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Teaching Inclusive Technology Design through Design Thinking: An Educational Framework for Community and Special Needs Education in Support of the Sustainable Development Goals (SDGs)

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ABSTRACT

Inclusive education plays a critical role in achieving the Sustainable Development Goals (SDGs), particularly those related to quality education, decent work, and reduced inequalities. This study aims to develop an educational framework for teaching the synthesis of inclusive technologies through the design thinking approach within community and special needs education. Using a conceptual and analytical methodology, the study integrates the stages of design thinking with inclusive pedagogy to guide students and educators in designing technologies that accommodate diverse physical, social, and cognitive needs. The proposed framework emphasizes empathy, collaborative problem-solving, and learner-centered design to support social adaptation, employability, and community participation of persons with disabilities. The findings suggest that design thinking can function not only as an innovation method but also as an effective pedagogical strategy for advancing inclusive and special needs education. This approach contributes to the implementation of Sustainable Development Goals (SDGs) by strengthening inclusive learning environments and promoting sustainable community-based inclusion.

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1. INTRODUCTION

Inclusive development has become a key concern in contemporary societies, particularly in relation to the social participation and quality of life of persons with disabilities. Many reports regarding this matter have been well-documented (Ashurova *et al*., 2026; Faddillah *et al*., 2022; Musayaroh *et al*., 2023; Adesokan & Bojuwoye, 2023; Oktamovna & Ruslanovna, 2024; Khudayshukurovna *et al*., 2024; Yunusovna *et al*., 2024; Nurullayevna *et al*., 2025). In the context of post-industrial transformation, technological change has fundamentally altered labor structures, professional activities, and forms of social inclusion (Ilkevich, 2023). While advances in technology create new opportunities for flexible work arrangements and digital participation, they also risk deepening inequality when inclusivity is not considered in the design process. These conditions underscore the critical role of education in ensuring that technological progress contributes to inclusive community development rather than social exclusion.

Employment plays a central role in social adaptation and well-being for persons with disabilities. Access to meaningful and sustainable employment supports independence, community engagement, and social recognition, making it a core indicator of inclusive development (Glushchenko, 2025). However, many existing technologies and professional environments remain implicitly oriented toward individuals without disabilities, limiting access and participation. This situation highlights the need for educational approaches that equip future professionals with the capacity to design technologies that explicitly address the needs of persons with disabilities within community and social contexts.

Research on technology design has emphasized conceptual, system-based, and integrative approaches aimed at improving technological effectiveness and coherence (Evgenev, 2020; Ilia, 2025; Lopukhina & Mikhaleva, 2023). Although these studies provide important insights into technology development processes, they often pay limited attention to inclusive outcomes and educational implementation. In particular, the integration of inclusive principles into technology design education remains insufficiently developed, especially in programs that prepare students to respond to the needs of special populations. This gap indicates the absence of pedagogical frameworks that explicitly connect technology design, inclusive education, and community participation.

Design thinking has increasingly been discussed as a human-oriented approach that emphasizes empathy, creativity, and iterative problem-solving in innovation processes (Glushchenko, 2022; Ogai, 2021). From an educational perspective, design thinking offers a flexible and structured methodology that can be adapted to teaching and learning activities addressing complex social challenges. Its emphasis on understanding user needs and co-creating solutions makes it particularly relevant for community and special needs education. Nevertheless, design thinking has not yet been sufficiently conceptualized as a pedagogical framework for teaching the synthesis of inclusive technologies that support the employability and social adaptation of persons with disabilities.

Therefore, based on our previous studies (Glushchenko, 2023; Glushchenko & Inei, 2024), this article aims to propose an educational framework for teaching the synthesis of inclusive technologies through design thinking within the field of community and special needs education. The study focuses on how educational practices can prepare students to design technologies that promote inclusive employment, social participation, and community well-being for persons with disabilities. The novelty of this work lies in repositioning design thinking not merely as an innovation methodology, but as a pedagogical strategy that

supports inclusive development in post-industrial societies (Glushchenko, 2025; Ilkevich, 2023).

2. METHOD

This study adopts a conceptual and instructional design approach to develop a pedagogical framework for teaching the synthesis of inclusive technologies through design thinking in the context of community and special needs education. The method is not intended to test hypotheses empirically but to structure a systematic educational model that can guide teaching and learning processes related to inclusive technology design.

The methodological framework emphasizes learning as an active, reflective, and problem-oriented process. Students are positioned as designers who engage with real or simulated community problems involving persons with disabilities. The teaching process is structured to support the development of empathy, inclusive awareness, and design competence, enabling learners to conceptualize technologies that respond to diverse physical, social, and functional needs.

The instructional process is organized into sequential learning stages that reflect the logic of design thinking adapted for educational purposes. These stages include understanding the social and functional context of disability, defining inclusive design challenges, generating solution ideas, developing conceptual prototypes, and evaluating proposed solutions based on inclusivity and feasibility. Each stage is implemented through guided learning activities, group discussions, and reflective exercises to ensure that students internalize inclusive values alongside technical and creative skills.

To support learning outcomes, the method integrates collaborative learning and community-oriented perspectives. Students are encouraged to work in teams and, where possible, to engage with real-life scenarios related to community participation and employment for persons with disabilities. This approach enables learners to align technological design with social inclusion objectives and to consider the broader implications of their design decisions.

The effectiveness of the teaching framework is evaluated through qualitative instructional indicators, including students' ability to articulate inclusive design principles, the coherence of proposed technology concepts, and the alignment between design solutions and identified community needs. Reflection activities and structured feedback are used to support continuous improvement of students' design thinking processes and inclusive understanding.

Overall, the method provides a structured yet flexible educational framework that supports the development of inclusive design competencies. By focusing on teaching processes rather than empirical measurement, this approach aims to prepare students to contribute to inclusive employment, community participation, and social well-being for persons with disabilities through technology design.

3. RESULTS AND DISCUSSION

3.1. Results: Proposed Teaching Framework for Inclusive Technology Design

The primary result of this study is the development of a structured teaching framework for the synthesis of inclusive technologies through design thinking within the context of community and special needs education. Rather than producing empirical measurements, the results of this conceptual study are reflected in the articulation of a pedagogical model that integrates inclusive education principles, community orientation, and technology design

competence. This framework provides a systematic approach for preparing students to design technologies that support social participation, employability, and well-being of persons with disabilities in post-industrial societies.

The proposed framework positions inclusive technology design as an educational outcome rather than a purely technical activity. In this approach, learning is understood as a process through which students gradually develop awareness of disability-related challenges, community needs, and the social implications of technology. Design thinking functions as the core instructional logic, guiding students from problem identification to solution conceptualization through iterative and reflective learning activities. This orientation aligns with contemporary views on human-oriented and integrative technology development, which emphasize the importance of aligning technical innovation with social objectives (Evgenev, 2020; Ilia, 2025).

A key feature of the framework is its emphasis on empathy as an entry point to learning. Students are encouraged to analyze real or simulated scenarios involving persons with disabilities, focusing on barriers to participation in employment and community life. This stage supports the development of inclusive awareness and provides a foundation for defining meaningful design challenges. By embedding empathy-driven analysis into the educational process, the framework ensures that inclusive considerations are not treated as secondary constraints but as central design criteria.

The subsequent stages of the framework guide students through problem definition, idea generation, conceptual prototyping, and evaluation of inclusive solutions. These stages are not treated as linear steps but as interconnected learning cycles that allow students to revisit earlier assumptions and refine their design concepts. This iterative structure supports deeper learning and mirrors the complexity of real-world inclusive technology development, where social, technical, and organizational factors interact dynamically (Glushchenko, 2022).

Table 1 summarizes the structure of the proposed teaching framework, illustrating the relationship between design thinking stages, learning focus, inclusive education objectives, and expected student competencies. This table represents a core result of the study, as it translates abstract pedagogical principles into an actionable instructional model that can be applied in higher education and professional training contexts.

Table 1. Structure of the teaching framework for inclusive technology design.

Design Thinking Stage	Learning Focus	Inclusive Education Objective	Expected Student Competencies
Empathy	Understanding disability and community context	Development of inclusive awareness and sensitivity	Ability to identify barriers and user needs
Problem Definition	Formulating inclusive design challenges	Alignment of technology goals with social needs	Skill in defining inclusive design criteria
Ideation	Generating inclusive solution concepts	Promotion of creative and human-oriented thinking	Ability to propose multiple inclusive solutions
Conceptual Prototyping	Structuring technology concepts	Translation of ideas into feasible models	Competence in conceptual design
Evaluation	Assessing inclusivity and feasibility	Critical reflection on social impact	Ability to evaluate solutions against inclusive goals

Another important result of this study is the explicit alignment of design thinking stages with the goals of community and special needs education. While design thinking is often applied in innovation and entrepreneurship education, its adaptation to inclusive education contexts requires careful consideration of social values and educational outcomes. In the

proposed framework, each design thinking stage is deliberately connected to community participation and special needs considerations, ensuring that learning outcomes extend beyond technical creativity.

Table 2 presents this alignment by mapping design thinking stages to community contexts, special needs considerations, and educational implications. This alignment demonstrates that inclusive technology design can function as a pedagogical bridge between technical learning and social responsibility. By situating technology design tasks within community-oriented scenarios, students are encouraged to consider the broader social consequences of their design decisions, particularly for marginalized groups.

Table 2. Alignment of design thinking with community and special needs education.

Design Thinking Stage	Community Context	Special Needs Consideration	Educational Implication
Empathy	Community participation barriers	Physical and social accessibility	Value-based inclusive learning
Problem Definition	Employment and social inclusion	Functional limitations and support needs	Context-sensitive problem framing
Ideation	Community-based solutions	Diversity of user capabilities	Collaborative and creative learning
Prototyping	Local and digital environments	Adaptability and usability	Applied inclusive design skills
Evaluation	Social impact assessment	Inclusivity and sustainability	Reflective and critical learning

The results presented in **Tables 1** and **2** indicate that the proposed framework systematically integrates inclusive education principles into the teaching of technology design. This integration addresses a key gap identified in previous studies, where technology design methodologies often overlook educational implementation and inclusive outcomes (Lopukhina & Mikhaleva, 2023). By embedding inclusive objectives into each instructional stage, the framework ensures coherence between educational goals and design activities.

From an educational perspective, the framework supports the development of competencies that are essential for inclusive employment and community participation. Students trained under this model are expected to acquire not only technical and creative skills but also social awareness, ethical sensitivity, and reflective judgment. These competencies are particularly relevant in post-industrial contexts, where professional roles increasingly require interdisciplinary thinking and social responsibility (Ilkevich, 2023).

Moreover, the framework contributes to the broader discourse on inclusive production technologies by emphasizing education as a foundational mechanism for change. Rather than treating inclusive technologies as isolated technical solutions, the results highlight the role of education in shaping future professionals who are capable of designing and implementing inclusive systems. This orientation reinforces the argument that inclusive development must be supported by pedagogical innovation alongside technological advancement (Glushchenko, 2025).

3.2. Discussion: Educational, Community, and Inclusive Implications

The results presented in the previous section demonstrate that the proposed teaching framework provides a coherent structure for integrating inclusive education principles into technology design learning. This discussion interprets these results in relation to community

and special needs education, inclusive employment, and broader social development goals. Rather than evaluating numerical outcomes, the discussion focuses on the educational significance and practical implications of the framework within post-industrial and inclusive contexts.

3.2.1. Educational implication for community and special needs education

One of the most significant contributions of the proposed framework lies in its pedagogical orientation. By embedding inclusive objectives within the stages of design thinking, the framework shifts technology design education from a product-centered approach to a learner- and community-centered process. This shift is particularly relevant for community and special needs education, where learning outcomes extend beyond technical competence to include social awareness, empathy, and ethical responsibility.

The emphasis on empathy and contextual understanding at the early stages of learning supports inclusive values and aligns with the goals of special needs education. Students are encouraged to view disability not as an individual deficit but as a socially constructed challenge shaped by environmental, technological, and organizational factors. This perspective enables learners to conceptualize inclusive technologies as tools for reducing barriers rather than merely compensating for limitations. Such an educational approach supports the development of reflective practitioners capable of addressing complex social problems through informed design decisions (Glushchenko, 2022).

Furthermore, the framework promotes active and collaborative learning, which is essential for preparing students to work in multidisciplinary and community-oriented environments. Through group-based ideation and prototyping activities, learners engage in dialogue, negotiate diverse perspectives, and collectively construct inclusive solutions. These pedagogical practices contribute to the formation of professional competencies that are increasingly demanded in post-industrial labor markets, including communication skills, adaptability, and social responsibility (Ilkevich, 2023).

3.2.2. Implications for inclusive employement and community participation

From a community perspective, the proposed framework addresses a critical gap between education and inclusive employment. As highlighted in the results, the framework explicitly connects technology design education with employment-related outcomes for persons with disabilities. By training students to consider accessibility, adaptability, and usability as core design criteria, the framework contributes to the development of technologies that expand employment opportunities and support independent participation in social production.

Inclusive employment is not only an economic issue but also a social mechanism that enhances dignity, autonomy, and community integration for persons with disabilities. The discussion of results suggests that educational interventions play a foundational role in shaping inclusive labor markets. When future professionals are trained to design technologies with inclusive employment in mind, the likelihood of developing exclusionary systems decreases. This finding reinforces the argument that inclusive production technologies must be supported by educational innovation rather than relying solely on regulatory or technical adjustments (Glushchenko, 2025).

The community-oriented nature of the framework further strengthens its relevance. By situating design challenges within real or simulated community contexts, students are encouraged to consider local needs, social relationships, and cultural factors. This approach aligns with community-based education models, which emphasize learning through

engagement with real-world social environments. As a result, inclusive technology design becomes a means of fostering social cohesion and community resilience rather than a purely technical exercise.

3.2.3. Alignment with sustainable development goals (SDGs)

The discussion of results also highlights the relevance of the proposed framework to global development agendas, particularly the Sustainable Development Goals (SDGs). Inclusive education and employment are central to several SDGs, and the proposed teaching framework contributes directly to these objectives by linking education, technology, and social inclusion.

Table 3 illustrates how the outcomes of the proposed framework align with specific SDGs, emphasizing the educational and social impact of inclusive technology design. This alignment demonstrates that pedagogical innovation can serve as a practical mechanism for advancing sustainable development at the community level.

Table 3. Contribution of the teaching framework to inclusive outcomes and SDGs.

Educational Outcome	Inclusive Impact	Community Benefit	Relevant SDGs
Development of inclusive design competence	Improved accessibility of technologies	Reduced participation barriers	SDG 10
Empathy-based learning	Recognition of diverse user needs	Strengthened social inclusion	SDG 4, SDG 10
Employment-oriented design thinking	Expansion of inclusive job opportunities	Enhanced community well-being	SDG 8
Community-contextualized learning	Socially responsive technology solutions	Sustainable local development	SDG 4, SDG 8

As shown in **Table 3**, the framework contributes most directly to SDG 4 (Quality Education) by promoting inclusive and learner-centered pedagogical practices. It also supports SDG 8 (Decent Work and Economic Growth) through its emphasis on inclusive employment and employability-oriented design. Finally, by addressing inequality in access to technology and participation, the framework aligns with SDG 10 (Reduced Inequalities). These contributions highlight the potential of educational frameworks to operationalize global development goals within localized learning and community contexts.

3.2.4. Comparison with existing technology design approaches

Compared with existing technology design methodologies, the proposed framework places greater emphasis on educational implementation and inclusive outcomes. While previous studies have focused on system integration, conceptual modeling, and technological efficiency (Evgenev, 2020; Ilia, 2025; Lopukhina & Mikhaleva, 2023), the current framework extends these approaches by embedding them within a pedagogical structure oriented toward community and special needs education.

This pedagogical extension represents a significant contribution to the literature. Rather than proposing new technical tools or systems, the framework reframes technology design as an educational process that shapes future professionals' values, competencies, and social responsibility. This orientation responds to calls for more holistic approaches to technology development that consider human, social, and ethical dimensions alongside technical performance (Ilkevich, 2023).

3.2.5. Limitations and future directions

Despite its contributions, this study has limitations that should be acknowledged. First, the framework is conceptual in nature and has not yet been empirically tested in classroom or community settings. Future research should explore its implementation in different educational contexts, including higher education, vocational training, and teacher education programs. Second, the framework focuses primarily on the design stage of inclusive technologies, leaving questions related to long-term implementation, policy integration, and institutional support for future studies.

Nevertheless, the results and discussion suggest that the proposed framework offers a valuable foundation for advancing inclusive technology education. By integrating design thinking, community orientation, and special needs education, the framework provides a pathway for aligning educational practice with inclusive development goals.

4. CONCLUSION

This study has proposed an educational framework for teaching the synthesis of inclusive technologies through design thinking within the context of community and special needs education. By integrating inclusive education principles with a human-oriented design approach, the framework positions education as a key mechanism for promoting inclusive employment, social participation, and community well-being for persons with disabilities. The results demonstrate that design thinking can function not only as an innovation methodology but also as an effective pedagogical strategy for fostering empathy, reflective learning, and inclusive design competence among students.

The framework contributes to addressing existing gaps in technology design education by explicitly aligning design processes with community needs and special needs considerations. Through structured learning stages and community-oriented perspectives, the proposed approach supports the development of professional competencies that are increasingly relevant in post-industrial societies. Furthermore, the discussion highlights the framework's contribution to broader inclusive development goals, including quality education, decent work, and reduced inequalities.

Despite its conceptual nature, this study provides a foundation for future educational practice and research. Further empirical studies are recommended to examine the implementation and effectiveness of the proposed framework across diverse educational and community settings. Overall, the findings underscore the importance of pedagogical innovation in advancing inclusive technology development and sustainable social inclusion.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

6. REFERENCES

Adesokan, A., and Bojuwoye, O. (2023). Teachers' perceived barriers to inclusive education. *ASEAN Journal of Community and Special Needs Education*, *2*(2), 91-96.

Ashurova, S.Y., Eshbekova, N.J., Dobilovich, K.U., Askaraliev, O.U., Rasulov, A.N., Sultonova, D.A., and Omonova, M.D. (2026). Scientific and theoretical model of continuous

inclusive education for equity and quality learning to support sustainable development goals (SDGs). *ASEAN Journal of Educational Research and Technology*, *5*(2), 219-228.

Evgenev, G. (2020). Open integrated semantic component design technology. *Open Semantic Technologies for Designing Intelligent Systems*, *4*, 149–152.

Faddillah, R.N., Nandiyanto, A.B.D., and Bilad, M.R. (2022) Literacy program for elementary school students about inclusive education in recognizing children with special needs. *ASEAN Journal of Community and Special Needs Education*, *1*(1), 1-8.

Glushchenko, V. V. (2022). Development of the design thinking paradigm in the context of the transition to a new technological order. *Indonesian Journal of Multidiciplinary Research*, *3*(1), 117–130.

Glushchenko, V. V. (2025). Development of inclusive production technologies and the labor market in the period of a new technological order. *International Scientific Research Journal*, *7*, 157.

Glushchenko, V.V. (2023). The use of Gestalt psychology in project work. *ASEAN Journal of Educational Research and Technology*, *2*(3), 173-178.

Glushchenko, V.V., and Inei, Y.H.A. (2024). Theoretical aspects of creating a scientific and educational platform for information and trading systems. ASEAN Journal of Educational Research and Technology, 3(2), 135-146.

Ilia, B. (2025). Parametric design and process automation in construction: Theoretical foundations and practical application of innovative digital technologies. *Universum: Technical Sciences*, *133*, 31–34.

Ilkevich, S. V. (2023). Integrative theory of the technology life cycle of the fourth industrial revolution. *Economic Sciences*, *227*, 44–54.

Khudayshukurovna, K.S., Asror, S.F., Nusrat, N.M., and Adamboy, M.K. (2024). Pedagogical and psychological factors for ensuring the sustainability of inclusive education in Uzbekistan. *ASEAN Journal of Community and Special Needs Education*, *3*(2), 115-126.

Lopukhina, V. P., and Mikhaleva, E. A. (2023). The concept of BIM technology in design, or technologies in BIM design. *The XVI Annual Scientific Session of Graduate Students and Young Scientists*, *3*, 189–191.

Musayaroh, S., Asmiati, N., Utami, Y.T., Mulia, D., Sidik, S.A., Abadi, R.F., Pratama, T.Y., Maslahah, S., and Pramudyo, A.S. (2023). A digital accessibility and inclusive design-based e-module in higher education: Does it work in a classroom with a deaf student?. *ASEAN Journal of Community and Special Needs Education*, *2*(1), 55-60.

Nurullayevna, I.S., Elyorali, B.S., and Yusubjamol, A.O. (2025). Overcoming barriers to inclusive education in new Uzbekistan: Challenges, strategies, and future directions. *ASEAN Journal of Community and Special Needs Education*, *4*(1), 63-72.

Ogai, V. V. (2021). The method of creating a human-oriented product through design thinking. *Bulletin of Young Scientists of St. Petersburg State University of Technology and Design*, *2*, 264–266.

Oktamovna, K.M., and Ruslanovna, K.T.A.M.B. (2024). Overcoming barriers and implementing best practices in inclusive higher education: Strategies for accessibility, equity, and student support. *ASEAN Journal of Community and Special Needs Education*, *3*(2), 105-114.

Yunusovna, F.U., Bakhromjon, M.S., and Akhmadali, A.U. (2024). Individualized assessment strategies for students with special needs in inclusive classrooms. *ASEAN Journal of Community and Special Needs Education*, *3*(2), 127-136.