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Bridging Higher Education and Local Rural Development Through Student-Led, Work-Integrated Problem Solving

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Abstract This chapter explores the implementation and impact of two student-led, problem-based learning (PBL) projects, developed at the Faculty of Information Studies in Novo mesto, Slovenia, in collaboration with local industry and community partners. Situated in rural border regions, the projects engaged students in addressing real-world challenges through interdisciplinary teamwork, student-centered mentorship, and community co-design. Engaging in highly contextualized and reflective project activities, students developed practical solutions that responded directly to the needs of underserved local communities and organizations, such as digital tools for small businesses and a strategy for adult digital upskilling. The chapter highlights how structured, community-connected learning fosters student competencies, while supporting inclusive digitalization and rural sustainability, offering a transferable model for integrating socially responsive innovation into curricular and co-curricular structures in higher education.

Keywords: • problem-based learning • rural development • academic-community partnerships • digital inclusion • sustainable development

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1   Introduction

The growing digital and sustainability divides between urban centers and rural regions across Europe pose critical challenges for equitable development. Underserved rural border communities, in particular, often lack the infrastructural, educational, and institutional resources needed to fully participate in digital transitions and benefit from emerging opportunities. Higher education institutions, as knowledge hubs and agents of local and regional development, are increasingly called upon to address these disparities. However, their engagement with local communities—especially those in rural and border areas—often remains fragmented and insufficiently integrated into curricula and student learning experiences.

This chapter explores how guided, student-led projects embedded in higher education can enhance students' competencies while generating meaningful social and economic impact in rural areas. It presents two innovative case studies from the Faculty of Information Studies in Novo mesto, Slovenia: Digital Data Tool for Sustainable Business Optimization (Digi-POP) and Lifelong Learning for Digital and Green Rural Development (Vse-UP[1]). Both initiatives responded to locally identified needs and were implemented in partnership with local stakeholders, including businesses, adult education providers, and community organizations. Their novelty lies in combining structured, interdisciplinary Problem-Based Learning (PBL) with community engagement and cross-sectoral collaboration to address real-world challenges in under-resourced regions—thereby supporting both student development and community resilience.

The projects emphasized interdisciplinary teamwork, student-centered mentoring, and reflective practice as pedagogical strategies for advancing social innovation and sustainability goals. Specifically, the chapter (a) examines the design and implementation of these two student-led projects in rural Slovenia; (b) analyzes how academic–community partnerships and structured mentorship supported the learning process; and (c) assesses the perceived benefits and challenges for students, mentors, and local partners.

Through the lens of these two cases, the chapter contributes to the growing literature that positions higher education as an active player in regional innovation ecosystems. It argues that student-led, interdisciplinary project work can bridge the gap between theory and practice, while strengthening students' employability, social responsibility, and innovation capacities. In doing so, it demonstrates how relational, participatory, and place-based pedagogies can foster inclusive and sustainable transformation in rural border regions—offering insights for educators, policymakers, and institutions seeking to develop locally grounded and future-oriented models of education and community engagement.

2 Literature Review on PBL and Place-Based Innovation in Higher Education

Problem-based learning (PBL) has emerged as a pivotal instructional approach in higher education, particularly in light of global shifts driven by technological advancement, labor market transformation, and sustainability imperatives. In a world marked by socio-ecological disruption, deepening digital divides, and persistent equity gaps, traditional didactic, content-delivery models are increasingly viewed as insufficient for preparing students to engage with real-world complexity and contribute meaningfully to their communities (González-Pérez & Ramírez-Montoya, 2022). PBL centers students as active participants in collaborative, inquiry-driven learning that engages them with open-ended, authentic chalenges demanding interdisciplinary thinking, creativity, and civic responsibility (Dochy et al., 2003).

Rooted in constructivist learning theories (Vygotsky, 1978), PBL emphasizes experiential and contextualized learning through processes of social interaction, analysis and reflection. Students take ownership of their learning trajectories, developing higher-order competencies such as critical reasoning, metacognition, and data-informed decision-making (Boud & Feletti, 1997). Research consistently shows that challenge-based pedegogical approaches enhance student agency, motivation, and deep learning, while nurturing lifelong learning dispositions (Engeström et al., 1995; Gallagher & Savage, 2020). They also strengthen essential 21st-century competencies, including collaboration, communication, adaptability, and complex problem-solving (Bell, 2010; Zhou, 2018).

A defining feature of PBL is its focus on authentic learning—learning embedded in meaningful, real-world contexts that reflect the complexities and ambiguities of actual professional and societal challenges (Barrett & Moore, 2011). These contexts often demand integrative knowledge and engagement with diverse stakeholders. As such, teamwork and hands-on, work-integrated learning are central to effective PBL design. Real-world activities and project-based formats enable students to apply their disciplinary knowledge in new settings, refine professional behaviors, and engage in reflective practice. Group learning and project collaboration enhance peer-to-peer learning, intercultural competence, and social accountability, especially when aligned with community- or industry-based partnerships in work-based settings (Ferns et al., 2024).

Reciprocal relationship-building and academic collaboration between higher education and local communities significantly extend the educational impact of PBL by enabling co-designed, socioculturally embedded learning experiences. These partnerships support mutual knowledge exchange: students benefit from real-world exposure and mentoring, while community partners gain access to formal-science ideas and student-led innovation grounded in contemporary academic knowledge (Zorec, 2024). When learning experiences are situated within place-based, community-responsive frameworks, it can

become a vehicle for local and regional innovation and equity (Hernandez Gonzalez, 2023). Particularly in rural and border areas, community-university partnerships can facilitate tailored, cross-sectoral solutions and contribute to social cohesion, inclusion and sustainability (Mancini et al., 2022).

In this context, mentoring plays a pivotal role in guiding students through the complexity of interdisciplinary, community-engaged PBL projects. Faculty members are expected to scaffold the learning process by supporting decision-making, modeling inquiry, and cultivating students' disciplinary and transversal skills (Grabowski et al., 2008). Importantly, collaborative, project-based approaches require a shift in the student–teacher relationship. Students are no longer passive recipients of knowledge but become co-constructors and co-designers of learning processes (Amerstorfer & von Münster-Kistner, 2021). This shift aligns with the concept of academic communities of practice, where learning occurs through participation, dialogue, and shared meaning-making in collaborative social settings (Lave & Wenger, 1991). Within this community, students, academic teachers and external partners engage in joint inquiry and knowledge-building, blurring traditional boundaries between teaching and research, and this may foster a culture of trust, responsiveness and mutual growth.

The integration of students as partners in teaching and learning further strengthens the transformative potential of collaborative PBL. The "students as partners" approach emphasizes relational pedagogies, in which connection, care, and mutual respect are seen as central to student learning and meaningful engagement (Matthews et al., 2018). These pedagogies foreground the importance of dialogue, shared purpose, and genuine relationships in fostering student self-authorship and a sense of belonging (Baxter Magolda, 2004; Sanjakdar & Premier, 2023). As Gravett and Winstone (2020) argue, relational pedagogies extend beyond enhancing the enjoyment of learning; they involve reconfiguring power dynamics in education to promote inclusion, relevance, social justice, and care. From this perspective, place-based, collaborative PBL emerges not merely as an instructional method but as a relational and civic practice. By immersing students in authentic, context-sensitive challenges, it cultivates personal growth, social responsibility and transformative learning (e.g., Gruenewald, 2003; Wyness & Dalton, 2018).

These approaches align with the broader paradigm of future-oriented education, which emphasizes systems thinking, adaptability, and the ability to act in conditions of complexity and uncertainty. International frameworks, such as UNESCO's New Social Contract for Education (2023), call for learner-centered, values-driven education as a driver of sustainable and inclusive futures. Similarly, at the European policy level, several initiatives reinforce this direction. The European Pillar of Social Rights (European Commission, 2017) underscores the need for equal opportunities and inclusive, high-quality education, training and lifelong learning for all, while the Digital Education

Action Plan 2021–2027 (European Commission, 2020) prioritizes the development of digital competencies and infrastructure, especially in underserved regions. The Council Recommendations on a European Approach to Micro-credentials for Lifelong Learning and Employability (2022) promotes flexible, skills-based learning aligned with labor market needs. Furthermore, Smart Specialisation Strategies (S3) (European Commission, 2018) stress innovation through place-based approaches that reflect regional priorities and mobilize local strengths.

At the national level, Slovenia's Resolution on the National Programme of Higher Education 2030 (Ministry of Education, Science and Sport, 2022) affirms the role of higher education in fostering local and regional development, social inclusion, and digital transformation. The Digital Slovenia 2030 strategy (Government of the Republic of Slovenia, 2023) sets strategic goals for increasing digital literacy and inclusion, expanding access to digital resources, solutions and lifelong learning, and closing infrastructure gaps. The Implementation Plan for Slovenia's EU Cohesion Policy Programme 2021-2027 (Government of the Republic of Slovenia, 2021) further emphasizes inclusive, regionally differentiated development strategies that bridge sectors and support local innovation ecosystems.

In this context, collaborative, community-engaged PBL holds unique promise as a transformative mechanism for both student development and local-community advancement. When higher education institutions partner with rural and border communities through authentic, student-led inquiry, they become engines of civic engagement and community resilience. The two mentored, interdisciplinary PBL initiatives, Digi-POP and Vse-UP, exemplify this approach by supporting students' critical thinking, interpersonal competencies, and sense of agency, while simultaneously addressing real-world challenges in collaboration with local industry partners and community stakeholders.

3   Case Studies of Digi-POP and Vse-UP

Projects Digi-POP and Vse-UP involved interdisciplinary student teams working alongside academic mentors, industry, and local non-profit partners. Both initiatives were developed as a response to the pressing challenges faced by rural and border regions of Slovenia. These areas are often marked by demographic decline, youth outmigration, and limited access to digital infrastructure and education. These complex, systemic issues require innovative, context-sensitive approaches—ones that position higher education as a catalyst for regional resilience and inclusion. The focus was on building bridges between higher education, industry, and local communities in rural border regions to foster skills development, enhance employability, and drive sustainable practices in real-world settings. The two five-month mentored interventions were part of a co-curricular work-based program for students, funded by Slovenia's Ministry of Higher Education,

Science and Innovation. Both projects supported a broader institutional effort by the Faculty of Information Studies (FIS) to integrate authentic experiences, grounded in PBL, into higher education while promoting civic engagement and social responsibility among students.

The primary goals of the Digi-POP and Vse-UP projects included:
- to involve students in authentic, project-based learning experiences that address contemporary industrial and societal challenges
- to enhance students' knowledge and skills, making them more competitive and adaptable in the job market
- to promote digital tools and sustainable practices for economic and social inclusion, particularly in rural and border regions
- to contribute to updating educational content and methods to reflect labor market needs.

Both interventions were intentionally designed to foster a range of interdisciplinary competencies aligned with institutional learning goals and the evolving demands of the labor market and local communities. Project Digi-POP aimed to develop a digital data management tool for one rural company in the Slovenia's border area of Kočevje to optimize the organization's data processes, enhance energy efficiency, and support the transition to a low-carbon circular economy. The project was designed as an experiential learning opportunity that immersed students in authentic, real-world challenges. Students were actively involved in analyzing complex, real-time problems faced by the partnering company, exploring and proposing technical solutions, and refining their ideas through continuous collaboration with industry professionals.

Whereas project Vse-UP focused on supporting lifelong learning for working adults in a rural region of Ormož, Slovenia, by promoting skill development in digital and green practices. The goal was to analyze the barriers to participation in educational programs and co-create strategies and concrete actions that would encourage more adults to participate in sustainable and digital skills development. The project involved expert-led lectures, flexible learning sessions, and hands-on activities to enhance digital literacy and equip participants with the skills necessary for the modern job market and full participation in society.

3.1 Pedagogical Approaches and Student Engagement

Student engagement was grounded in Vygotsky's Sociocultural Theory of Learning and the framework of shared transformative agency within Cultural-Historical Activity Theory (CHAT). Vygotsky (1978) highlights the importance of socially mediated learning occurring within the learner's Zone of Proximal Development (ZPD), where meaningful interaction and scaffolding support knowledge construction. In these projects,

students collaborated closely not only with academic mentors and peers but also with local community stakeholders and industry partners, embedding their learning in authentic social contexts. The shared transformative agency perspective (Haapasaari et al., 2014; Sannino et al., 2016) further frames students as active agents capable of collectively addressing and reshaping the challenges of their local environments—rural digital exclusion in Vse-UP and sustainable business practices in Digi-POP. These frameworks helped to acknowledge and support the vital role of students in co-creating solutions that resonate with the lived realities and needs of their communities. The interventions used a variety of learning approaches and activities that placed student engagement and collaboration at the heart of project success, i.e., effectively addressing complex, real-world challenges in border rural areas, while also developing key competencies in communication, critical thinking, digital literacy, and civic agency (e.g., Van Nguyen et al., 2024).

- **Structured Project Work**

In both Digi-POP and Vse-UP, students engaged in highly structured and goal-oriented project activities that provided a clear framework for their work, directly aligned with pressing local challenges and needs.

Each project engaged students in a four-phase process: identifying challenges and opportunities through fieldwork and stakeholder interviews; co-designing solutions through iterative teamwork; developing and testing implementation proposals and tools; evaluating impact; and sharing new experiences and findings in public-facing events. The projects integrated principles of user-centered design, participatory research, and systems thinking, encouraging students to reflect critically on their roles and responsibilities in complex social ecosystems. Each student group also received clearly defined objectives, expected learning outcomes, guidance materials, and timelines. This structure supported students in managing their learning process through ongoing planning, progress monitoring, and evaluation, while maintaining flexibility to adapt to evolving community feedback. The structured approach supported students' development of project management skills tailored to real-world conditions, fostering a sense of responsibility toward tangible community impact.

- **Guided Inquiry and Mentorship**

The guided inquiry model placed students in the center of learning processes that were embedded in the local contexts. Mentors played a critical role in supporting students as they navigated unfamiliar community settings, rural digital divides, and small business realities. This mentorship involved not only academic guidance but also contextual insight into local socio-economic, cultural, or organizational dynamics. By providing scaffolding aligned with these realities, mentors helped students critically analyze and

adapt solutions to fit the unique characteristics and dynamics of the community and partners. This ongoing dialogue encouraged students' development of self-directed learning and transformative agency, empowering them to act thoughtfully and responsively within their local contexts.

- **Interdisciplinary Collaboration and Peer-Learning**

The projects' interdisciplinary teams mirrored the complexity of the local problems, which required insights from technology, social sciences, and business disciplines. This diversity enabled students to appreciate multiple perspectives rooted in community experience and local knowledge systems. Students collaborated closely with mentors and peers from different fields, fostering a culture of co-creation where local knowledge and practices were as valued as academic expertise. Peer mentoring and reciprocal learning were especially important in contexts where students encountered unfamiliar local conditions, enabling them to share strategies and collectively interpret the needs of local communities and partners. This approach aligns with research highlighting integrative approaches and cognitive diversity as essential for addressing multifaceted local challenges (e.g., Corbacho et al., 2021).

- **Design Thinking and Iterative Development**

Project activities incorporated principles of design thinking, encouraging students to empathize with local stakeholders, clearly define the problem, generate creative ideas, prototype solutions, and test them in real-world, local contexts. This iterative, user-centered process was particularly relevant in both projects: in Digi-POP, students had to understand the technological and operational needs of a local company; in Vse-UP, they explored the needs of adult learners and lifelong learning providers in a rural region. Design thinking helped students engage with user-perspectives and craft meaningful, sustainable and community-relevant innovations.

- **Hybrid Learning Environments**

The learning experience combined in-person fieldwork in local settings with digital collaboration, mirroring the increasingly hybrid nature of professional work and community engagement. Students conducted on-site research in rural communities and small enterprises, directly interacting with local actors and environments. Complementing this, interactive digital platforms enabled remote coordination and data analysis, reflecting the technological tools increasingly vital in regional development. This hybrid model and learning activities allowed students to experience firsthand the realities of border rural contexts while developing competencies essential for modern professional collaboration and societal roles (e.g., Wiek et al., 2021).

- **Multimodal Participation and Knowledge Expression**

To communicate their findings and solutions effectively within diverse local stakeholder groups, students employed a variety of expressive modes—visual, auditory, tactile, and digital. This multimodal engagement acknowledged the diverse communication preferences and accessibility needs in rural and industry settings. By creating infographics, interactive presentations, audio materials and other artifacts, students practiced translating complex information into accessible formats, thereby enhancing community understanding and buy-in. Such multimodal literacy is crucial for bridging academic knowledge and community contexts, supporting inclusive and participatory solution-development (e.g., Minelli de Oliveira, 2024).

- **Reflective Practice and Self-Evaluation**

Regular reflection and feedback cycles played a critical role in helping students assess their contributions in relation to local realities and project goals. To support self-awareness and promote continuous learning, students completed monthly self-reflection reports aligned with each project phase. These followed a structured format: first, students described their key activities and experiences, linking tasks to real-world applications; second, they identified knowledge and skills gained, both discipline-specific and transversal; and third, they identified areas for further development and articulated how they intended to improve. This process encouraged students to track their learning, bridge theory and practice, and cultivate a mindset of lifelong learning (e.g., Harvey et al., 2025). The reflections also served as a valuable feedback mechanism for academic mentors, helping them tailor support and address students' emerging needs.

In addition, guided group discussions, written reports, and peer feedback enabled students to continuously refine their understanding of project goals, concepts, and the nuances of local contexts. These metacognitive activities enhanced students' capacity to learn from experience, fostered self-regulation, and built resilience—essential traits for navigating complex and evolving professional environments. Moreover, reflection emphasized the value of sustained community engagement and the reciprocal nature of learning between students and local stakeholders.

3.2 Partner Involvement Strategies

Partner involvement in the Digi-POP and Vse-UP projects was strategically embedded across all phases of the project lifecycle. Rather than occupying a peripheral or consultative role, industry and community partners were positioned as active collaborators in planning, implementation, mentoring, and reflection. This comprehensive engagement strategy ensured that project outcomes remained relevant to

local needs, supported real-world learning, and fostered stronger ties between higher education and local ecosystems.

- **Structured Participation Across Project Phases**

From the outset, local partners were invited to co-design project activities in collaboration with academic mentors and students. They participated in needs analyses, helped define the scope of the challenges to be addressed, and contributed to shaping the structure of the interdisciplinary student project teams. During the implementation phase, their role extended to joint problem exploration, testing of prototypes, and ongoing evaluation of progress. This ensured that projects were grounded in real-world contexts and responsive to community and labor market needs in rural and cross-border areas.

- **Collaborative Problem-Solving and Co-Creation**

A cornerstone of the involvement strategy was co-creation through interdisciplinary teamwork. Local partners worked directly with students and academic mentors to identify practical challenges and develop targeted solutions. Their insights were critical in helping teams frame problems realistically and explore innovative, feasible responses. This hands-on collaboration promoted exchange of knowledge and good practices and fostered mutual learning, as partners contributed sector- and community-specific expertise while gaining exposure to student-driven, research-informed approaches and solutions.

- **Mentorship and Professional Guidance**

Industry and community partners served as mentors throughout the project, offering continuous domain-specific guidance to student teams. Their engagement included technical consultations, participation in regular feedback sessions, and provision of relevant tools, data, and access to workspaces or local environments. By acting as both advisors and facilitators, partners supported students in navigating thematic and operational complexities. Importantly, this relationship was bidirectional: local partners also benefitted from students' up-to-date academic knowledge and ideas, particularly in areas related to digitalization, inclusion and sustainability, contributing to a process of reverse mentoring (e.g., Murphy, 2012).

- **Contribution to Evaluation and Reflection**

Partner participation extended to the solution-development, evaluation and reflection stages of the projects. They took part in milestone presentations, offered structured feedback on the progress and outcomes of student work, and engaged in reflective discussions about the relevance and applicability of the project outputs. At the conclusion of their involvement, local partners shared oral and written reflections, which informed

project evaluation and helped identify good practices and opportunities for future collaboration and sustainable local development in rural areas.

- **Input into Curriculum and Educational Content**

To strengthen the long-term impact of the academic-community collaboration, partners were also included in the review and (co-)development of academic content and study activities. Their feedback informed the adaptation of teaching and learning practices to better reflect current trends and demands in local industry and community work, particularly in the areas of digitalization, interdisciplinary teamwork and inclusive design. This process helped align academic curriculum with practical needs in underserved local areas and improved the employability of future graduates.

- **Engagement in Dissemination and Public Dialogue**

Local partners played a key role in the dissemination of project outcomes. They were invited to co-present project findings, thereby sharing their insights and reinforcing the co-creative ethos of the project activities. Their involvement culminated in interactive hybrid seminars that brought together a wide range of stakeholders—students, educators, employers, NGOs, and local community representatives—to discuss the results and implications of the project. Through these opportunities, the partners contributed to broader public dialogue on how collaborative, community-engaged higher education can support local development and social innovation, particularly in underserved, border rural settings.

3.3   Project Outcomes and Gains

Student reflections, self-evaluations, and ongoing discussions with academic mentors and local partners from industry and non-profit sectors revealed the wide-ranging impacts of the Digi-POP and Vse-UP projects. These collaborative, real-world PBL experiences contributed not only to student learning and development, but also to meaningful outcomes for participating organizations and border rural communities.

- **Contextualized Learning**

The projects enabled students to engage with real challenges rooted in specific local, place-based contexts. Whether addressing the digital needs of a local business, or exploring how to reach underrepresented adult learners, students applied their academic knowledge to situations that demanded responsiveness, creativity, and socio-cultural awareness. This contextualized approach to learning enhanced the authenticity and perceived value of their educational experience.

Students consistently reported strengthened employability skills, particularly in problem-solving, communication, and project planning. They became more adept at identifying local stakeholder needs, setting realistic goals, and navigating real-life constraints—all within the framework of socially relevant, community-based projects. These experiences also helped students to see the direct link between their learning and the broader economic, digital, and social transformations underway in the local regions.

- **Collaborative Innovation Across Sectors**

The interdisciplinary and cross-institutional nature of the projects allowed students to co-create solutions in partnership with diverse stakeholders. Student teams worked across academic disciplines and collaborated closely with business leaders, non-profit staff, local community members and academic mentors. These interactions broadened students' understanding of how innovation emerges through dialogue, trust, and alignment of understanding and goals across different sectors and disciplines. The mentoring provided by both academic staff and local practitioners further strengthened their capacity to navigate complex problem-solving processes collaboratively. This cross-disciplinary approach mirrored the complexity of contemporary societal challenges, encouraging students to think holistically and communicate across fields.

- **Social Responsibility and Community Impact**

The projects helped students build a deeper understanding of the role education and technology can play in addressing inequality and fostering social cohesion. Through direct interaction with rural communities, particularly in areas facing socio-economic and digital exclusion, students gained awareness of the structural and interpersonal barriers that limit access, participation and productivity in industry, education and community life.

Working on projects with clear social aim, such as increasing adult participation in learning or improving digital capacity within local enterprises, allowed students to see themselves as contributors to social good. Many became more attuned to the value of listening, empathy, and trust-building in fostering inclusive practices and sustainable impact in local communities. At the same time, local partners benefited from new tools, plans, and pathways for engagement that were both accessible and aligned with local needs and values.

- **Future-Oriented Thinking**

Participation in these projects encouraged students to develop a forward-looking orientation. The process of co-designing solutions with long-term relevance required students to think beyond immediate deliverables and consider sustainability, adaptability,

and ethical implications. This cultivated a mindset oriented toward innovation, civic engagement, and active participation in shaping the future of their communities and professions.

Student reflections and team discussions indicated that students began to perceive themselves as emerging professionals with the agency and responsibility to influence broader systems. Many expressed increased interest in contributing to socially impactful work, particularly within their own regions, and recognized the importance of aligning personal ambitions with collective futures.

- **Tangible Benefits for Local Stakeholders**

Both projects resulted in practical, high-impact deliverables tailored to the needs of local partners and rural communities. In Digi-POP, students co-developed a user-friendly digital tool to support business data tracking and internal communication in a small local enterprise, contributing to the company's digital maturity and operational efficiency. In Vse-UP, students created a strategic framework featuring guiding principles and concrete action points to improve access and participation in lifelong learning for working adults in rural border areas. This document now serves as a valuable planning and advocacy tool for a local non-profit educational organization working with underserved adult learners.

These outputs demonstrated the practical value of student-led innovation and strengthened partnerships between higher education institutions and local stakeholders. Community and industry partners gained insights and solutions adapted to their specific contexts, while students deepened their learning through collaboration, community service, and impact. In this context, the projects supported broader goals of inclusion, sustainability, and local/regional development by promoting digital transformation, expanding educational opportunities, and fostering mutual learning between academia and the local, border rural environment.

4   Discussion

The implementation and outcomes of the Digi-POP and Vse-UP projects demonstrate the transformative potential of student-led, collaborative PBL when situated in authentic, community-facing contexts. By embedding student learning within real-life challenges in rural and border areas, these projects went beyond traditional notions of employability to foster civic-mindedness, innovation, and intersectoral collaboration, thereby responding to evolving educational and labor market trends and offering promising models for promoting inclusive digital and sustainable development in underserved localities.

The projects' outcomes affirm the widely acknowledged strengths of PBL in fostering critical thinking, collaborative inquiry, and motivation (Affandy et al., 2024; Dochy et

al., 2003; Ersoy & Baser, 2014). However, the project activities and student gains extend by operationalizing these benefits within the specific sociocultural contexts of rural Slovenia—areas that are frequently marginalized in digital transformation agendas and educational innovation. This context-sensitivity significantly enhances the authenticity and holistic dimensions of learning, as advocated by Kioupi and Voulvoulis (2022), and positions students as both learners and contributors to sustainable regional development. Unlike classroom-bound PBL, these projects required students to navigate unpredictable, ill-structured, and often politically or socially nuanced challenges in real communities, thereby sharpening not only their analytical skills but also their emotional intelligence, ethical awareness and sustainability competencies (e.g., Cörvers et al., 2016; Sterling, 2011).

Moreover, the integration of academic learning with community engagement and mentorship from local partners resonates with what Bovill (2025) and Molderez and Ceulemans (2018) describe as co-creation, where students, educators and external partners collaboratively co-generate new knowledge and solutions. This model not only enriches student outcomes, but also disrupts hierarchical models of knowledge production, recognizing the validity and value of local, experiential and context-specific knowledge. The resulting reciprocity enhances students' sense of agency and relevance, while also delivering tangible benefits to communities historically excluded from mainstream policy and innovation discourses.

From an institutional perspective, the Digi-POP and Vse-UP projects illustrate how higher education can evolve to meet the demands of future-oriented education. As UNESCO (2023) emphasizes, contemporary pedagogies must prepare students for complexity, uncertainty, and interdependence—qualities deeply embedded in these projects. The use of design thinking, hybrid environments and reflective practice not only equipped students with adaptive capacities, but also mirrored the real-world conditions of digital and green transitions, particularly in underserved regions. In doing so, the projects responded to the EU's twin transition agenda (digital and green) and contributed to broader social goals, such as territorial cohesion and inclusion.

Importantly, these initiatives challenge dominant narratives that position rural and border regions merely as recipients of development, instead highlighting their potential as active sites of innovation and learning. This reframing has significant implications for policy and practice. Too often, border and rural areas are overlooked in national strategies for digitalization or lifelong learning, despite their unique needs and contributions. By deliberately targeting these areas, the projects offer a replicable model for how student-led, university-supported initiatives can address systemic issues of demographic change, access and inclusion. The work aligns with calls for expanded understanding and integration of sustainability education that includes place-based learning and regional equity (e.g., Brundiers & Wiek (2017).

The outcomes of the projects also bring to light some key tensions and considerations for scaling such approaches. For example, while the structured scaffolding and mentors' guidance and support were essential to student learning and project success, they also demand significant institutional and social investment in terms of time, resources and coordination. Faculty workload, curriculum alignment and the establishment of sustained reciprocal partnerships with local stakeholders from underserved communities are all non-trivial challenges. However, the projects illustrate that when such investment is made, the return is substantial not only in student growth, but also in the relevance of higher education and its responsibility for and contribution to public good and sustainable future. Moreover, the effectiveness of interdisciplinary collaboration, while celebrated in both projects, depends heavily on creating a shared language, common understanding and mutual respect across disciplinary and professional boundaries and knowledge systems. This was achieved in part through deliberate facilitation and design-thinking processes, but it also required time and trust-building that may be difficult to engineer in more compressed or formal learning environments. These insights suggest the importance of longitudinal and flexible programmatic structures that can accommodate iterative development and reflection.

In terms of digitalization, the projects further demonstrate that access and inclusion must be fully considered at the heart of technological innovation. The development of a digital data management tool in Digi-POP was not only a technical endeavor but a socially embedded one; it addressed the needs of a small rural enterprise and was co-designed with its staff, ensuring usability and relevance. Similarly, Vse-UP's focus on adult digital literacy foregrounded equity, recognizing that digital skills are not merely economic assets, but enablers of full participation in contemporary society. This aligns with calls for digital competence approaches that are inclusive, contextual, and focused on empowerment (e.g., Redecker 2017). Sustainability was likewise understood holistically, extending beyond traditional, environmental considerations to include social and economic dimensions. Students were encouraged to think in systems, e.g., about energy efficiency, digital infrastructure, educational access, and labor market integration as interconnected challenges. This integrative approach echoes the need for cross-cutting skills such as systems thinking, autonomy, and collaborative problem-solving in uncertain contexts (e.g., Kolmos, 2020).

Given these notions and outcomes, the projects offer a compelling case for the value of border and rural regions as learning ecologies. Often framed as peripheral, these areas and communities offer unique and rich pedagogical opportunities to explore global challenges, such as climate resilience, digital equity, and demographic transitions, in highly situated ways. For students, this localization grounds abstract theories in lived experience and fosters a deeper connection to community, sustainability, and the potential of higher education as a driver of social innovation and community empowerment.

5   Conclusion

This chapter contributes to the growing body of literature advocating for higher education institutions to serve as active agents in local/regional transformation, particularly in underserved rural and border contexts. Drawing on two structured, student-led PBL projects implemented in Slovenia, the analysis illustrates how academic–community partnerships—when supported by meaningful student engagement, structured reflection, and interdisciplinary collaboration—can simultaneously enhance student learning and generate tangible benefits for local communities. The projects addressed place-specific challenges in education and business environments, demonstrating how work-based, intersectoral PBL can support inclusive digital and green transitions in geographically and socioeconomically marginalized areas.

The chapter underscores the potential of community-engaged, problem-oriented projects as a high-impact pedagogical approach that fosters holistic student development, aligns educational outcomes with labor market and societal sustainability needs, and facilitates participatory knowledge creation. It highlights the importance of engaging with local contexts, specifically the realities, constraints, and strengths of rural communities, as a means to deepen student learning and cultivate a sense of social responsibility. This work proposes an adaptable model for embedding relational, community-connected, and justice-oriented pedagogies into higher education, advancing both student development and the long-term resilience and empowerment of local communities.

Notes:

[1] The chapter uses acronyms derived from the original Slovenian titles of both projects to maintain authenticity.

References:

Affandy, H., Sunarno, W., Suryana, R., & Harjana. (2024). Integrating creative pedagogy into problem-based learning: The effects on higher order thinking skills in science education. *Thinking Skills and Creativity, 53*, 101575. https://doi.org/10.1016/j.tsc.2024.101575

Amerstorfer, C. M., & von Münster-Kistner, C. F. (2021). Student perceptions of academic engagement and student–teacher relationships in problem-based learning. *Frontiers in Psychology, 12*, 687529. https://doi.org/10.3389/fpsyg.2021.687529

Barrett, T., & Moore, S. M. (2011). *New approaches to problem-based learning.* New York: Routledge.

Baxter Magolda, M. B. (2004). Self-authorship as the common goal of 21st-century education. In M. B. Baxter Magolda & P. M. King (Eds.), *Learning partnerships: Theory and models of practice to educate for self-authorship* (pp. 35–62). New York: Routledge.

Bell, S. (2010). Project-based learning for the 21st century: Skills for the future. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 83*(2), 39–43. https://doi.org/10.1080/00098650903505415

Boud, D., & Feletti, G. 1997. *The challenge of problem-based learning.* London: Kogan-Page.

Bovill, C. (2025). *Co-creating learning and teaching: Towards relational pedagogy in higher education* (1st ed.). St Albans: Routledge.

Brundiers, K., & Wiek, A. (2017). Beyond interpersonal competence: Teaching and learning professional skills in sustainability. *Education Sciences, 7*(1), 39. https://doi.org/10.3390/educsci7010039

Corbacho, A. M., Minini, L., Pereyra, M., González-Fernández, A. E., Echániz, R., Repetto, L., Cruz, P., Fernández-Damonte, V., Lorieto, A., & Basile, M. (2021). Interdisciplinary higher education with a focus on academic motivation and teamwork diversity. *International Journal of Educational Research Open, 2*, 100062. https://doi.org/10.1016/j.ijedro.2021.100062

Council of the European Union. (2022). Council Recommendation of 16 June 2022 on a European approach to micro-credentials for lifelong learning and employability. *Official Journal of the European Union, C 243*, 1–6. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022H0627(01)

Cörvers, R., Wiek, A., de Kraker, J., Lang, D. J., & Martens, P. (2016). Problem-based and project-based learning for sustainable development. In H. Heinrichs, P. Martens, G. Michelsen, & A. Wiek (Eds.), *Sustainability science* (pp. 349–362). Dordrecht: Springer. https://doi.org/10.1007/978-94-017-7242-6_29

Dochy, F., Segers, M., Van den Bossche, P., & Gijbels, D. (2003). Effects of problem-based learning: A meta-analysis. *Learning and Instruction, 13*(5), 533–568. https://doi.org/10.1016/S0959-4752(02)00025-7

Ersoy, E., & Başer, N. E. (2014). The effects of problem-based learning method in higher education on creative thinking. *Procedia - Social and Behavioral Sciences, 116*, 3494–3498. https://doi.org/10.1016/j.sbspro.2014.01.790

Engeström, Y., Engeström, R., & Kärkkäinen, M. (1995). Polycon textuality and boundary crossing in expert cognition: Learning and problem solving in complex work activities. *Learning and Instruction, 5*, 319–336.

European Commission. (2017). *European Pillar of Social Rights.* Retrieved from https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/economy-works-people/jobs-growth-and-investment/european-pillar-social-rights_en

European Commission. (2020). *Digital Education Action Plan 2021–2027: Resetting education and training for the digital age.* Retrieved from https://education.ec.europa.eu/focus-topics/digital/digital-education-action-plan

European Commission. (2020). *Smart Specialisation Platform (S3).* Retrieved from https://s3platform.jrc.ec.europa.eu/

European Commission. (2019). *Delivering on the UN's Sustainable Development Goals – A comprehensive approach.* Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52019DC0022

Ferns, S. J., Zegwaard, K. E., Pretti, T. J., & Rowe, A. D. (2024). Defining and designing work-integrated learning curriculum. *Higher Education Research & Development, 44*(2), 371–385. https://doi.org/10.1080/07294360.2024.2399072

Gallagher, S. E., & Savage, T. (2020). Challenge-based learning in higher education: An exploratory literature review. *Teaching in Higher Education, 28*(6), 1135–1157. https://doi.org/10.1080/13562517.2020.1863354

González-Pérez, L. I., & Ramírez-Montoya, M. S. (2022). Components of Education 4.0 in 21st century skills frameworks: Systematic review. *Sustainability, 14*(3), 1493. https://doi.org/10.3390/su14031493

Grabowski, J. J., Heely, M. E., & Brindley, J. A. (2008). A model for scaffolding faculty-mentored authentic research experiences for first-year students. *Council on Undergraduate Research Quarterly, 29*(1), 41–47.

Gravett, K., Taylor, C. A., & Fairchild, N. (2021). Pedagogies of mattering: re-conceptualising relational pedagogies in higher education. *Teaching in Higher Education, 29*(2), 388–403. https://doi.org/10.1080/13562517.2021.1989580

Gruenewald, D. A. (2003). The best of both worlds: A critical pedagogy of place. *Educational Researcher, 32*(4), 3–12. https://doi.org/10.3102/0013189X032004003

Haapasaari, A., Engeström, Y., & Kerosuo, H. (2014). The emergence of learners' transformative agency in a Change Laboratory intervention. *Journal of Education and Work, 29*(2), 232–262. https://doi.org/10.1080/13639080.2014.900168

Harvey, M., Walkerden, G., Semple, A., McLachlan, K., Lloyd, K., & Bosanquet, A. (2025). Reflecting on reflective practice: Issues, possibilities and guidance principles. *Higher Education Research & Development, 44*(6), 1–9. https://doi.org/10.1080/07294360.2025.2463517

Hernandez Gonzalez, F. (2023). Exploring the affordances of place-based education for advancing sustainability education: The role of cognitive, socio-emotional and behavioural learning. *Education Sciences, 13*(7), 676. https://doi.org/10.3390/educsci13070676

Kioupi, V., & Voulvoulis, N. (2022). Education for sustainable development as the catalyst for local transitions toward the Sustainable Development Goals. *Frontiers in Sustainability, 3*, 889904. https://doi.org/10.3389/frsus.2022.889904

Kolmos, A., Hadgraft, R., & Holgaard, J. E. (2020). Response strategies for curriculum change in engineering. *International Journal of Technology and Design Education, 30*, 447–466. https://doi.org/10.1007/s10798-019-09504-w

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge: Cambridge University Press.

Mancini, M. C., Arfini, F., & Guareschi, M. (2022). When higher education meets sustainable development of rural areas: Lessons learned from a community–university partnership. *Social Sciences, 11*(8), 338. https://doi.org/10.3390/socsci11080338

Matthews, K. E., Cook-Sather, A., Acai, A., Dvorakova, S. L., Felten, P., Marquis, E., & Mercer-Mapstone, L. (2018). Toward theories of partnership praxis: an analysis of interpretive framing

in literature on students as partners in teaching and learning. *Higher Education Research & Development, 38*(2), 280–293. https://doi.org/10.1080/07294360.2018.1530199

Minelli de Oliveira, J. (2024). Enhancing multimodal literacy through community service learning in higher education. *Frontiers in Education, 9*, 1448805. https://doi.org/10.3389/feduc.2024.1448805

Ministrstvo za digitalno preobrazbo. (2022). *Digitalna Slovenija 2030: Strategija digitalne preobrazbe Slovenije.* Retrieved from https://www.gov.si/assets/ministrstva/MdP/Dokumenti/Digitalna-Slovenija-2030.pdf

Ministrstvo za visoko šolstvo, znanost in inovacije. (2022). *Resolucija o nacionalnem programu visokega šolstva 2030. Uradni list RS, št. 87/22*. Retrieved from https://www.uradni-list.si/_pdf/2022/Ur/u2022087.pdf

Ministrstvo za kohezijo in regionalni razvoj. (2022). *Program za izvajanje evropske kohezijske politike v obdobju 2021–2027 v Sloveniji.* Retrieved from https://evropskasredstva.si/programsko-obdobje-2021-2027/program/

Murphy, W. M. (2012). Reverse mentoring at work: Fostering cross-generational learning and developing millennial leaders. *Human Resource Management, 51*(4), 549–574. https://doi.org/10.1002/hrm.21489

Nguyen, L. T. V., Cleveland, D., Nguyen, C. T. M., & Joyce, C. (2024). Problem-based learning and the integration of sustainable development goals. *Journal of Work-Applied Management, 16*(2), 218–234. https://doi.org/10.1108/JWAM-12-2023-0142

Redecker, C. (2017). *European framework for the digital competence of educators: DigCompEdu.* Publications Office of the European Union. Retrieved from https://publications.jrc.ec.europa.eu/repository/handle/JRC107466

Sannino, A., Engeström, Y., & Lemos, M. (2016). Formative interventions for expansive learning and transformative agency. *Journal of the Learning Sciences, 25*(4), 599–633. https://doi.org/10.1080/10508406.2016.1204547

Sanjakdar, F., & Premier, J. (2023). Teaching for social justice in higher education: Reflexive and critical auto-ethnographic narratives of hope, resilience, and change. *Teaching and Teacher Education, 127*, 104114. https://doi.org/10.1016/j.tate.2023.104114

Sterling, S. (2011). Transformative learning and sustainability: Sketching the conceptual ground. *Learning and Teaching in Higher Education, 5*(11), 17–33.

UNESCO. (2023). *Reimagining our futures together: A new social contract for education.* Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000379707

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge: Harvard University Press.

Weiss, M., Barth, M., & von Wehrden, H. (2021). The patterns of curriculum change processes that embed sustainability in higher education institutions. *Sustainability Science, 16*, 1579–1593. https://doi.org/10.1007/s11625-021-00984-1

Wyness, L., & Dalton, F. (2018). The value of problem-based learning in learning for sustainability: Undergraduate accounting student perspectives. *Journal of Accounting Education, 45*, 1–19. https://doi.org/10.1016/j.jaccedu.2018.07.001

Zhou, Z. (2018). An empirical study on the influence of PBL teaching model on college students' critical thinking ability. *English Language Teaching, 11*(4), 15–20. https://doi.org/10.5539/elt.v11n4p15

Zorec, K. (2024). "We're all for the same mission": Faculty mentoring Native Hawaiian undergraduates in STEM research. *Journal of Diversity in Higher Education, 17*(1), 40–53. https://doi.org/10.1037/dhe0000387