RUBRICS

PERCEPTION & REALITY

multi-disciplinary education

Dr. J. Raja Murugadoss & Dr. R. Priya Vaijayanthi

This book seeks to offer a comprehensive insight into the multidisciplinary educational approach rooted in a profound passion for and mastery of knowledge in the field of outcome-based education. It is published with a personal commitment to disseminate the genuine essence of outcome-based education via rubricsedu.com. While there is an abundance of articles, research literature, and various forms of information available on the topic of multi-disciplinary educational frameworks, this work endeavors to shed light on the subject by providing a few classical examples. Gratitude is extended to a higher power for this opportunity and also we would like to acknowledge the support being provided by the Management of NSRIT.

Dr. J. Raja Murugadoss | Dr. R. Priya Vaijayanthi
Director (NSRIT) | Dean (IQAC)
Nadimpalli Satyanarayana Raju Institute of Technology (NSRIT)
An autonomous institution affiliated to JNTU -GV, Visakhapatnam,
Andhra Pradesh.

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PART ONE

Challenges in Curriculum Design & Inclusion of Skill Oriented Courses for demanding skill set

In recent years, there has been a growing global emphasis on the importance of a multi-disciplinary education curriculum design, not limited to India alone. This trend can be attributed to several factors. One notable reason is the profound transformation within the computing industry, driven by rapid technological advancements, particularly the widespread adoption of buzzword technologies like Artificial Intelligence, Internet of Things (IoT), Data Science in almost all programs of study. Another contributing factor is the evolving expectations of the industry, which now demand a more diverse skill set from graduates, in addition to their specialized domain knowledge. This shift underscores the necessity to move from an accreditation system based solely on academic output to one focused on outcomes (Outcome-Based Accreditation or OBE). In this context, the industry places greater emphasis on skills and competencies rather than mere academic credentials. This reflects the current landscape, leaving a host of unanswered questions that require further exploration.

PART ONE

Challenges in Curriculum Design & Inclusion of Skill Oriented Courses for demanding skill set

- Does our curriculum predominantly hew towards theoretical paradigms, or does it judiciously amalgamate both theoretical constructs and pragmatic competencies?

- How do we ascertain the curation of courses within our curriculum? Is there a methodical process in place, potentially integrating insights from industry luminaries?

- If our curriculum features courses designed to foster practical skills, what fraction of the total structure does this segment comprise?

- Do we place a substantial emphasis on experiential learning, underscored by a robust commitment to practical application? If so, how are practical components graded? Is commensurate weightage allocated, and what methodologies underpin our assessment and evaluation?

- Do we enlist Subject Matter Experts (SMEs) to cultivate the practical aptitude of our graduates? Are these SMEs duly qualified for this task? If not, is perpetual recruitment a viable solution, or does it risk engendering an inflation in the overall curriculum expenditure?

PART ONE

Challenges in Curriculum Design & Inclusion of Skill Oriented Courses for demanding skill set

- Does enabling learners to acquire certifications from diverse platforms, whether they entail 45 hours, 30 hours, or 15 hours of study, efficaciously propel them toward the attainment of a substantive cognitive threshold? Should these outcomes prove favorable, what is the requisite duration for institutional endorsement, and does it evolve into an enduring, ceaseless endeavour? If the continuity is upheld, has an ecosystem conducive to self-directed learning been instated, or do we persist in an instructional framework that remains firmly guided?

- Advancing one step further, does the pursuit of certifications in an unrelated domain by a learner culminate in the nurturance of exceptional skills within the institution, or does it engender only a cursory and superficial acquaintance with the subject matter?

- Overall, it is a matter of concern and needs consideration to a greater extent for an effective curriculum design

PART TWO

Reassessing Multidisciplinary Education and Outcome-Based Learning: A Critical Analysis

Introduction

This book delves into the concept of multidisciplinary education within the framework of outcome-based education (OBE) and seeks to address critical concerns regarding the alignment of courses with OBE learning outcomes (LO). The book also examines the implications of internships and project-based learning on multidisciplinary education. The central question that arises pertains to whether we are effectively nurturing the skills and qualities expected in the context of outcome-based education. Furthermore, it questions the adequacy of our understanding of OBE and whether this framework extends beyond academics.

Mapping Multidisciplinary Courses

In most educational curricula, courses offered by other programs are often designated as multidisciplinary and mapped to the LO of OBE. This practice raises significant concerns about our approach to understanding OBE and the accuracy of the mapping process. While educational programs may claim that graduates have achieved target performance levels,

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Reassessing Multidisciplinary Education and Outcome-Based Learning: A Critical Analysis

the book underscores the critical need to evaluate whether the expected qualities and skill sets are genuinely being cultivated.

Impact of Internships and Project-Based Learning

In certain curriculum frameworks, experiential learning through internships is also mapped to LO, but often, this entails students working in isolation from their peers in other programs. This scenario raises questions about the effectiveness of multidisciplinary education in practice. Furthermore, the report highlights instances where students address LO within program-specific courses, which can lead to a blurry understanding of multidisciplinary settings.

Conclusion

This book underscores the urgency of revisiting our approach to multidisciplinary education. necessitating a critical reassessment of the mapping, the cultivation of desired skills while understanding of OBE. Ultimately, it emphasizes that it should extend beyond the confines of academia and necessitates a comprehensive approach to prepare students for the multifaceted challenges.

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PART THREE

Multidisciplinary Education: Shaping Holistic Learners for solving Complex Engineering Problems

Introduction

In today's ever-evolving and interconnected world, the need for multidisciplinary education has become paramount. This book aims to explore the intricacies and key components of a comprehensive multidisciplinary educational approach. By delving into this subject, we hope to shed light on the principles that underpin this innovative approach, which empowers students to tackle complex real-world challenges. Our focus is on engineering education, where multidisciplinarity is of paramount importance, but the principles can be applied to various fields.

Crafting a Multidisciplinary Curriculum

The curriculum should be a crucible of knowledge, designed to immerse students in a genuine multidisciplinary environment. Here, we discuss the importance of fostering collaborative interactions among students from various academic programs. We emphasize the need to challenge students with intricate engineering problems that align with the core principles outlined in the Washington Accord, an international agreement signed by member countries.

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Multidisciplinary Education: Shaping Holistic Learners for solving Complex Engineering Problems

The Elements of a Multidisciplinary Ecosystem

This chapter examines the essential components that form a multidisciplinary ecosystem. We delve into the critical elements of:

- Courses that empower students to address interdisciplinary challenges where domain-specific knowledge may prove insufficient to tackle complex tasks

- Adequate institutional infrastructure, including state-of-the-art laboratories equipped with the necessary components. These facilities enable students to identify problems, conduct comprehensive literature reviews, formulate problems with mathematical precision, develop models, conduct testing, and ultimately transition their laboratory-based innovations into real-world applications. Such laboratories essentially function as centers for product development within a multidisciplinary context.

- An environment that mirrors real-world working conditions, offering a platform for authentic multidisciplinary education.

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Multidisciplinary Education: Shaping Holistic Learners for solving Complex Engineering Problems

Instructors must possess a deep comprehension of the intended learning outcomes and key performance indicators required for assessing and evaluating students effectively. Both instructors and students must grasp the true essence of a "complex engineering problem." It extends beyond the realm of textbook examples and is characterized by:

- A reliance on profound engineering knowledge for resolution
- The consideration of multiple interacting variables encompassing technical, economic, social, environmental, ethical, and other aspects
- Involvement in intricate, interrelated technical and engineering issues
- The ability to devise abstract, original solutions and formulate suitable models
- Encounters with rarely experienced issues
- The navigation of challenges beyond established professional engineering standards and codes of practice
- Engagement with diverse stakeholder groups, each with distinct and varied needs
- Addressing high-level problems involving numerous component parts or sub-problems

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Multidisciplinary Education: Shaping Holistic Learners for solving Complex Engineering Problems

Preparing Graduates for a Multidisciplinary World

In this final chapter, we discuss the fundamental objective of this approach: preparing graduates to confidently embrace a multidisciplinary perspective in both their academic journeys and professional careers. We highlight the significance of equipping graduates with the skills and knowledge necessary to thrive in a rapidly changing, interconnected world.
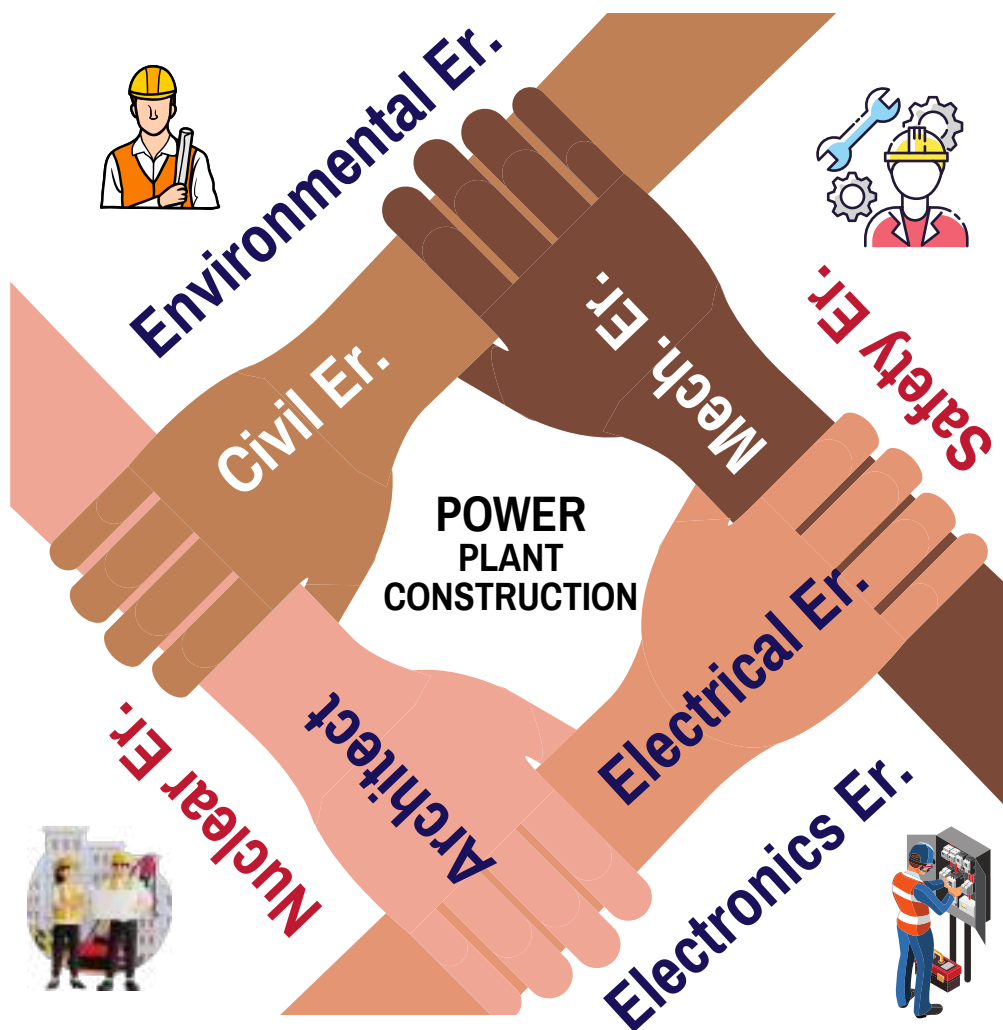
Conclusion

This book offers a comprehensive exploration of multidisciplinary education and its significance in today's educational landscape. By understanding and implementing the principles discussed in this book, educational institutions can better prepare their students for the multifaceted challenges of the modern world, fostering holistic, adaptable learners who are equipped to thrive in diverse professional contexts through a contented curriculum addressing the true fragrance of multi-disciplinary education mimicking the real time working environment.

PART THREE

Multidisciplinary Education: Shaping Holistic Learners for solving Complex Engineering Problems

A typical multi-disciplinary setting

Environmental Er.

Civil Er.

Mech. Er.

Safety Er.

POWER
PLANT
CONSTRUCTION

Electrical Er.

Nuclear Er.

Architect

Electronics Er.

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PART FOUR

Seamless shift in educational curriculum towards a multi-disciplinary approach (Part Four)

In recent years, there has been a remarkable surge in the awareness and adoption of the National Education Policy 2020 within Higher Education Institutions (HEIs) that have traditionally offered single-phased education. Many educational institutions have taken significant steps to instill the fundamental values and principles of NEP 2020 within the constraints of their available resources. This noteworthy effort deserves high commendation, with special acknowledgment extended to the Ministry of Education in India and other regulatory bodies, for their consistent and robust support, as well as their celebration of the achievements resulting from this transformative shift in educational policy.

However, an intriguing development is occurring within the curriculum that is often overlooked. It's a subtle transformation towards a multi-disciplinary educational framework. A key point to emphasize is that this transformation is taking place without a full grasp of the profound impact it will have on learners, as they gradually evolve into multi-disciplinary graduates. This shift also applies to educators and instructors. What's more, in my understanding, today's industries no longer seek graduates with a sole focus on core domain knowledge; they also require proficiency in the latest trending technologies and additional skill sets, often referred to as 'buzzword technologies' in the ever-evolving job landscape.

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Seamless shift in educational curriculum towards a multi-disciplinary approach

Consequently, the role of a Civil Engineer, for instance, is no longer confined to a single, isolated discipline. Instead, they must collaborate with fellow engineers possessing diverse skills and expertise. Unfortunately, this realization is often lacking during the educational journey. As a consequence, biases and discrimination emerge among different program branches, leading to the perception that one program is more popular or superior to others. However, this perception does not align with the actual demands of the modern job market, which no longer favours a limited set of traditional programs.

It is a matter of concern to observe that institutions must now pivot and place equal emphasis on allowing learners to explore a wide range of disciplines and skill sets. In doing so, they can embrace a national philosophy of a 'ONE DEGREE' supplemented with multiple skill sets. To put it succinctly, institutions must acknowledge that we are undergoing a transformation, sometimes without full awareness, and entering into a multi-disciplinary setting. They must educate learners that all programs are of equal value.

Presently, Higher Education Institutions (HEIs) are confronted with a significant challenge: the redesign of their educational curricula to meet the demands of a multi-disciplinary educational environment.

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Seamless shift in educational curriculum towards a multi-disciplinary approach

This entails the creation of suitable facilities, such as laboratories, that seamlessly integrate core domain knowledge with emerging fields like artificial intelligence, data science, IoT, cyber security, information security, robotics, industrial automation, and software development and testing. This integration is essential to cultivate the genuine essence of multi-disciplinary settings.

However, a major obstacle lies in ensuring that human intellects are adequately equipped with knowledge of these technologies, regardless of their chosen academic program. Without this broad-based training, the initiative may falter at a crucial juncture. Ultimately, one of the most critical aspects is the establishment of key performance indicators (KPIs) that can effectively evaluate the role of an individual and their contributions within a multi-disciplinary context. Furthermore, assessing personal qualities, such as character traits, becomes increasingly vital in this complex educational landscape.

Major Challenges ahead in nutshell

he central challenge in implementing a multi-disciplinary educational model resides in the skillful integration and harmonious coordination of a diverse array of academic disciplines and knowledge domains. This formidable task is complicated by several intricate hurdles. Foremost among these is the need to harmonize a wide variety of curricula.

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Seamless shift in educational curriculum towards a multi-disciplinary approach

Crafting a curriculum that seamlessly interlaces content from numerous fields while preserving the integrity of each discipline is an exceptionally complex endeavor. It calls for a collaborative effort among faculty to ensure that the subject matter aligns with the overarching goals of the educational program.

Additionally, encouraging collaboration among educators with distinct academic backgrounds poses a formidable challenge. This endeavor demands the establishment of a shared understanding, a common language, and a unified pedagogical approach that spans across the full spectrum of disciplines. Resource allocation, a critical aspect, becomes more intricate within the context of a multi-disciplinary program. It entails allocating funding for faculty development, creating new courses, and supporting interdisciplinary research projects.

Another pivotal concern revolves around student assessment. Determining suitable methods for assessing learning across these diverse disciplines can be complex, given that traditional assessment tools may not adequately capture the comprehensive skills and knowledge nurtured within a multi-disciplinary context. Resistance to change, whether originating from faculty, students, or institutions, presents a substantial obstacle. Departing from traditional disciplinary structures in favor of embracing multi-disciplinarity can impede progress.

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Seamless shift in educational curriculum towards a multi-disciplinary approach

Preserving the quality of education while transitioning to a multi-disciplinary model stands as a fundamental priority, necessitating the establishment of stringent quality assurance mechanisms. Achieving recognition and accreditation for multi-disciplinary programs can involve bureaucratic challenges, as academic institutions and accrediting bodies may lack established frameworks for evaluating these innovative models. Engaging various stakeholders to convey the value and advantages of multi-disciplinary education, including employers, alumni, and the broader community, is an arduous task.

Equally essential is ensuring equitable access to specialized equipment and facilities, which certain disciplines may require. Managing the continually evolving landscape of knowledge, characterized by ongoing expansion and technological advancements across diverse fields, presents a demanding undertaking. Successfully addressing these multifaceted challenges demands unwavering dedication from educational institutions, faculty, students, and stakeholders. It hinges on the ability to adapt and innovate in the domains of teaching, curriculum development, and program management, thereby facilitating the emergence of a robust and dynamic multi-disciplinary education model.

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PART FIVE

Pre-requisites and Approaches to assess & evaluate

This chapter centers on the prerequisites essential to lay the groundwork for the successful execution of a multi-disciplinary education approach prior to its implementation.

- Effortless curriculum integration through the creation of Subject Matter Experts (SMEs) dedicated to achieving the desired learning outcomes
- Fostering a transformation-oriented mindset among stakeholders
- Enhancing faculty capabilities
- Identifying and allocating appropriate resources
- Promoting faculty integration and collaboration
- Bolstering infrastructure resources
- Implementing Standard Operating Procedures (SOP) to gauge and enhance Student Learning Outcomes (SLO)
- Cultivating awareness of the forthcoming job landscape over the next five years

Crucially, when developing a multi-disciplinary education program, it's essential to consider the following components that course designers should keep in mind during content creation. A multi-disciplinary educational approach goes beyond simply acquiring knowledge from different fields; it also involves the acquisition of various skill sets. IIn the curriculum, offering cross-disciplinary knowledge through just one or two courses labeled as inter-disciplinary is insufficient for claiming a program as genuinely multi-disciplinary.

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PART FIVE

Pre-requisites for implementing multi-disciplinary setting

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Key performance indicators to assess and evaluate the individual and team work

When evaluating multi-disciplinary skill sets, it is crucial to comprehensively assess various attributes related to cross-disciplinary knowledge, as well as the skill sets and character competencies of both individuals and teams. This is a significant learning outcome, as character competencies play a pivotal role in real-world work environments.

Assessment methods typically utilize both direct and indirect tools to gauge the acquisition of the mentioned skill sets. It is possible to create appropriate rubrics that encompass all the essential key performance indicators comprehensively, enabling assessors to measure the following parameters when evaluating task completion:

- Assessing an individual's awareness of their specific role, such as a Civil Engineer or Mechanical Engineer, in relation to the assigned task.
- Evaluating an individual's contribution to a team's effort in accomplishing the task and their awareness of their role within the team
- And, eventually evaluating the behavioral aspect viz. attending meetings/discussion on time, providing useful inputs pertaining to the task/discussion by holding positive attitude, gelling with other peer members in the team, communication, integrity, ethics, accountability and so on

FINAL THOUGHT

In today's evolving job landscape, there is a pressing demand for a multi-disciplinary educational approach model. This approach cultivates the essential qualities required for an interconnected and multidisciplinary world. Higher education institutions (HEIs) should extend their focus beyond traditional academics by incorporating courses that wholly embody the multi-disciplinary education approach. This will create an environment where learners from various academic programs can collaborate effectively. Most importantly, it is the time to understand that augmenting few inter-disciplinary courses may not help at all to claim as a multi-disicplinary curriculum. In the process, the curriculum is accommodating specific demands, which ultimately adds unnecessary complexity to it. To put it bluntly, it's akin to an empty vessel generating noise.

Additionally, the educational framework should foster an environment that enables learners to collaboratively address complex engineering challenges as a team. It's crucial to note that, often unnoticed, a subtle transformation is taking place following the implementation of the National Education Policy 2020, with the curriculum gradually evolving into a multi-disciplinary curriculum. Ultimately, the author recommends the inclusion of a minimum of one course employing either an experiential learning methodology or a project-based learning approach, providing students with the opportunity to acquire knowledge, skills, and behavioral attributes in a multi-disciplinary setting.

FURTHER READING

- ABET outcome (d): An ability to function on multidisciplinary teams by Susan Haag, Jeff Froyd, Shantuan Coleman, Rita Caso, Foundationcoalition.org

THE FIRST

Professional Training Academy of Outcome Based Education
Email: info@rubricsedu.com | Web: www.rubricsedu.com