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INTERDISCIPLINARY AND TRANSDISCIPLINARY APPROACHES FOR FUTURE SKILLS AND CURRICULUM TRANSFORMATION IN THE 21ST CENTURY

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ABSTRACT
John Dewey (1929) observed that separation from other fields was one of the primary difficulties in making education a science. Therefore, fundamental reform of the traditional single-discipline education system is necessary to integrate knowledge. As a result, special importance is currently placed on interdisciplinary and transdisciplinary approaches in education. The study aims to understand interdisciplinary and transdisciplinary approaches, their differences, and future skills for curriculum transformation. The researcher adopted the thematic analysis technique for this study. Data were collected from various secondary sources, such as journal articles, e-content, web resources, and blogs. The study reveals the understanding of interdisciplinary and transdisciplinary approaches, how they function, and the differences between them. This study also shows that some future skills are required to manage these modern approaches, such as critical thinking. creativity, collaboration, adaptability, and systems thinking. This study identified strategies for curriculum transformation through interdisciplinary and transdisciplinary approaches, such as project-based learning, curriculum redesign, stakeholder collaboration, and teacher training.

KEYWORDS: *Interdisciplinary And Transdisciplinary Approaches, Future Skills, Curriculum Transformation*

INTRODUCTION
Today, the world is called a 'Global Village' (McLuhan, 1964). In the current era of globalization, boundaries in the field of knowledge are no longer appropriate. According to the National Knowledge Commission (2005), the dissemination of knowledge among the people will be universal, inclusive, and accessible. Therefore, there should be no boundaries in the field of education. Contemporary fields of study have emerged to meet the demands of a transforming world, rendering the conventional disciplinary approach obsolete (Turna et al., 2012).

The current era has been described as the 'Knowledge Explosion Era'; thus, the need to organize knowledge from a holistic, inclusive, and multi-level perspective for all levels of society has come to the fore (Santos, 2014). Therefore, fundamental reform of the traditional single-discipline education system is necessary to integrate knowledge. The limited perspective on a single discipline that was prevalent in education and research in the past decades is gradually being replaced by an interdisciplinary, transdisciplinary, and multidisciplinary approach.

The multidisciplinary approach analyzes problems by applying multiple disciplines in parallel, but does not develop deep connections among them. The interdisciplinary approach creates new insights by analyzing problems by combining concepts and methods from different disciplines. Transdisciplinary methods cross subject boundaries, combining academic knowledge and real-life experiences to create a new, relevant knowledge structure (Choi & Pak, 2006; Lang et al., 2012).

RATIONALE OF THE STUDY
Nowadays, education and knowledge are no longer confined to boundaries. NPE 2020 also emphasizes interdisciplinary and transdisciplinary approaches in education. But now the question is how these new approaches can be applied in the education sector. What will be the future skills for this? What will the curriculum transition strategies be? This study will help answer the questions above.

OBJECTIVES OR AIMS OF THE PAPER
The objectives of the study are as follows:
i. To know about the interdisciplinary approach
ii. To know about the transdisciplinary approach
iii. To know the differences between interdisciplinary and transdisciplinary approaches.
iv. To explore the future skills of the interdisciplinary and transdisciplinary approach.
v. To explore the strategies of the interdisciplinary and transdisciplinary approachto curriculum transformation?

RESEARCH QUESTIONS
To achieve the stated objectives, the researcher formed the following research questions-
I. How is the Interdisciplinary approach defined and perceived in educational contexts?
II. How is the Transdisciplinary approach defined and perceived in educational contexts?

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III. What are the differences between interdisciplinary and transdisciplinary approaches?
IV. What are the future skills of the interdisciplinary and transdisciplinary approach?
V. What are the strategies of the interdisciplinary and transdisciplinary approach for curriculum transformation?

SCOPE AND SIGNIFICANCE

Interdisciplinary and transdisciplinary approaches lie in their ability to transform education from a content-focused model to a skill- and solution-focused model, aligning learning with the real world. The scope and significance of this paper are mentioned below.

I. This paper will help to develop an understanding of interdisciplinary and transdisciplinary approaches.
II. This paper highlights the differences between the two approaches.
III. This paper is significant in shaping the understanding of how these approaches can be applied in current learning environments.
IV. This paper sheds light on the skills required to apply these approaches.
V. This paper highlights the strategies of curriculum transformation.

EXPLANATION OF KEY TERMS AND CONCEPTS:

❖ Interdisciplinary Approach

An interdisciplinary approach enables students to gather knowledge and skills from various disciplines to address a particular problem from multiple perspectives (Ashby & Exter, 2019). It is the most effective way to explain, analyze, or solve a topic, phenomenon, or problem using methods from different disciplines. The Interdisciplinary approach combines ideas, theories, or methods from multiple disciplines to solve or analyze a specific problem. Example: Geography, economics, and environmental science work together to analyze a climate change problem.

❖ Transdisciplinary Approach

A transdisciplinary approach is a method that enables us to gather information from various disciplines, non-academic fields, and real-world knowledge to solve a problem. It brings together information and views from diverse sectors to address complex, real-world problems, building a comprehensive understanding and encouraging innovative solutions. A transdisciplinary approach not only connects multiple subjects but also creates a new perspective in which academic and real-world knowledge come together. Nicolescu (2006), a founder of the UNESCO Study Group on Transdisciplinary, explains the transdisciplinary approach and notes that the term "transdisciplinary" was first used by 1970s France. Example: Working together, the experiences of doctors, sociologists, economists, and local people can help solve a health-related problem.

❖ Future Skills and Curriculum Transformation:

The world today faces rapidly changing technologies, innovations, and multidimensional problems. To adapt to these 21st-century changes, the education system must emphasize future skills such as critical thinking, creativity, problem-solving, digital literacy, AI application, collaboration, and development.

These skills are also particularly important in curriculum transformation. Curriculum transformation through interdisciplinary and transdisciplinary approaches requires problem-based learning, collaborative projects, the integration of soft and hard skills, and an application-oriented focus.

Related Theories or Models

❖ Repko's Model for Interdisciplinary Research

Repko (2008, 2012) presented a step-by-step, reasonable paradigm for multidisciplinary integration. The steps of integration are mentioned below.

I. Define the problem or issue.
II. Determine the appropriate disciplines.
III. Analyse findings from many fields.
IV. Identify tensions between insights.
V. Create common ground.
VI. Integrate and generate new understanding.

This model is commonly utilized in education and research where disciplinary insights need to be integrated rather than juxtaposed.

❖ Nicolescu's Theory of Transdisciplinary:

Based on the logic of the included middle and the concept of a unified reality, Nicolescu (2002) contends that transdisciplinary is a higher level of knowledge production in which the boundaries between disciplines, as well as between science and society, collapse. The goal of this theory is to Produce Integrative, participatory knowledge for real-world transformation.

❖ Fogarty's 10 Models of Curriculum Integration:

Fogarty (1991) provides practical models for integrating disciplines in K–12 education, ranging from simple(discipline-based) to complex. He gives an idea of a cognitive and holistic learning approach. This model is useful for integrating the primary and secondary school curricula. He gives 10 models of curriculum integration. These are:

1. **Fragmented Model**: Each subject is taught in complete isolation, as traditionally done. There is no intentional connection between disciplines.
2. **Connected Model**: Teachers make connections within a single discipline. For example, linking algebra and geometry within mathematics to show relationships.
3. **Nested Model**: Multiple learning objectives (like thinking skills or writing) are embedded within a single subject lesson. For example, incorporating critical thinking into a science class.
4. **Sequenced Model**: Teachers coordinate content across subjects so that related topics are taught in a logical order. For instance, teaching ancient civilizations in history while reading historical fiction in language arts.
5. **Shared Model**: Two disciplines with overlapping concepts are planned and taught together. For example, a combined unit on measurement in both math and science.

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6. **Webbed Model**: A central theme (like "change" or "water") is used to connect multiple subjects, especially effective in elementary education.
7. **Threaded Model**: Skills such as problem-solving, writing, or ethical reasoning are "threaded" across different disciplines consistently throughout the curriculum.
8. **Integrated Model**: Several disciplines are combined into a single unit or project. The subject boundaries are blended to create a holistic learning experience.
9. **Immersed Model**: The learner focuses deeply on one area of interest and uses that lens to draw knowledge from various disciplines.
10. **Networked Model**: The learner independently creates connections between subjects and life experiences, developing a personalized, integrated understanding.

These models range from discipline-specific to fully integrated and learner-centred, offering multiple pathways to connect knowledge across subjects.

REVIEW OF RELATED LITERATURE

Suchitra, M. et al. (2024) conducted a study on the present problem. The purpose of this study is to provide a theoretical foundation and practical insights into how transdisciplinary methods contribute to improvements in learning outcomes and how they can influence curriculum development and educational innovation in higher education. The paper revel that that transdisciplinary approaches are crucial for transforming higher education. They not only improve individual learning outcomes but also prepare students to tackle complex global challenges, contributing to sustainable societal development.

Liu, X., & Wang, L. (2019). Conducted a study related to the present problem. This paper aims to introduce the Disciplinary and Interdisciplinary Science Education Research (DISER). The researcher used conceptual synthesis based on a review of literature, policy documents, and curriculum trends. The study shows that interdisciplinary integration can solve difficult problems more effectively. The study also distinguishes among the terms disciplinary, interdisciplinary, multidisciplinary, and transdisciplinary approaches of research.

Budwig, N., & Alexander, A. J. (2020). Conducted a study related to the present problem. The paper explores how a transdisciplinary approach—integrating insights from learning sciences, developmental sciences, and higher education frameworks—can enhance student learning and development in universities. The researchers synthesized existing literature and made a conceptual framework. The study reveals that transforming student learning in universities requires a transdisciplinary, systems-based approach that bridges theory, policy, and practice, centred on developing student agency, identity, and deep learning.

Ertas, A. et al. (2003) conducted a study related to the present problem. The paper examines how transdisciplinary education and curriculum integration support students' search for meaning, identity formation, and a sense of belonging or community—particularly in the context of youth development. The researcher used a conceptual synthesis for this study. This paper shows that the transdisciplinary approach supports holistic, collaborative, and student-centered learning, with a focus on real-world relevance and social responsibility.

METHODOLOGY

In this study, data and information were collected from various secondary sources, such as journal articles, e-content, web resources, and blogs. The researcher used a thematic analysis technique for this study.

ANALYSIS AND INTERPRETATIONS:

Through careful investigation of the research questions, several observations, facts, and pieces of information were identified. The obtained observations, facts, and information answer the research questions as follows.

Research Question: 1. How is the Interdisciplinary approach defined and perceived in educational contexts?

If we code the information obtained by reviewing various research papers, we can see that the words associated with the interdisciplinary approach are:**'crossing disciplinary boundaries', 'collaborative approach', 'multiple perspectives of problem solving.'**

By categorizing the above codes, the interdisciplinary approach can be defined as combining various disciplinary views, methods, and knowledge to solve a particular problem. Repko (2012) also said about merging disciplinary insights to address complex problems.

Research Question: 2. How is the Transdisciplinary approach defined and perceived in educational contexts?

By coding the obtained data, we can see that the words associated with the Transdisciplinary approach are: **'beyond disciplines', 'real-world issues', and 'community involvement.'**

By categorizing the above codes, the transdisciplinary approach can be named using the following themes: **Transdisciplinary approach** –Transdisciplinary approaches bridge subject borders, merging academic knowledge with real-life experiences to generate knowledge or solve problems. Bernstein (2015) also supports this, saying that knowledge is co-created across academic and non-academic stakeholders.

Research Question: 3. What are the differences between interdisciplinary and transdisciplinary approaches?

The researcher codes the information obtained by reviewing various research papers. We can see that the words associated with the interdisciplinary approach vs. transdisciplinary approaches are: **'academic vs. societal focus', 'across disciplines vs. beyond disciplines', and 'integration vs. unification.'**

By categorizing the above codes, the *differences between interdisciplinary and transdisciplinary approaches* can be explained by using the following themes:

Interdisciplinary vs. Transdisciplinary approaches

The interdisciplinary approach is limited in disciplinary areas; on the other hand, the transdisciplinary approach emphasizes

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both disciplines and real-world experience, and community involvement.

The interdisciplinary approach integrates knowledge and methods to solve complex problems, whereas the transdisciplinary approach emphasizes integrating knowledge and fostering a unified, harmonious development.

Research Question: 4. What are the future skills of the interdisciplinary and transdisciplinary approach?
In this modern approach to education, we need some skills for knowledge generation and transformation. By reviewing various papers, the researcher finds some future skills of the interdisciplinary and transdisciplinary approaches, these are: **'critical thinking', 'Developing creativity', 'adaptability', 'collaboration', and 'systems thinking.'**

By categorizing the above codes, the future skills of the interdisciplinary and transdisciplinary approaches are described as follows:
Critical Thinking: Interdisciplinary learning requires students to examine a problem through the lens of multiple disciplines (e.g., science + history). Critical thinking helps them evaluate conflicting viewpoints, challenge assumptions, and synthesize evidence across subject areas. Transdisciplinary learning involves addressing real-world problems by combining academic knowledge with societal experience. Critical thinking is crucial for questioning the root causes of complex issues (such as poverty or climate change) and for assessing solutions proposed by various stakeholders.

Developing Creativity: Creativity enables students to connect ideas from different subjects in innovative ways, such as using math to design an art installation or applying biology concepts in a literature project. In transdisciplinary settings, students often co-create knowledge with people outside academia (e.g., farmers, engineers, artists). Creativity allows them to design novel, inclusive solutions that go beyond textbook answers.

Adaptability: Interdisciplinary work often involves shifting between methods and mindsets (e.g., qualitative to quantitative reasoning). Adaptability allows students to switch perspectives and stay open to new ideas. transdisciplinary issues evolve in real time (e.g., global pandemics, energy crises), and learners must be flexible to respond to new data, community needs, or ethical concerns.

Collaboration: Interdisciplinary teams rely on collaboration between experts and students from different disciplines. Success depends on listening, dialogue, and shared problem-solving.
Transdisciplinary projects require collaboration not only within disciplines but also with the public, policy-makers, and practitioners. Effective communication and teamwork are essential for meaningful community engagement.

Systems Thinking: Systems thinking helps students understand how different subjects connect (e.g., how economics influences environmental science) and why solutions must be sustainable and holistic. Transdisciplinary approaches require a systems mindset to understand the root causes, feedback loops, and long-term consequences of complex problems such as climate change, food security, and educational inequality.

Research Question: 5. What are the strategies of the interdisciplinary and transdisciplinary approach for curriculum transformation?
By reviewing various papers, the researcher finds some strategies of the interdisciplinary and transdisciplinary approaches for curriculum transformation, these are: **'project-based learning', 'curriculum redesign', 'stakeholder collaboration', and 'teacher training.'**

Through categorizing the above codes, the strategies of the interdisciplinary and transdisciplinary approaches for curriculum transformation are described as follows:
Project-Based Learning: PBL is a central strategy in both interdisciplinary and transdisciplinary education, promoting active, inquiry-based learning**.** It allows students to investigate complex questions or real-world problems by integrating knowledge from multiple disciplines **(**interdisciplinary**)** and engaging with authentic societal issues alongside external stakeholders **(**transdisciplinary**).**

Curriculum Redesign: Curriculum transformation through redesign involves moving away from isolated subject silos toward thematic, problem-centered frameworks. Interdisciplinary redesign connects subject areas around big ideas (e.g., sustainability). In contrast, transdisciplinary redesign builds the curriculum around real-life concerns that transcend academic boundaries**,** such as climate justice or digital wellbeing. The result is a flexible, integrated, and learner-centered curriculum**.**

Stakeholder Collaboration: Collaboration is key to both approaches. Interdisciplinary collaboration typically occurs among educators and subject experts who co-design or co-teach content. Transdisciplinary collaboration goes further, involving community members, industries, policy-makers, and learners themselves in the knowledge-creation process. Together, they shape learning that is co-owned and socially impactful**.**

Teacher Training: Effective implementation of both approaches demands ongoing professional development**.** Teachers must learn to collaborate across subjects (interdisciplinary) and act as facilitators of real-world inquiry and community engagement (transdisciplinary). Training should emphasize integrative curriculum design, reflective practice, systems thinking, and partnership-building.

IMPLICATIONS OF THE STUDY

In modern education, the main objective is to spread knowledge through analysis and synthesis, without limiting it to disciplinary boundaries. John Dewey (1929) observed that separation from other fields was one of the primary difficulties in making education a science. Therefore, special importance is currently placed on interdisciplinary and transdisciplinary approaches in education. This study has provided an understanding of what interdisciplinary and transdisciplinary

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approaches are, how they function, and the differences between them. This study also shows that some future skills are required to manage these modern approaches, such as critical thinking. creativity, collaboration, adaptability, and systems thinking. This study identified strategies for curriculum transformation through interdisciplinary and transdisciplinary approaches, such as project-based learning, curriculum redesign, stakeholder collaboration, and teacher training.

CONCLUSION

In education, the expansion of knowledge and the solution of problems are possible through the integration of knowledge, skills, and methods from different disciplines. Likewise, knowledge can be connected to the real world through stakeholder engagement, non-academics, and community involvement. Interdisciplinary and transdisciplinary approaches help solve problems by applying multidisciplinary methods that cross disciplinary boundaries and connect knowledge to the real world. In the present era, knowledge integration is very necessary. From this study, we learned that interdisciplinary and transdisciplinary approaches are needed in the current education sector, which skills are required to apply these approaches, and which strategies are needed for curriculum transfer in this context. However, in the current situation, more extensive research is needed on how these approaches can move the field of learning towards knowledge integration.

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