidence, reduces anxiety, and creates a sense of belonging.

For many students, welding programs have been a lifeline, offering purpose and stability during difficult times." Similarly, in the welding program at Utah State University's Blanding campus, instructor Chloe Wilson notes that "welding changes lives; students realize they can do something difficult, and that confidence helps them in everything

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else." These experiences show that well-organized technical training programs have a positive impact on participants' self-esteem and sense of purpose—a universal outcome of most well-executed technical training programs.

The value of social recognition is important in Esmeraldas's experience. This becomes clear when we compare this experience with other places where community service is part of the training. Instructor Aaron Ervin explains that the welding program at Pike-Lincoln Technical Center in Missouri does more than teach technical skills; it also teaches students to serve their community. Students repair farm equipment for local farmers, demonstrating that technical training can help strengthen the community. In our case, empowerment and community recognition were very important, as they created momentum even when there were no immediate formal job opportunities. This shows that the social impact of a community engagement project must be measured more broadly than simply by whether people found a job. This relates directly to the community engagement objectives established in Articles 3 and 4 of the Community Engagement Regulations published by UTLVTE: "building capacity and facilitating knowledge exchange" and "improving living conditions."

Empowerment is a crucial process that prevents frustration among vulnerable groups. This becomes clearly evident when we compare it to other programs that focus solely on finding a job. For example, the "Jóvenes Productivos" program in Puno, Peru, showed that only 46.3% of the people who participated in a technical training program managed to enter the labor market. This suggests that there are other important factors that also influence success. Furthermore, when the project in Tarma was evaluated, it was found that although the training was carried out successfully, participants had trouble finding work due to external factors. This caused a great deal of frustration among the people who benefited from the project in Tarma. Our project focused on empowering the community and recognizing its importance, which helped participants become stronger and more resilient in the face of frustration, creating a group of people with valuable skills and social connections that go beyond simply seeking formal employment.

This project not only helped its participants find jobs but also provided them with the opportunity to start their own businesses. An example of this is the story of Yohanes Alembirhan, a young man from Ethiopia who was unemployed after graduating from college. After learning to weld in a 45-day course, Yohanes was able to open his own workshop with four friends. This shows that technical training can help people start their own businesses and improve their economic situation, especially in rural areas where people face greater challenges. This is a tangible prospect for the 52 young people from Esmeraldas.

It is essential that continuing education be based on quality standards that guarantee safety and professional competence, as established by international standards.

According to Cabrera Jaramillo and Corozo Arroyo, it is important to meet these standards. Looking ahead, the incorporation of tools such as virtual reality—developed by Moncada Santos and Rivera Tobar—could enhance technical and safety training, as it

would allow young people to practice safely before facing real-world situations. The combination of a community-supportive approach—such as that prioritized by UTLVTE's policies—with advanced simulation tools and an entrepreneurial vision could shape the future of technical training for vulnerable populations in Esmeraldas and the region. This model of sustainable development could be replicated in other areas in the future.

CONCLUSIONS

This study systematized and analyzed the impact of the community engagement project "Strengthening Technical Skills for Community Development," carried out by the "Luis Vargas Torres" Technical University of Esmeraldas (UTLVTE) during the first semester of 2025. The results show that this program is an outstanding example of social intervention through mechanical engineering. It aligns with the Constitution's provisions on higher education and with UTLVTE's institutional policies. These policies are aimed at providing support to historically excluded groups and promoting sustainable regional development.

The research shows that when the transfer of technical and scientific knowledge in welding is combined with a participatory needs assessment and socio-emotional support, a significant impact on the community is achieved. In this case, the explicit goal was to manufacture 50 pieces of furniture (chairs), not only to develop human capital but also to empower the young participants in decision-making and autonomous performance. During the implementation of the first phase of this project, in which 52 young people participated, the results were very positive: participants' self-esteem, vision for the future, and sense of belonging increased—a key advantage over other programs that focus solely on job placement, which have been shown to generate frustration among participants.

The experience in Esmeraldas aligns with findings from other parts of the world. Welding training offers many benefits. Studies in Canada and at Utah State University have shown that learning to weld not only teaches a technical skill but also builds confidence, reduces anxiety, and fosters a sense of community. Furthermore, in Esmeraldas, students build furniture for the community—similar to what is done at other institutions, such as the Pike-Lincoln Technical Center in Missouri—demonstrating that technical training can benefit the community. The experience in Esmeraldas also shows that young people can learn to become entrepreneurs, just as was the case with young people in Ethiopia, who, after learning to weld, were able to open their own workshops. Through this initiative, the university not only transferred technical knowledge but also planted in these young people the seed of a future with real opportunities for personal and economic development.

This project has achieved its objectives and demonstrated that its approach is effective. This approach combines technical excellence, social impact, and the empowerment of individuals. It thus establishes a replicable model for future initiatives, both at UTLVTE

and at other higher education institutions seeking to align their core functions to contribute to social transformation in vulnerable contexts.

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