



## REVIEW ARTICLE

# Multidisciplinary vs. Interdisciplinary vs. Transdisciplinary Approaches: Key Differences and In-Depth Analysis

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## ABSTRACT

Research is considered as the most authentic way of knowledge derivation which might be applied either in science (scientific research) or industry (industrial research) or both to solve the global issues. To achieve the optimum version of reproducible and authentic knowledge, several approaches are being applied such as interdisciplinary, multidisciplinary and transdisciplinary research approaches. Multidisciplinary and interdisciplinary research approaches are widely used techniques where the experts of different disciplines work together whereas in the Transdisciplinary research approach, an individual or team is expert of almost all disciplines and apply a holistic approach enforcing you to think outside the box. Current article is an In-Depth Analysis of all these approaches, understanding the key differences and how to apply a transdisciplinary approach for a more authentic conclusion.

**Keywords:** Research Approaches, Multidisciplinary, Cross-disciplinary, Interdisciplinary, Transdisciplinary

Doing research is a passionate career in which researchers are dedicating their lives to knowledge creation and problem-solving. Doing research requires a systematic approach to draw meaningful, reliable and reproducible conclusions with valid methodologies and authentic references. Doing research is a repetitive cascade of research activities which is generally composed of nine general steps, including research idea → literature review → methods → results → publications (research outputs) (Zhu, 2025). Past few decades have seen enormous research outputs following several research approaches with the involvement of collaboration across different fields of expertise. Among all these, three approaches are

widely used such as multidisciplinary, interdisciplinary and transdisciplinary research approaches. Although these terms are generally discussed as working together, all these approaches have distinct characteristics defining the way of collaboration (Mitchell, 2005). The current analysis is an attempt to describe and discuss these approaches in detail focusing on the practical applications and best outcomes of these approaches in solving global issues.

## In-Depth Analysis of Research Approaches

Knowledge is a valuable tool and humanity is relying on innovative and new knowledge to survive,

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evolve and develop. Recent example of applied knowledge to survive is the Covid19 knowledge which helped to design preventative strategies and to develop a vaccine to counter the spread of the disease (Tovstiga and Tovstiga, 2021). Several research approaches are applied to develop knowledge based on the type of knowledge like priori knowledge or posteriori knowledge (Tahko, 2011).

**Table 1A: Classification of Qualitative Research Methodologies**

No.	Name	Characteristic
1.	Case Study	1. Study of a specific subject 2. Variety of data collection 3. A holistic understanding
2.	Ethnography	1. Study of culture of communities 2. Data collected via close observation 3. Interpreting beliefs, social dynamics, etc
3.	Grounded Theory	1. Systematically analysis of qualitative data
4.	Phenomenology	1. Understanding a phenomenon or event by participants' experiences

**Table 1B: Classification of Quantitative Research Methodologies**

No.	Name	Characteristic
1.	Experimental	1. Used to test causal relationships 2. Manipulating the variables 3. Randomly assignment of subjects 4. Conducted in a controlled environment (e.g., a lab)
2.	Quasi-experimental	1. Testing the causal relationships 2. No-random assignment of subjects 3. Comparative analysis of the outcomes 4. Conducted in a natural environment (i.e. ecological)
3.	Correlational	1. Testing the relationship of variables 2. Influence-free measurement of variables
4.	Descriptive	1. Describing characteristics, averages, trends, etc 2. Influence-free measurement of variables

Every research approach is applied via various research methodologies to derive the knowledge and these research methodologies are divided into two main categories, qualitative research or quantitative research which are further classified into several sub-categories as explained in table 1A and 1B (Dawadi et al., 2021, Irfan-maqsood, 2024).

In **multidisciplinary research** approach, researchers from different disciplines work together in a compartmentalized model of contributions to provide discipline-specific methods, perspectives, and knowledge on a common research project. This approach lacks a unified framework of collaboration as researchers work side by side, presenting solutions in their own perspectives (Heller et al., 2008). Consider an example of a biomedical engineering project, where a team of scientists and engineers are collaborating for the development of a technological innovation. In this project, the biological scientists are focusing on the biological aspects, whereas engineers are focusing on the technical feasibility lacking a comprehensive understanding of the issue from all angles (Glasgow et al., 2018). Multidisciplinary research is a good approach for issues that require contributions from various disciplines and there is no need of integrated knowledge for reaching a conclusion. Another prominent example of multidisciplinary research is related to environmental sciences where climatologists provide data on weather patterns, environmental scientists explore the ecosystems and economists evaluate the potential economic impacts of climate change (Burroughs, 2001). Although it remains as a most popular way of collaboration among researchers, but recently, **interdisciplinary research** approach is gaining more momentum which is in contrast to multidisciplinary research, involves a higher degree of integration among the disciplines. In interdisciplinary research, researchers from various fields collaborate on an issue with the sole purpose of knowledge integration and to develop methods for a more holistic understanding of the issue (Tobi and Kampen, 2018). The key feature of interdisciplinary research which make it distinguished from multidisciplinaryity is the blending of knowledge from different fields into a cohesive framework. The example of an

interdisciplinary project could be the understanding of the impact of urbanization on public health, in which experts from different fields such as urban planning, sociology, medicine, and environmental science would not only contribute their individual insights but also work together to combine their knowledge into a comprehensive analysis and reach a more holistic conclusion acceptable for all disciplines (Krabbendam et al., 2021). Issues related to the environmental sustainability and social inequality etc are often require interdisciplinary approaches (Hariram et al., 2023).

The **transdisciplinary research approach** is an enhanced evolution of the multidisciplinary and interdisciplinary approaches where a team leader or team of experts having knowledge and understanding of almost all disciplines work together on a specific issue to think out of the box (Lawrence et al., 2022). They consider the academic community as a box and focus on real social issues via developing comprehensive knowledge of social science, policy science in addition to medical or pure science and technological development. The transdisciplinary researchers focus to engage the all stakeholders of the society such as policymakers, practitioners, and even the community members i.e. general public (Bracken et al., 2015, John et al., 2023). Transdisciplinary researchers are aimed to generate the knowledge that focus on addressing the real-world problems in a comprehensive and practical manner.

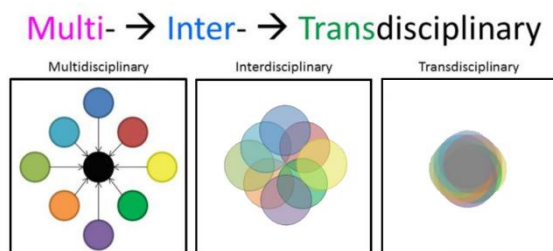
Transdisciplinary research approaches often develop new theories, SOPs, models, or methodologies that are directly beneficial for the society (del Cerro Santamaría, 2015). The examples of the issues where transdisciplinary research approaches are applied include but not limited to climate change, global health crises, or social justice etc. For example, in case of global health crises, transdisciplinary teams composed of researchers with major in medicine, public health, economics, law, and community development etc work together to develop scientifically strong and socially applicable models or solutions. Transdisciplinary research approach is also

known as the approach of co-creation of knowledge which is not achievable without strong integration of all related disciplines as this approach deals with the real-world issues and develops technologies and models that are directly applicable in the society instead of just remaining pieces of knowledge in the research papers (Jacobi et al., 2022).

### **Holistic Approach and Transdisciplinarity**

In the modern era, we are facing more complex and interconnected global issues as compared to the past decades such as climate change, social inequality, and health crises etc. The researchers around the world have failed or been less successful to present the solution as they followed old fashioned, traditional and siloed research approaches. These complex global issues are in need of holistic approach signifying the value of an emerging area of research, Transdisciplinarity (Bunders et al., 2015).

In holistic approaches, the society is considered as a whole system in the research project instead of focusing just one sided solution of each social issue. The system here, could be a social, ecological, or technological system and it is divided into components where inter-relations of each component are studied in multiple perspectives before finalizing the project. As holistic approach is the base of transdisciplinarity, a concept of co-creation is followed strictly while focusing on the collaboration across disciplines e.g., natural sciences, social sciences, humanities and involvement of non-academic contributors such as policymakers, local communities and industry experts. For example, when addressing issues like public health, transdisciplinary teams might include medical professionals, social workers, policymakers and community members, each contributing their unique insights to develop comprehensive solutions (Somerville and Rapport, 2002, Leavy, 2016). A pictorial presentation of similarities and key differences of multidisciplinary, interdisciplinary and transdisciplinary research approaches are given in figure 2



*Figure 2: Pictorial presentation of multidisciplinary, interdisciplinary and transdisciplinary research approaches.*

### Perspective of Transdisciplinary Research

Working together and understanding the need of global collaboration for the social and global issues have gained a momentum in the past few years especially due to the Covid19 pandemics when almost whole world worked together to develop the knowledge about covid19 diseases, prevention strategies and vaccine development. The perspective of transdisciplinary research is intertwined in the idea of co-creation and co-development (Khorram-Manesh et al., 2024). It should be believed that complex, real-world problems cannot be understood or solved by any single discipline alone as academics should work with the societal members and policymakers for more applicable solutions. A key feature of transdisciplinary research is the commitment of working together for a multidimensional and practicable knowledge (Lang et al., 2012). For example, when addressing urban poverty, a team leader or team members following transdisciplinary research approach should have the knowledge of social structures contributing inequality, knowledge of sustainable housing, involvement of local residents sharing their individual experiences and understanding of the financial implications of poverty (Black et al., 2019).

Similarly, in the case of global health crises such as pandemic or epidemic, a transdisciplinary research team, should have medical researchers, government officials, community leaders and the general public, all working together to develop culturally appropriate and practically feasible knowledge to stop spreading the disease and to

develop a safe treatment. The transdisciplinary perspective is about recognizing the inter-connectedness of all fields and embracing diverse sources of knowledge and experience to create comprehensive and sustainable solutions to societal challenges (Mitchell and Moore, 2015).

### Conclusion

Research approaches define the way of knowledge derivation and reliability of a knowledge depends upon the type of research approach being applied to derive the knowledge. Scientists are applying several approaches based on the applicability of the knowledge from an intra-disciplinary research approach to the transdisciplinary research approach. Several other research approaches such as cross-disciplinary, multidisciplinary and interdisciplinary research approaches are also being applied with limited to a broader holistic approach. Multidisciplinary research approaches have developed technologies to solve the human issues but many technologies remain useless in spite of the investment of billions of dollars which led to the development of more holistic approach and forced scientists to think out of the box. Interdisciplinary research approaches is a more holistic approach which has produced more applicable results whereas a transdisciplinary research approach is considered a research approach with full holistic perspective to solve the social and real-world issues. Scientists are developing models to cope with challenges such as global health crises and by understanding the key differences between these approaches, more effective and innovative collaboration may result to address the global issues humanity is facing today.

### Conflict of Interest

Author of this paper declare that there is no conflict of interest with anyone or any organization regarding this review paper.

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