An Overview on Trans Disciplinary Approach for Science and Technology Education

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Abstract— Science and technology advancement resulted in quicker globalization and commercialization. Globalization signifies Omni present culture (DEPFE, NCERT). The influence of basic research in science and technology continues to increase as advances in many areas that are being translated into better tools - approaches especially for studying health and disease. Multifarious development poses many challenges to the science and technology education. Learning in single discipline may excel in one domain but now a days research demands all round knowledge and skill in many sectors. There is clear gap in the skill and knowledge of the student and the technical demands of the research and also in the society. To overcome this problem, Trans Disciplinary approach will be the best solution. Here a focused overview provided on the necessities for Trans disciplinary learning in science and technology education.

***Keywords*— Science & Technology, Trans Disciplinary education, Scientific tools and research**

I. INTRODUCTION

The advanced life science research is more inclined towards interdisciplinary studies. Recent developments in the technologies have led to a better understanding of living systems, and this has removed the distinctions between various disciplines of life sciences. A modern trend in life science incorporates biological research involving a merger of diverse disciplines such as microbiology, biotechnology, molecular biology, biochemistry, ecology and agriculture and powerful approaches like computational biology, bioinformatics, biostatistics; and more sophisticated electrophysiological strategies to monitor and modify functioning of human physiology.

The future promises many exciting opportunities for scientific research in the life sciences, but there are also considerable uncertainties (NCBI). The term transdisciplinary research (TR) first emerged in the 1970s [1]. Science & technology studies should also involve the integration of theoretical and methodological perspectives from different disciplines to develop novel conceptual and empirical analyses of a research problem [2, 3]. For complex life science studies, it is hoped that TR can provide “a systematic, comprehensive, theoretical framework [2] and also for understanding environmental, and institutional factors that influence human health and well-being”. This paper briefly reviews the some of the gaps and challenges in scientific research fields that hold particular promise for the immediate future. It then describes some of the uncertainties that life scientists will face in completing their research studies and concludes with a discussions of the diversity of career options that might be available to young life scientists.

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II. STRENGTHENING EXPERIMENTAL, ANALYTICAL AND COMMUNICATION SKILLS:

A challenge currently being addressed across the life sciences education is the need to improve the quality of experiential and experimental work. Improved training only is not important means to achieve this goal, but also education system must incorporate multi domain skills in their curriculum from the level of graduation itself; because after finishing the research part in a particular field the researcher should interlink the gained knowledge to other tasks for interpreting good results to real-time problems and ultimately to get good position in future. Robust science requires rigorous experimental design, including blinded assessment of outcomes, prospective sample size calculations, and prospective accounting for exclusion of aberrations. Although a generic statistics course is commonly included in biological science graduate programs, very few programs include statisticians on their faculty. A more intensive effort to include the biostatistics in curriculum at post graduation level itself and improve the level of statistical reasoning and facility with statistical methods should be a high training priority for achieving quality research results.

Current experimental approaches, such as gene sequencing, micro arrays, and image analysis, all produce large datasets that pose challenging analytical understandings. The interpretation of these datasets demands more experienced quantitative skills to understand the data and to perform appropriate statistical analyses. Thus require computational skills, including knowledge in languages such as Python, ‘‘R,’’ or MATLAB. The majority of our graduate students lack these skills, and it is essential that we revise our curricula to ensure that bioscience students must competent enough in the area of computer programming.

Computational training can be jump-started by intensive instruction in a bio-statistics that build on and reinforce these skills. Students can also learn from online platforms- a plethora of web based resources, such as massive open online courses (MOOCs), swayam, Coursera etc.,. More emphasis must also be given in items such as research project-writing skills, laboratory and office management, ethics in science, teaching, and mentoring are important for bioscience learners; because as a researcher scholar must know financial management, procurement of material of budgeted projects in life science research institutes. Biologically trained should receive sufficient mathematical training to communicate with informaticians and computational scientists. In turn, computational biologists must translate ideas conceptually to interpret their conclusions of the problem.

III. FORMS OF KNOWLEDGE IN TRANSDISCIPLINARY RESEARCH:

1) Strengthening Transdisciplinary Training:

As outlined by Albert et al., a transdisciplinary structure for the university its main elements are three types of organizational units—systems design laboratories, function-oriented departments, and discipline-oriented departments—which focus on the interdisciplinary coordination between the three pairs of levels in the education/innovation system. The advancement in life sciences fields led to the development of an ever-increasing number of subfields, e.g., molecular, cellular, Bioinformatics, biochemistry and system biology. More deliberate attention to promote cross-fertilization and communication across biological sciences is necessary in advanced education and working together to crack a problem is important that would never be solved with a single approach. Likewise, the tools available for biological science research have become increasingly sophisticated. It is very important to impart and discover the working knowledge and principles of operations of these tools and techniques by the trainees. They must develop analytical thinking and explore themselves outside their domain field and must have enthusiasm to learn from new technology developers.

2) Present scenario in Life science education:

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The undergraduate students getting trained in teams with industry experts and clinicians and bioethicists have brought much more experiential and experimental learning in real- time problem solving approach have fostered more successful translation in innovative teaching learning practices. But at the same time inculcating transdisciplinary mode of instruction needs much more structured and careful strategy for framing the curriculum as without strong basic understanding in logical reasoning aspects of life science, mere machine learning will not give holistic knowledge and that would be very heavy on the young minds of learners. It makes very difficult for any given program to excel in all facets of training; hence programs need to build their curricula to take optimal advantage of the strengths within their institutions and in the surrounding environment.

3) Opportunities for Careers:

The mind set of new century students who now entering graduate school are very receptive to the wide variety of available opportunities both within and outside of academia. It is the responsibility of biosciences training programs to provide trainees with the tools, skills, and knowledge that enable the trainees to make effective contributions to the workforce. Career-focused curriculum offerings and local need based demand oriented programs are going to continue to increase in importance in training programs.

There is huge skill demand from the society in the fields such as clinical health sciences, molecular biology, r DNA technology, Biochemistry, medical microbiology, bioinformatics, biostatistics and systems biology etc. Students of life sciences can seize the opportunity when they ready with required skill and knowledge. COVID 19 pandemic posed a great challenge to education system and at the same time increased the demand for life sciences professionals - specific focus within pharmaceuticals, biotechnology, medical devices and clinical research. Pandemic situation instructed all for the need of Trans disciplinary approach in building all round professionals in biological sciences and the importance of readiness in health sector. This can be best addressed through internships, apprenticeship programs. Many small, mid-sized, and big pharma have summer internship programs for undergraduates and offer lab rotation opportunities to graduate master’s and PhD degree students, sometimes as part of a broader collaborative platform with individual academic institutions.

IV.CONCLUSION

Training of students at graduate level itself by collaborative research agencies through internship and apprenticeships go above traditional disciplinary boundaries, and helps to bridge research areas. Furthermore, it encourages the development and implementation of training curricula that prepare students for multiple career pathways and also gives solutions to certain uncertain environmental pandemic challenges. This young generation has grown in the midst of an extraordinary explosion in knowledge, technologies, data, and tools. These enthusiastic young scientists begin their training with great talent, curiosity. Moreover, biosciences field is vibrant, exciting, and in the midst of a insurgence that aims to integrate human knowledge across many levels of analysis.

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