Active Learning in a School-Based Innovation Ecosystem: An Experience Report from Colégio Donaduzzi at Biopark Educação (Brazil)

Carolina Balera Trombini[1], Paulo Roberto Cordeiro Rocha[1]

[1]Associação de Ensino, Pesquisa e Extensão Biopark (Biopark Educação), Brazil

Abstract

Recent evidence from international educational research indicates that active learning methodologies, including cooperative and experiential learning approaches, demonstrate statistically significant correlations with academic achievement, learner motivation, and student engagement across educational levels when compared to traditional teaching methods [1]. Systematic literature reviews further indicate that such approaches lead to improved educational outcomes and are associated with greater knowledge retention and academic performance, particularly when supported by appropriate pedagogical design and effective technological integration [1,2]. This paper reports on the innovative pedagogical practices implemented at Colégio Donaduzzi, an educational institution operating within the Biopark ecosystem in Toledo, Brazil. Situated in a context that integrates formal education, research, and technological innovation, the school adopts active and experiential learning strategies, interdisciplinary project work, and personalized learning pathways as core elements of its educational model. These practices are supported by collaborative learning environments, a bilingual program, formative assessment processes, individualized mentoring, the possibility of customizing learning pathways outside regular class hours to support personalized education, and the use of digital technologies and artificial intelligence to assist learning progression.The institutional model is unique, while inspired by dialogue and knowledge exchange with educational approaches from Finland, the United States, and Portugal, enabling the translation of globally researched practices into the local school context. Preliminary institutional evidence indicates that this approach has translated into measurable outcomes, including strong student participation in scientific projects and consistent performance in national academic competitions, such as sustainability, robotics and language challenges. Drawing on institutional observations and aligned with current international evidence on active methodologies, this experience illustrates how relationally structured and inquiry-driven educational practices can foster deeper engagement, autonomy, and academic resilience.

Keywords: *Personalized learning; Student engagement; Innovation ecosystem; Educational innovation.*

1. Introduction

Active learning has become a central paradigm in contemporary education in response to the demand for learning environments that foster student engagement, autonomy, and meaningful knowledge construction. Methodologies such as project-based learning, collaborative learning, gamification, and inquiry-based approaches have been associated with improvements in academic performance, student motivation, and persistence across educational levels [1]. Empirical and systematic studies indicate that these strategies enhance participation, autonomy, and problem-solving engagement when compared to traditional lecture-based teaching models, contributing to more consistent learning outcomes and sustained student involvement in the learning process [1,2]. Research also shows that student engagement is shaped not only by instructional methods but by institutional environments, collaborative cultures, and classroom dynamics. Learning contexts that integrate participatory pedagogies, interaction, and formative feedback tend to promote stronger and more sustained engagement and learning continuity [2,3]. Although the theoretical and empirical literature on active learning has expanded substantially, its translation into everyday school practices remains uneven, particularly in basic education. Schools frequently face structural, pedagogical, and organizational constraints that limit the systematic adoption of innovative approaches. This scenario reinforces the relevance of studies that document and analyze concrete institutional experiences situated in innovation-oriented educational environments [4].

Innovation ecosystems have been increasingly recognized in educational research as relevant contexts for transformation, particularly when they integrate schools, universities, research initiatives, and technological infrastructures in collaborative arrangements that connect theory and practice and support adaptive learning models and innovation-driven pedagogies [5,6].

Colégio Donaduzzi is a basic education institution that began its operations in January 2025, initially serving students in the final years of elementary education and upper secondary education within the Biopark innovation ecosystem. In 2026, it offered the complete cycles of elementary and upper secondary education. The school is a non-profit educational initiative maintained by Biopark Educação, a civil society organization dedicated to education, research, and innovation. The institution is certified as a charitable educational entity by the Brazilian Ministry of Education and holds public utility recognition at both the state level of Paraná and the municipality of Toledo. This institutional structure supports the integration between schooling, technological development, and interdisciplinary learning environments.

During its first year of operation, the school implemented a pedagogical model grounded in active learning, interdisciplinary projects, individualized mentoring, bilingual exposure, and digitally supported environments, including the use of artificial intelligence to assist learning progression. Within this approach, student protagonism was developed through guided participation and pedagogical mediation. This study examines the implementation of a new pedagogical approach in a basic education school situated within an innovation-oriented environment, analyzing how this model was structured, translated into the local educational context, and remained aligned with international educational trends and research on active learning and student engagement.

2. Methodology

This study adopts an institutional case study design to examine the implementation of an active learning model developed within an innovation ecosystem. This methodological approach is suitable for investigating complex educational processes situated in real institutional contexts, particularly when the objective is to understand pedagogical organization, implementation dynamics, and emerging educational outcomes rather than to test controlled experimental interventions [7,8].

Data were derived from multiple institutional sources, including documentation of interdisciplinary projects, records of student participation in academic and scientific activities, and institutional pedagogical reports. Data triangulation based on documentary sources strengthened methodological rigor and enabled a comprehensive understanding of how active learning and other pedagogical strategies were implemented during the initial phase of the pedagogical model [9,10].

The temporal scope of the study spans from January 2025 to February 2026, covering the first year of operation of Colégio Donaduzzi and the initial implementation phase of its pedagogical model within the Biopark innovation ecosystem in Toledo, Paraná, Brazil.

3. Results and Discussion

The following sections present the results organized into four subtopics: teaching professionals, learning environments and pedagogical practices, integration with the innovation ecosystem, and student and institutional outcomes.

3.1 Teaching Professionals

Colégio Donaduzzi is grounded in the principle that the quality of educational innovation is directly related to the qualification, stability, and continuous development of its teaching professionals. For this reason, the institutional model incorporates structured processes for teacher selection, professional valorization, and pedagogical development as central elements for the implementation of relationally oriented pedagogical practices grounded in teacher–student interaction.

The recruitment process involves a comprehensive evaluation of academic background and professional trajectory, including prior teaching experience and engagement in research activities. Candidates are assessed through a structured selection process conducted by a panel of specialized educators and participate in a simulated classroom teaching session, enabling the evaluation of pedagogical competence, communication skills, and alignment with the institutional educational approach. All teachers are specialists in their respective fields, with 82% holding postgraduate qualifications corresponding to ISCED above 6. According to the International Standard Classification of Education (ISCED), developed by UNESCO, level 6 corresponds to bachelor's or equivalent degrees, level 7 to master's or equivalent degrees, such as postgraduate programs of strong specialization, and level 8 to doctoral or equivalent research degrees [11].

To contextualize the institutional qualification profile, Tables 1 and 2 compare Colégio Donaduzzi with national and international benchmarks from the Brazilian School Census 2024 and TALIS 2024, covering overall qualification levels and doctoral-level training.

Table 1. Teacher qualification profile (basic education) in national and international comparison according to ISCED classification [11,12,14].

Context	ISCED < 6	ISCED 6	ISCED > 6
Colégio Donaduzzi	0.0%	17.9%	82.0%
School Census 2024 - Brazil	10.3%	42.7%	48.0%
TALIS 2024 - International	3.2%	38.1%	59.7%
TALIS 2024 -Top 1: Slovak Republic	0.6%	0.9%	98.5%
TALIS 2024 -Top 2: Poland	0.3%	2.3%	97.4%
TALIS 2024 -Top 3: Croatia	0.6%	4.5%	94.5%
TALIS 2024 -Top 4: Portugal	0.9%	5.0%	94.1%
TALIS 2024 -Top 5: Finland	3.7%	4.5%	91.8%

Table 2. Proportion of teachers at ISCED level 8 (doctoral level) in national and international comparison [11,13,14].

Context	ISCED 8
Colégio Donaduzzi	12.8%
School Census 2024 - Brazil	1.1%
TALIS 2024 - International	1.7%
TALIS 2024 -Top 1: Italy	5.2%
TALIS 2024 -Top 2: Cyprus	4.9%
TALIS 2024 -Top 3: Spain	4.8%
TALIS 2024 -Top 4: Romania	4.3%
TALIS 2024 -Top 5: Czechia	3.8%

Together, these data indicate that Colégio Donaduzzi presents a higher proportion of teachers with postgraduate and doctoral qualifications than national averages and approaches patterns observed in education systems characterized by strong academic preparation of teaching professionals.

Colégio Donaduzzi adopts employment conditions aimed at attracting and retaining highly qualified professionals. Teaching contracts are structured with full institutional dedication (100%), encompassing the teacher's weekly workload within the school. This model differs from the national Brazilian context, in which a substantial proportion of teachers work under part-time arrangements and approximately 41% need to divide their weekly workload across two or more schools. At the global level, around 20% of teachers work part-time across education systems. Among these, 17% work in only one school, indicating that a substantial proportion of part-time teachers are employed across more than one school, reflecting fragmented professional arrangements and representing a relevant share of teachers working across multiple institutions worldwide [11, 14, 15].

Within the full-time model adopted by Colégio Donaduzzi, half of this workload is allocated to classroom teaching, while the remaining time is dedicated to lesson planning, development of instructional materials, individualized mentoring of students, developing research projects, and continuous professional development, supported by sufficient administrative staff to allow teachers to focus primarily on pedagogical activities. This configuration also differs from the broader Brazilian educational reality, where Federal Law No. 11.738/2008 establishes a maximum distribution of 2/3 of teachers' working time for classroom instruction and 1/3 for extracurricular pedagogical activities, which may include administrative tasks [16]. In practice, however, schools frequently tend to allocate teachers as close as possible to the maximum permitted time in classroom teaching, a condition associated in the literature with reduced well-being and increased work-related stress among teachers, thereby constraining the time, cognitive availability and pedagogical flexibility required to effectively implement active and personalized teaching approaches [17].

At the institutional level, the school also provides dedicated facilities for teachers, including a staff lounge equipped with kitchen facilities, designed to support rest, interaction and well-being during the working day. International evidence indicates that teacher well-being is influenced by multiple factors beyond remuneration, including workload, working conditions, leadership support and opportunities for continuous professional learning; however, salary remains a significant element associated with professional satisfaction and retention in the teaching career [11].

Based on these considerations, teacher valorization is also expressed through remuneration practices above the local average. The entry-level salary is approximately 26% higher than the national salary floor for public basic education teachers in Brazil, while the average remuneration is about 50% higher than the mean salary observed in public basic education teaching positions [18,19], as well as through institutional investment in continuous professional learning pathways. The school provides structured support for the development of individualized professional growth plans and offers continuing education opportunities embedded within the working schedule. As part of these actions, teachers were offered postgraduate specialization programs, each exceeding 360 hours and provided free of charge, including training in learning practices and the development of neurodivergent students, as well as participation in the Star Lessons program, developed through a partnership between Biopark Educação and the University of Helsinki and recognized as an international professional development initiative originating in Finland. This program was also part of an institutional strategy aimed at strengthening international collaboration. Within this international dimension, knowledge exchange dialogues were established with educational institutions in Finland, the United States, and Portugal. These activities were supported by in loco visits aimed at identifying collaboration opportunities and informing future international engagement of teachers.

Beyond postgraduate training, the institution also promoted professional engagement at the international level, both by hosting and sending educators, including the visit of a renowned educator

from Portugal to Brazil to deliver lectures for all teaching professionals, as well as an immersion experience carried out in Finland, in schools internationally recognized for pedagogical excellence, in which 17 teachers from Colégio Donaduzzi participated, enabling them to observe educational practices in context and subsequently adapt these experiences to the Brazilian basic education reality.
Furthermore, other institutional practices contribute to teachers' professional support, including continuous dialogue with institutional leadership, which provides ongoing feedback and feedforward on professional development and offers guidance when challenges are identified.

3.2 Learning Environments and Pedagogical Practices

Learning environments are structured as thematic laboratories rather than conventional fixed classrooms, reflecting an infrastructure intentionally designed to stimulate students' curiosity, creativity, and engagement. Each discipline is associated with its own dedicated environment, for example, a Mathematics laboratory organized with challenges and educational games, and a science laboratory equipped with instruments and reagents to support experimentation aligned with the topics addressed in class. This configuration enables students to move beyond abstract content, engaging directly with concepts through practical experience and experimentation, so that learning is constructed not only through theory but through concrete interaction with the subject matter [20].
The integration of digital tools supports pedagogical organization and formative assessment practices. Each student was provided with an individual portable computer to support digital learning activities and access to intelligent educational platforms that facilitate the monitoring of academic progress and the generation of information to support feedback processes.
Classes are limited to a maximum of 24 students, a size considered pedagogically appropriate to allow closer monitoring of learning processes and effective classroom management by the teacher, also influencing the quality of perceived teacher–student interactions and, consequently, higher levels of student satisfaction [17]. Within each laboratory, learners are typically organized into 4 collaborative learning islands composed of 6 students, fostering teamwork, peer interaction, and collective problem solving. According to the pedagogical objectives of each lesson, the spatial configuration can be reorganized by the teacher, allowing the environment to adapt dynamically to different learning activities. Each class lasts 50 minutes, followed by a 5 minute pause for transition between laboratories according to students' schedules. This circulation contributes to maintaining students physically and cognitively active, while each change of environment functions as a new moment of immersion in the subject area. In this model, space is not simply a physical setting but becomes an active component of the learning process, supporting active and personalized teaching practices [21]. In addition, the school provides dedicated spaces for rest, emotional regulation, and guided study, supporting students' well-being, cognitive recovery, and targeted academic assistance. Differently from the prevailing schedule observed in most Brazilian schools, at Colégio Donaduzzi classes began after 8:00 a.m., a timing consistent with evidence indicating that later school start times are associated with longer sleep duration, improved cognitive functioning, and better academic and mental health outcomes among adolescents [22].
Students participate in a diagnostic assessment when they enter the school, and the results are analyzed by a multidisciplinary pedagogical team. Based on this assessment, working groups are organized to guide classroom activities, aiming to promote complementarity among students and support the progressive development of socioemotional competencies, leadership, collaboration, and other dimensions relevant to learning and personal development.
Each student is also assigned a faculty mentor who provides individual guidance for approximately one hour per week. During the first weeks of the school year, students indicate three preferred teachers to act as mentors, and the school allocates mentorships according to availability to ensure that all students are supported. Mentoring sessions focus on students' academic and personal development and on the continuous refinement of their individualized development plan, referred to as the Life Plan. Whenever necessary, the multidisciplinary pedagogical team supports both students and mentors, contributing to monitoring progress and guiding decision-making throughout each student's developmental trajectory.
When specific learning needs are identified in particular subjects, mentors may recommend the organization of supplementary instructional groups to provide targeted academic support. Students' academic progress, activities, and individualized development plans are systematically recorded in a pedagogical learning log, supporting monitoring, feedback, and communication among teachers, mentors, and the pedagogical team.
Within classroom settings, pedagogical practices were organized around core dimensions aligned with relational pedagogical principles and active learning. Teaching strategies positioned students as active agents in the learning process through project-based activities, problem-oriented tasks, and collaborative knowledge construction. Classroom experiences were designed to support creativity, experimentation, and innovation as components of cognitive engagement. Socioemotional dimensions

were also incorporated into the pedagogical organization, with emphasis on structured interactions, active listening, and respectful communication, contributing to students' emotional development and learning engagement. The pedagogical model further emphasized the development of transversal competencies, including communication, problem-solving, interpersonal collaboration, and leadership. These elements were integrated into classroom dynamics to support student participation, motivation, and sense of belonging, understood as relevant factors in the learning process.

Assessment practices were formative and participatory, focusing on performance and learning trajectories. Instruments included learning records, self- and peer assessment, and project-based evaluation, with trimester presentations supporting the monitoring of student development.

Students participated in comprehensive institutional evaluation processes conducted at the end of each trimester, providing structured feedback on learning environments, teaching practices, teacher performance, administrative procedures, transportation logistics, the quality of school meals, and the overall organizational functioning of the school, thereby contributing to a broad and systematic assessment of both pedagogical and operational dimensions of the educational experience.

The school approaches technology as a means to enhance human development and learning processes rather than as an end in itself. Digital resources are integrated transversally into the curriculum to support inquiry, collaboration, knowledge construction, and formative assessment, while maintaining the human dimension as central to educational practice. Within this perspective, technological integration is understood as a pedagogical instrument that supports students' autonomy, critical thinking, and responsible engagement with digital environments.

In alignment with this approach, the institution introduced a dedicated Artificial Intelligence (AI) course for upper secondary students, expanding structured opportunities for digital literacy and computational thinking within basic education. This initiative positions the school among early adopters of curricular AI education in the Brazilian context, reflecting its commitment to aligning educational practices with emerging technological and societal developments.

To begin within the Brazilian regulatory framework for bilingual education, Colégio Donaduzzi chose not to operate initially as a bilingual school. In Brazil, a bilingual school is defined as one that implements a single, integrated curriculum delivered in two languages, with a minimum proportion of instruction conducted in the additional language (30% in elementary education and 20% in upper secondary education) [23,24]. Instead, the institution opted to implement a bilingual program, characterized by extended exposure to the English language within the school schedule. Approximately 20% of instructional time was conducted in English, supported by daily language classes. This decision considered that, in its first year, the school offered classes for the final year of elementary education and all grades of upper secondary education, and that many learners might not yet have sufficient linguistic background to immediately engage in content-based instruction delivered through English, in which curricular subjects are taught in the additional language, potentially affecting their academic development. Research indicates that, particularly among learners with limited prior exposure to the additional language, the integration of disciplinary content and a second language may affect students' comprehension and engagement with subject matter. Evidence from studies on bilingual and content-based language education shows that, in the initial stages of implementation, learning gains are more consistently observed in language development than in disciplinary achievement, and outcomes in content learning tend to vary according to students' linguistic readiness and the conditions of implementation. These findings support recommendations to strengthen explicit language instruction and to adopt gradual or sequential models before expanding subject teaching in English [25,26]. The adopted approach therefore reflects contextual adaptation and alignment with recommendations from the literature on gradual implementation of bilingual education.

As a key component of its institutional strategy to strengthen student protagonism, engagement, and curriculum development, the school organized the daily timetable to ensure alignment with the curricular components required by the Brazilian National Curriculum Guidelines for Basic Education issued by the Ministry of Education, while also providing opportunities for the personalization of education in the complementary period. Teaching and learning practices were structured according to active and experiential learning strategies, interdisciplinary project work, and personalized learning pathways as central elements of the educational model. The pedagogical organization was articulated through interdisciplinary projects, collaborative learning environments, inquiry-oriented activities, and the integration of digital resources into teaching and learning processes. These strategies were designed to promote student engagement and the articulation between academic knowledge and real-world problem solving. The model was influenced by principles of active learning, including project-based learning and phenomenon-based learning, as well as by the integration of digital technologies and artificial intelligence, while maintaining the human dimension as a central element of educational processes. Personalization of learning was established as a core component of this approach,

supported by individualized mentoring and continuous guidance in the definition and development of students' learning pathways according to their interests, needs, and future aspirations.
Finally, as one of the school's main distinguishing features, in the complementary period students were able to fully personalize their developmental trajectories by selecting areas aligned with their individual interests and vocations from approximately 60 possibilities, encompassing science, arts/culture, sports, and technology. This stage of personalized education was implemented within a dedicated structure integrated with Colégio Donaduzzi, located in the Biopark innovation ecosystem and known as Academia Donaduzzi, an institution that is part of Biopark Educação. The Academia Donaduzzi provided additional specialized learning environments, including laboratories for food science, pharmacy, microbiology, arts and culture, and information technology, as well as a makerspace equipped with 3D printers and infrastructure for prototyping and woodworking, in addition to sports facilities and other resources. Within this context, students were able to design and pursue individualized learning pathways aligned with their interests and developmental needs. This approach enabled the exploration and consolidation of competencies connected to personal aspirations, while establishing links between school experiences, higher education trajectories, and potential entry into the labor market.

3.3 Integration with the Innovation Ecosystem Biopark

The integration of Colégio Donaduzzi within the Biopark innovation ecosystem enabled continuous interaction with companies, research initiatives, and educational institutions, providing students with access to infrastructure, technological resources, and innovation-oriented environments. Educational activities were supported by proximity to laboratories, entrepreneurial initiatives, and institutional networks that characterize the ecosystem.
This integration translated into concrete educational opportunities for students. Within this context, students also had access to an entrepreneurial development pathway through a child-focused incubation program linked to the innovation ecosystem. For younger participants, the initiative was adapted into a pre-incubation format appropriate to their age and stage of development. In this program, students were able to develop their own business ideas and projects, developing products or services as well as entrepreneurial proposals, while receiving technical guidance and support from professionals associated with the technology park. At the time of this study, 17 initiatives participated in this program, with approximately 20 additional initiatives projected for 2026.
Scientific initiation activities also formed part of the integration between the school and the innovation ecosystem, involving students in research-oriented projects connected to real-world problems and innovation contexts. The school is currently selecting 30 projects involving up to 50 students, in which each participant will receive a monthly research fellowship of R$ 300 to support their dedication to research activities. These projects are generally developed in dialogue with demands and areas of interest identified within the Biopark ecosystem, strengthening the relationship between school-based research, technological development, and local innovation dynamics.
The relationship between the school and the ecosystem was not unidirectional. The presence of the school also contributed to the dynamics of the ecosystem by expanding the circulation of people and strengthening connections between educational and innovation environments. The student population comes from a regional area that includes 21 municipalities within an approximate radius of up to 290 km, with the host city accounting for about 67% of total enrollment. Families connected to the Biopark ecosystem, including those working in companies and research institutions, became actively involved in school activities. At the same time, the school also attracted new social groups who would not normally access the Biopark environment on a daily basis, representing more than 90% of the student population.
In addition, the school functions as an early educational stage within a broader educational trajectory associated with the innovation ecosystem, which includes higher education institutions located within the same environment, such as Faculdade Donaduzzi and public universities. In this sense, students represent potential future participants in the innovation ecosystem, contributing to the continuity of educational and professional pathways aligned with research, entrepreneurship, and technological development.

3.4 Student and Institutional Outcomes

Colégio Donaduzzi began its activities with an initial enrollment of 303 students and, within a short period, expanded to 554 students. Participation in personalized learning pathways beyond regular class hours was observed among 422 students, indicating strong engagement with the personalized learning model beyond the compulsory instructional components required by Brazilian basic education regulations. Institutional records also indicate that 160 students have formal diagnoses associated with high abilities. This profile reinforces the relevance of differentiated pedagogical strategies, mentoring,

and project-based learning structures and represents a distinctive feature of the school, which is particularly responsive to the needs of high-ability learners.

As a private non-profit educational institution, Colégio Donaduzzi incorporates financial support as an important component of its access model. The majority of students receive some form of scholarship support, determined by family socioeconomic conditions, parents' professional links with the Biopark ecosystem, partnerships with public programs, and internal academic selection processes. Overall, 66% of students receive scholarships, among whom 47% benefit from full scholarships, while an additional 19% receive partial support covering up to half of the tuition fees.

Project-based learning was implemented as a transversal pedagogical axis, with all students participating in interdisciplinary initiatives throughout the academic year. Projects were aligned with real-world challenges and, in many cases, connected to sustainability, technological innovation, and social inclusion. Several initiatives gained visibility in educational and media contexts, including the development of a nutritional supplement for cattle aimed at reducing methane emissions, biodegradable dressings with natural active compounds for acne treatment, and an intelligent wheelchair capable of interpreting facial movements to control mobility [27,28].

Student engagement in scientific fairs and academic competitions resulted in multiple recognitions across areas including sustainability, health, robotics, entrepreneurship, technological development, languages, engineering, and astronomy, totaling 33 medals and 63 honorable mentions in national Olympiads, as well as 12 medals in regional contests. As an illustrative example of performance above the national average, data from the Brazilian Astronomy Olympiad (OBA) indicate that the school achieved an award rate of 8.2%, compared to the national average of 5.6%, representing a performance more than 45% higher than the national benchmark. A similar pattern was observed in the Brazilian Public Schools Mathematics Olympiad (OBMEP), in which approximately 10% of participating students advanced to the second phase, compared to a national average of 5%, corresponding to twice the national rate [29].

Diagnostic evaluations conducted at the time of student entry revealed heterogeneous learning levels across curricular components, guiding the implementation of personalized learning strategies and academic support pathways. Subsequent internal evaluations indicated progressive improvement in average performance across disciplines over the academic terms, increasing from an average of 6.5 to 8.7 (maximum score of 10) in the first trimester of evaluations, suggesting stabilization of learning processes and consolidation of foundational competencies.

Survey data collected from students and families indicated high levels of satisfaction with pedagogical methodologies, learning environments, and institutional organization. Students rated teaching methodology at 8.8 and overall institutional performance at 8.6 (maximum score of 10), while parents or guardians reported ratings of 9.3 for methodology and 9.5 for overall institutional evaluation, reinforcing the perceived relevance of the educational model and its impact on student engagement.

At the ecosystem level, the integration between the school and the Biopark innovation environment produced additional impacts. As described in the previous subtopic, student participation in scientific initiation projects, entrepreneurial pathways, and applied research activities reinforced connections between basic education, technological development, and innovation practices. Furthermore, among students who completed the final year of upper secondary education, 100% were admitted to higher education entrance examinations, and 70% secured admission to higher education institutions within the Biopark ecosystem, enabling continuity of their educational trajectories within the same innovation environment.

4. Conclusion

The implementation of an educational model grounded in active learning, personalization, and integration with an innovation ecosystem was associated with high levels of student engagement, participation in interdisciplinary projects, and recognition in academic and scientific environments during the initial period analyzed.

Aligned with international evidence, the experience suggests that relational and inquiry-driven environments can foster autonomy, engagement, and academic resilience, while strengthening connections between schooling, research, and real-world problem solving.

Within the Brazilian educational context, Colégio Donaduzzi emerges as an institutional model structured to remain connected to global research agendas and educational innovation, translating internationally discussed pedagogical approaches into a locally grounded implementation.

REFERENCES

[1] Conde-Izquierdo S., et. al. “The impact of active methodologies in the classroom on academic achievement: A systematic literature review using the PRISMA protocol”, International Journal of Educational Research 132, Amsterdam, Elsevier, 2025.
[2] Costa L.M.G., Reis M.J.C.S. “Motivational Teaching Techniques in Secondary and Higher Education: A Systematic Review of Active Learning Methodologies”, Digital, Basel, MDPI, 2025.
[3] De Bruijn-Smolders M., et al. “Effective student engagement with blended learning: A systematic review”, Heliyon, Amsterdam, Elsevier, 2024.
[4] Rosienkiewicz M., et al. “Enhancing Technology-Focused Entrepreneurship in Higher Education Institutions Ecosystem: Implementing Innovation Models in International Projects”, Education Sciences, Basel, MDPI, 2024.
[5] Serrano-Ruiz J.C., et.al. “A conceptual framework for the interaction processes within innovation ecosystems”, Journal of Intelligent Manufacturing, Cham, Springer, 2025.
[6] Bremner N., et.al. “The outcomes of learner-centred pedagogy: A systematic review”, International Journal of Educational Development, Oxford, Elsevier, 2022.
[7] Grbich C., “Qualitative Data Analysis: An Introduction”, Sage Research Methods, London, SAGE Publications Ltd, 2022.
[8] Lim W. M., “What Is Qualitative Research? An Overview and Guidelines”, Australasian Marketing Journal, Melbourne, Elsevier, 2025.
[9] Valencia M. M. A. “Principles, Scope, and Limitations of Methodological Triangulation”, Investigación y Educación en Enfermería, Medellín, Universidad de Antioquia, 2022.
[10] Smith P. R. “Collecting sufficient evidence when conducting a case study”, The Qualitative Report, Nova Southeastern University, 2018, pp. 1043–1048.
[11] OECD. “Teaching and Learning International Survey (TALIS) 2024 Results”, Organisation for Economic Co-operation and Development, Paris, OECD, 2025.
[12] Brasil. “Censo Escolar da Educação Básica 2024: Notas Estatísticas”, Brasília, INEP/MEC, 2025.
[13] Brasil. “Meta 16 – Formação continuada e pós-graduação de professores da educação básica: indicador 16A”, Brasília, INEP/MEC, 2024.
[14] OECD. “Teaching and Learning International Survey (TALIS)” database and statistical tables”. Paris, OECD, 2026.
[15] Brasil. Relatório de Resultados SAEB 2023: Eixos de Qualidade da Educação – Volume 2 (versão preliminar). Brasília, INEP/MEC, 2025.
[16] Brasil. “Lei nº 11.738, de 16 de julho de 2008”. Diário Oficial da União, Brasília, Presidência da República, 2008.
[17] Santos K. C. R., et al. “Understanding depression in basic education teachers: evidence from Brazil”, Frontiers in Education, Lausanne, Frontiers Media, 2025.
[18] Brasil. “Portaria MEC nº 77/2025 – Reajuste do piso salarial profissional nacional do magistério público da educação básica”, Brasília, MEC, 2025.
[19] Brasil. “Anuário Brasileiro da Educação Básica 2025 – Professores (Capítulo 6)”, São Paulo, Todos Pela Educação, 2025.
[20] Wang L., et al. “Class size, student behaviors and educational outcomes”, Organization Management Journal, 2022.
[21] Barrett P., et.al. “The impact of classroom design on pupils’ learning: Final results of a holistic, multi level analysis”, Building and Environment, Oxford, Elsevier, 2025.
[22] Mousavi Z., Troxel W. M. “Later School Start Times as a Public Health Intervention to Promote Adolescent Health and Learning”, Current Sleep Medicine Reports, Springer, 2023.
[23] Brasil. “Parecer CNE/CEB nº 2/2020 – Diretrizes Curriculares Nacionais para a oferta de Educação Plurilíngue”, Brasília, MEC, 2020.
[24] Reis, J. N. S., et al. “Diretrizes curriculares nacionais para educação plurilíngue no Brasil: qual educação bilíngue?”, Revista Teias, Rio de Janeiro, Universidade do Rio de Janeiro, 2022.
[25] Dallinger, S. et al.“The effect of content and language integrated learning on students’ English and history competences”, Learning and Instruction, Oxford, Elsevier, 2016.
[26] Lee, J. H., et.al. “Effects of content and language integrated learning at the primary school level: A multilevel meta-analysis”, Educational Research Review, Amsterdam, Elsevier, 2025.
[27] Globo Rural. “Estudantes criam ração para reduzir emissão de metano na pecuária”. Available at: https://globorural.globo.com/educacao/noticia/2025/08/estudantes-criam-racao-para-reduzir-emissao-de-metano-na-pecuaria.ghtml. Accessed on: February 23, 2025.
[28] Isso é Brasil. “Academia Donaduzzi soma mais de 25 premiações em 2025 e se destaca em olimpíadas nacionais”. Available at: https://www.issoebrasil.com.br/2026/01/academia-donaduzzi-soma-mais-de-25.html. Accessed on: February 25, 2025.

[29] Colégio Donaduzzi. “Colégio Donaduzzi destaque em olimpíadas científicas 2025”. Available at: https://colegiodonaduzzi.com.br/colegio-donaduzzi-destaque-olimpiadas-cientificas-2025/. Accessed on: February 25, 2025.