COLLABORATIVE INTERDISCIPLINARY RESEARCH FOR SOLVING DIVERSE SOCIETAL PROBLEMS: AN EXPLORATORY STUDY

Dr. B. Nagalakshmi

Asst. Professor, Department of English (SFS),SDNB Vaishnav College for Women, Chennai – 44 Tamil Nadu nagalakshmi.b@sdnbvc.edu.in

Dr. S. Santhana Lakshmi

Asst. Professor, Department of Bio-Statistics (SFS),SDNBVaishnav Collegefor Women,Chennai– 44 TamilNadu santhanalakshmi.s@sdnbvc.edu.in

Abstract

This paper aims to study the significance of Collaborative Interdisciplinary Research (CIDR) to address the emerging societal problems. This paper describes the concept of Inter disciplinarily and Collaboration by grounding with theory. This paper makes an attempt to study the current statistics on interdisciplinary researches within the regional, national and international level to identify the gap using the available database and other Survey methods. Subsequently the research explores the definitions, advantages, perceptions, challenges and limitations in carrying out such collaborative research using literature review and mixed method of qualitative and quantitative study to arrive at solutions and implications for implementing. The purpose of the exploratory study is not to provide conclusive results but to provide better understanding of the problems and trigger further researches. This draws on the significance of Collaborative Interdisciplinary Research (IDR)in Multidisciplinary education and Interdisciplinary study is also identified as thrust area for providing solutions for emerging day-today life, diversified problems by triggering future research and development. The study has provided a strategic design for implementing collaborative IDR and gives suggestions and implications for policy making decisions.

(KeyWords: Interdisciplinary, collaboration, multidisciplinary, technology, social sciences, research writing, societal problems)

Introduction

Collaboration is increasingly becoming spontaneous, voluntary, inevitable and seamless in all the spheres strongly driven by the spirit of development at times of growth and the feeling of compassion at times of crises. As the world today is grappled with complex crises ranging from threats of technology, calamities to the recent pandemics, it is becoming impossible to address these with experts specialized in a particular domain. The best solution arises out of interaction and collaboration among the experts from adjoining areas relating to the problem. This is evident in the indispensable role played by statistics in the recent pandemics in controlling the spread of Covid. Technologies and social media enable reaching out the unreached at the time of natural calamities and disasters by mobilizing the resources and manpower. Use of AI is increasingly indispensable in the fields of medicine, banking, e- commerce, Travel and Hospitality. This interaction across disciplines is not new but have happened and evolved ever since ancient times. A dire need arises for collaboration across disciplines. This

interdisciplinary and cross-disciplinary collaborative researches fosters innovation, creativity, problem-solving and other skills needed for 21st century. Interdisciplinary Collaborative Research is taking at two levels i) Project ii) Research Writing. As projects involve funding, it has limited scope for every individual staff transcending barriers to carryout research whereas research writing can be explored as the boundaries among disciplines are merging with collaborative researches.

Significance of the study

Excerpts from staffroom interaction between two staff in the department of languages in an Arts and Science college.

Tamil Department. Staff: Madam, our college has introduced a new course B.sc. Computer Science(AI)in this academic year. What is AI and how is i t related to Computer science?

English Department Staff :AI is Artificial Intelligence. Even I do not know much about this course. But I came to know from a webinar in which the speaker Dr. K. Ilango spoke extensively about technology that in future medical field would be making advancements by integrating AI into toilet closets to diagnose diseases from human excretion.

It is evident from this that interaction and exchange of ideas among faculty is a common phenomenon in colleges. A lot of learning happens naturally, unknowingly and without going to records. Channeling and professionalizing with methodical approach results in collaboration. Since several disciplinary traditions are at play in the same learning and research environments, it is viable with systemic regulation. Townsend et al. (2005) have investigated how scholarly independence and patterns of collaboration are related to the development of early-stage researchers in two multidisciplinary learning environments at a Swedish university. There is no consensus in the literature with respect to how the terms multidisciplinary, interdisciplinary, transdisciplinary, or cross-disciplinary are used and defined as very often it is used in exchangeable ways. The following table compares, demarcates and the defines these - multi/inter/cross disciplinary terms.

Table1.Definitions and features of major disciplinary streams

Multidisciplinary	Interdisciplinary	Transdisciplinary	Cross-disciplinary
Rosenfoeld (1992)defines Multidisciplinary as interaction between members from varying disciplines in academia, where the disciplinary boundaries are kept intact.	Interdisciplinary studies draw on disciplinary perspectives integrates their insights through construction of a more comprehensive perspective. Interdisciplinary shows openness in applying all the theories and methods to any set of given phenomena.	Transdisciplinary is the most integrated form of knowledge making existing paradigms and research practices are dissolved and transformed into new theoretical and methodological approaches that	It is as a numbrella term for Interdisciplinary & Transdisciplinary studies research since interdisciplinary activities Can become transdisciplinary overtime.

		donot appear in the parent discipline s	
Multidisciplinary research gives a type of environments to the members with a learning space that allow them to enhance their skills, scholarly independence and networks.	Inter disciplinarians believed that research should be judged based on how it contributes to the collective understanding.(Szostak, 2003, pp. 30-34)		Although cross-disciplinary research is usually found incollaborative projects, it may also be performed by individual researchers who integrate knowledge and skills from more than one intellectual school or methodology(Br e w 2008; Calvert2010).

Collaboration facilitates a dialogue between critical friends belonging to different disciplines (Lewis etal. 2012).	Interdisciplinary collaboration becomes unidirectional if the interaction is dominated by a single discipline whereas it goal-oriented when the interaction is fueled by the identified issue rather than disciplinary hierarchies. (Jakobsen et al., 2004)	It is purpose-oriented integration of knowledge to grasp the complexity of problems in the lifeworld.(Nicolescu,2002)	The sociological dimension as represented by Lewin and the educational dimension of Paulo Freire (1921-1997) are the two factors identified where the problematic actors became participants and co-responsible insolving their own problems. (Brodin&Avery, 2 020)

Problems identified

As NEP 2020 introduces Multidisciplinary Education which through clustering of colleges that aims at making the courses more dynamic through collaboration with other universities, and industrial houses and to provide the courses both in online and ODL mode. This multidisciplinary system would function efficiently only with interdisciplinary collaboration. There would be a dire need for inter disciplinary collaboration. This study locates the problems in collaborative interdisciplinary research in terms of awareness, interest, challenges in implementation, the existing interdisciplinary publication and enabling policy making. The following are the research questions based on the problems.

1.   What are the perceptions about Inter disciplinary Research among faculty?
2.   What are the strategies for implementing Interdisciplinary Research?

Literature Review

Interdisciplinary study draws insights from relevant disciplines and integrates those insights into a more comprehensive understanding. In order to justify the interdisciplinary approach, its object of study must be multifaceted to achieve coherence among its facets. Newell's (2018) research on Systems approach theory and on the more recent versions of the complex adaptive systems theory had focus on the holistic patterns formed through human interactions (Meek et al. 2007).Complex adaptive systems "are composed of diverse agents with the ability to learn as new information becomes available," including "the development of dynamic social structures and patterns through local interactions among agents"(McDaniel

& Lanham, 2010, p. 53 as cited in Newell 2018). Newell describes complex systems as, "their overall pattern of behaviour is self-organizing, thus different from the sum of its parts and not fully predictable from them. Because the various facets are connected by nonlinear relationships, the overall pattern of behavior of the phenomenon (and thus the system) is not only self-organizing but also complex such, the pattern is only quasi- stable, partly predictable, and dynamic. An effective method for modeling such a phenomenon must offer insight into its separate facets as well as into the self-organizing, complex pattern produced by their overall interaction".(2001,p. 2)

Szostak (2007) has discussed the complex relationship between inter disciplinarily and other intellectual currents namely postmodernism, unity of science, complexity analysis and feminism with emphasis upon the need for guiding the students critically on interdisciplinary research and the arising need to address some potential objections to teach interdisciplinary research practice. Jones's (2009) concluding remark on his study about future benefits of interdisciplinary research says that students and their teachers will advance incritical thinking, communication, creativity, pedagogy, and essential academia with the use interdisciplinary techniques. adopted an interdisciplinary approach in choosing the deliverables and assessment tools to create an open space for students to present their professional profiles using various modalities. Tobi and Kampen (2018) had formulated the

Methodology for Interdisciplinary Research (MIR) framework with a purpose to help cross disciplinary borders, especially those between the natural sciences and the social sciences. This serves as a reference for monitoring the phases, as a tool for designing in process approach, suitable for research projects of different sizes and levels of complexity and allows for a range of methods' combinations. The interdisciplinary approach is not uniquely different from a multidisciplinary approach, which is the teaching of topics from more than one discipline in parallel to the other, nor is it a cross-disciplinary approach, where one discipline is crossed with the subject matter of another. Interdisciplinary techniques go beyond these two techniques by allowing students to see different perspectives, work in groups, and make the synthesizing of disciplines the ultimate goal.(Jones,2009)

Methodology

This study uses an exploratory approach as Interdisciplinary Research is at nascent stage. As exploratory study involves low cost, less time to study, flexibility and adaptable to changes in laying the groundwork for determining the earlier stage of the type of research that may lead to future studies. According to Nargundkar, "an exploratory study may no have as rigorous as methodology as it is used in conclusive studies, and sample sizes may be smaller. But it helps to do the exploratory study as methodically as possible, if it is going to be used for major decisions about the way we are going to conduct our next study".

Sandhursen (2000) draws a difference between an exploratory and conclusive research in away that exploratory studies result in a range of causes and alternative options for a solution of a specific problem, whereas, conclusive studies identify the final information that is the only solution to an existing research problem. This study makes a mixed method of quantitative study and qualitative study to explore the current status, possibility, perceptions,

interest and challenges of collaborative interdisciplinary research.Busettoet.al (2020) defines

Qualitative research as the study of the nature of phenomena and is especially appropriate for answering questions of why something is(not) observed, assessing complex multi-component interventions, and focusing on intervention improvement. A qualitative study of semi-structured interview with faculty experts representing the departments of Social Studies, Science and technology Management was conducted. To cross- examine the validity of the inferences, a quantitative study was conducted among the College / University faculty using a survey Questionnaire with the parameters on awareness, perception, addressing societal problems, need for policy making, curriculum intervention, assessment research publications and future of IDR.

Data about existing Interdisciplinary Research publication
A study was planned to collect data about IDR publication at regional, national and international level from published authors. Data collection at national and International is highly difficult as there is no unified system of publication record. Hence it was possible for the researchers to collect from their organization by obtaining permission from the principal. The publication between the period 2015-2022 by the staff from all departments of S.D.N.B. Vaishnav College for women was collected through IQAC data base and was scrutinized with their titles and discipline. While scrutinizing the titles of 723 articles, most of the articles were found to be disciplinary whereas 3% of the titles seemed to be IDR. The findings have identified the gap and which is revealed in the following graph.

Figure1: Disciplinary and Interdisciplinary Paper Publication

Findings of the Quantitative Study
A Survey was taken from the faculty working in Arts and Science College, Engineering college and University to study the perception, interest and challenges of Collaborative interdisciplinary research. The size of the sampling is 60. The parameters of the Questionnaire are awareness, interest, significance of IDR in Multidisciplinary education, difficulty, Collaboration of natural and social science challenges in implementing, curricular intervention, conceptual understanding, availability of time, funding, Interdisciplinary publication, Interdisciplinary elements of curriculum, and scope for future development.

Table2.DemographicDetails of the Participants

|	Frequency	Percent	Valid Percent	Cumulative Percent
Male	16	27.6	27.6	27.6
Valid Female	42	72.4	72.4	100.0
Total	58	100.0	100.0	

From the above table the majority of the respondents are female (72.4%).

Table3.Teaching experience

	Frequency	Percent	Valid Percent	Cumulative Percent
lessthan4years	12	20.7	20.7	20.7
4-10years	22	37.9	37.9	58.6
Valid 10yearsandabove	24	41.4	41.4	100.0
Total	58	100.0	100.0	

The above table shows that 20.7% of the respondents are less than 4 years ,37.9% of the respondents are between 4-10years, 41.4% of the respondents are 10years and above experience in teaching.

Figure2:Project Experience and Important of Interdisciplinary Studies
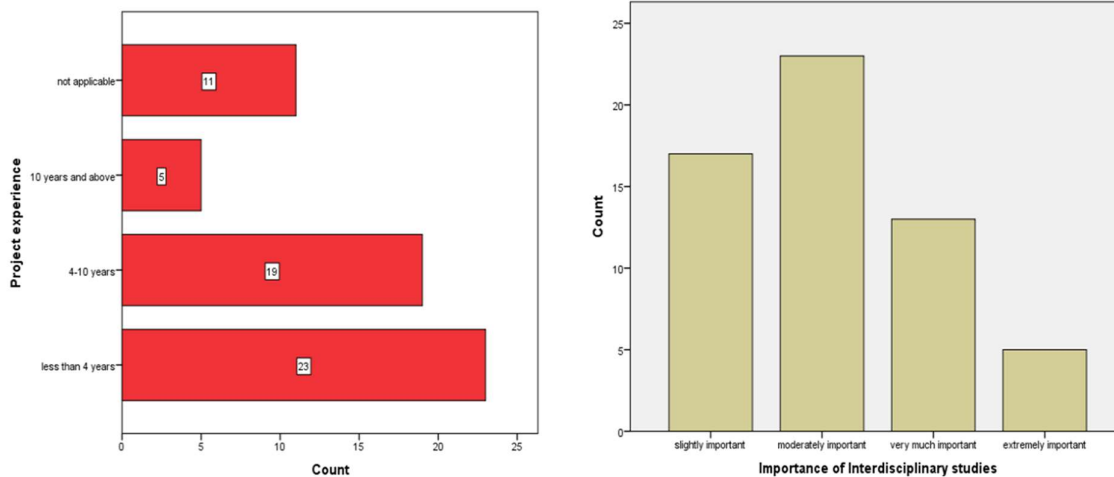

The above figure it is concluded that the maximum respondents are less than 4 years' experience in project and the maximum respondents are moderately know the importance ofinterdisciplinarystudies.Itisclearthatthosewhohavelessthan4yearsofexperience show interest in projects rather than experienced staff.

Table4: IDR Awareness

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all aware	11	19.0	19.0	19.0
	Slightly aware	22	37.9	37.9	56.9
	Moderately aware	17	29.3	29.3	86.2
	Very well aware	6	10.3	10.3	96.6
	Extremely aware	2	3.4	3.4	100.0
	Total	58	100.0	100.0	

The above table shows that 19% of the respondents are not aware of collaborative interdisciplinary research, 37.9% of the respondents are slightly aware,29.3% of the respondents are moderately aware and10.3% of the respondents are very well aware and 3.4% of the respondents are extremely aware.

Figure3: Interest in Inter disciplinary studies
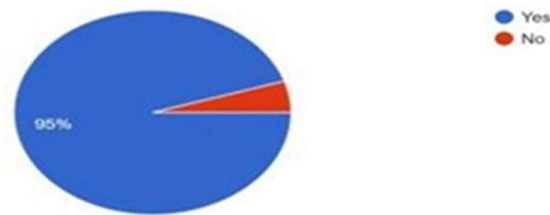
The above graph shows that 95% of the respondents are interested in interdisciplinary studies whereas a negligible 5% of the respondents are not interested in Interdisciplinary studies and it is evident that a larger number of participants show interest in IDR.

**Figure 4: Importance of IDR in Multidisciplinary Education**

It is revealed from the above graph that38.3% of the participants have stated that IDR is very much important in Multidisciplinary education.

Figure5: Conceptual Understanding of IDR
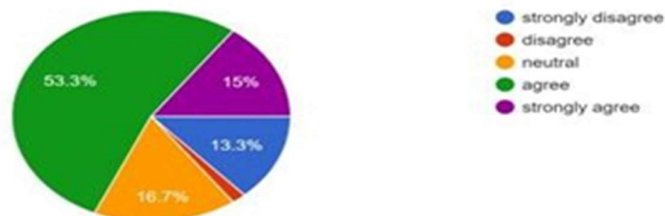
As conceptual understanding is very much important for carrying out IDR, a question was asked on this. 53.3% of the respondents have agreed upon the need for the conceptual understanding of the IDR.

Figure6: Collaboration between natural science and social sciences
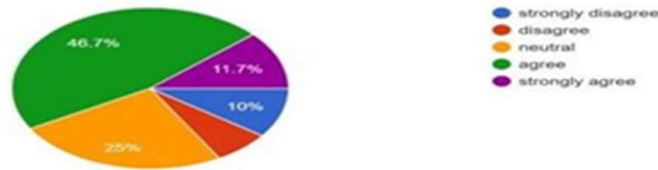
A question was asked to study about the nature and difficulty of collaboration between natural sciences and social sciences. Almost fifty percent of the respondents have agreed that collaboration between natural sciences is easier where as it is difficult between natural science and social sciences.

Figure7: Difficulty of Language department in doing Collaborative Research
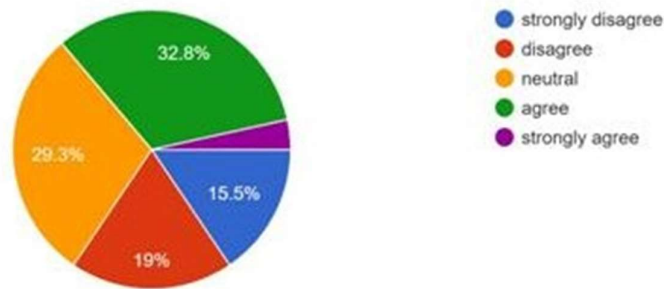

It is evident from the above graph that 32.8% of the respondents have highlighted the difficulty in carrying out IDR in language department.

Figure 8: Implementation of IDR with parameters
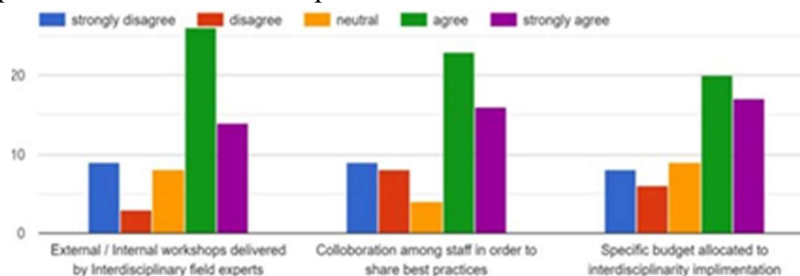
A question was asked to assess the implementation of IDR on the parameters of intervention of IDR experts through seminars, sharing best practices among staff and the need for budget allocation. Of which 43.3% have expressed for the need for the intervention of IDR in the form of workshops and seminars. 38.3 % have stated that the staff needs to collaborate among themselves for sharing their best practices. 33.3% have emphasized upon the need for budgetary allocation.

Figure9: Challenges in implementing IDR
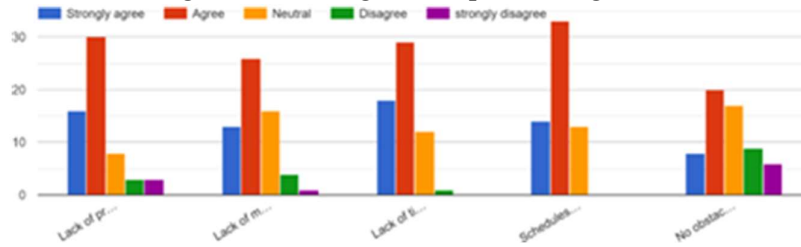
A question was asked to study the challenges of implementing IDR on the parameters of professional support, motivation, schedule and time of which 50% of the respondents have agreed upon the fact that our system lacks professional support, 43.3% stated as lacking ofmotivation,76.6%haveexpressedthedirefactthattheylacktime,55%oftherespondents Have stated that the existing schedule could not adopt IDR,33.3% have expressed that there is no challenge in implementing this.

Figure10: Elements of Curriculum used in IDR
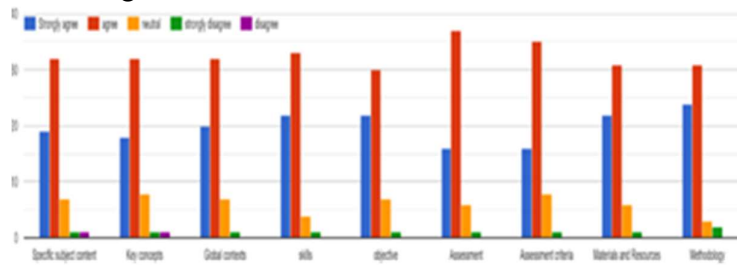
To a question on the elements of curriculum, almost 50% of the respondents have agreed upon the need for specific subject contents, key concepts, skills, global contexts, assessment, assessment criteria, materials, resources and methodology for IDR.

Figure11: Publication in IDR
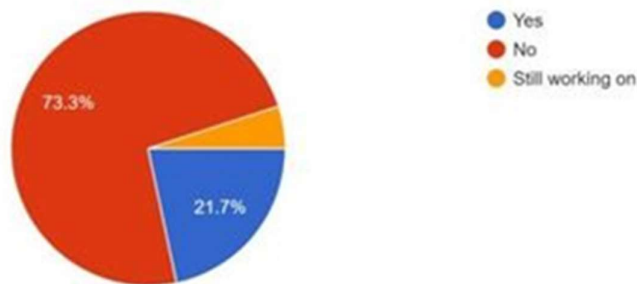
It is revealed from the above graph that 73.3% of the respondents have not published IDR article where as a minority is still working on.

Findings of the Qualitative study

The following experts working in S.D.N.B. Vaishnav College for Women in Chennai were identified as representative participants based upon their academic background, research output

and a semi-structured interview was conducted on the same parameters of quantitative study to validate the data collected.

Table No:2 Expert Participants representing various streams

S. No.	Name	Department
1.	Dr.Padmavilasini	Tamil
2.	Dr.Subbulakshmi	Commerce
3.	Dr.Radha	Science and Technology
4.	Dr.ManimegalaiSanthosh	HRM
5.	Miss.S.Sara Priscilla	Nutrition Food Service Management and Dietetics

Perceptions and views of Expert participants Participant1
The participant (1) representing Tamil Dept. has collaborated with an English department expert from IIT (M) and a History Department expert from BITS, Pilani as Research Associate. She stated that there is widespread awareness about IDR in language department and cited the study of Translations. The participant reported that Government funding is hugely available and unused by staff due to lack of knowledge of know- how of
collaboration. She referred some Interdisciplinary articles published by the staff of

Commerce and Psychology with Tamil Department. She had observed that Tamil department faculty finds some difficulty in gaining understanding about other disciplines while reading articles in English and needs some assistance from the translators.

Participant2
The expert representing PG Commerce Dept, participant (2) is identified for her good journal, book publication at national and international level shared her observations that inter disciplinarily is widespread in Commerce with all spheres in terms of business, stock market, insurance, cyber security, online trading, banking, Accounts, online money transactions. She also pointed out that academic, collaborative publishing is to gain momentum with intervention by experts to channelize methodically. She emphasized the need for need to gain conceptual understanding by the faculty while collaborating with each other's domain. She highlighted the necessity for awarding the interdisciplinary researchers with incentives/ reward/ best paper award. Students also need to be encouraged with awarding credits/ certificates. She identified the need for creating awareness about IDR, translating into action and identifying societal problems. She stated the rigid time frame faculties are working which gives less space for

collaborating with faculty from other discipline even for a small discussion. Time, Funding and cost are the challenges cited by the participant(2) for implementing this.

Participant3

Representative participant(3) from Compute science Department who has good publication credentials started her discussion that interdisciplinary feature of Computer science is indispensable and exists everywhere in this technology enabled world. She stated how it is widely and commonly used in online banking, e-commerce, agriculture, online ticket booking, online medical consultation. She enlisted some illustrative collaborative projects MOOC, SWAYAM, Amazon, SPSS, Tally, OLA, GPay, HRM apps Make My Trip, Google map, etc, she highlighted that in academics this interdisciplinary collaboration is lagging as academicians have some insecurity in sharing their knowledge with others. She pointed out that PG teaching gives more exposure for faculty as well as guidance for collaborative projects of students. She compared that at global level ten authors from different domain collaborate for paper publishing whereas within our national level such collaboration is scanty. According to her, the challenging factors for implementing this in academics are time constraint, funding and manpower.

Participant4

Participant (4) representative of HRM Dept. was chosen for her IIT background and exemplary publishing records. As she is active in collaboration with industry as well as working on collaborative ID research writing with commerce department staff, her inputs add more value to this study. She started her discussion that our Indian educational system and culture gives much importance for knowledge. Hence everything in academics like job, promotion, performance is weighed upon knowledge power and hierarchy. This makes the people feel more self-centric and insecure to share their knowledge which everyone earns by investing their time, money and energy. She stated that IITs and IIMs are booming with Collaborative projects. She emphasized the need for the identified problems to be methodically substantiated with published evidences. She pointed out that the objective of collaboration should be exchange of ideas. She observed those faculties are into image building which is the biggest challenge for collaboration. Another challenge as identified by the participant was incongruence of thoughts in the process of collaboration as thoughts from different disciplines get clashed.

Participant5

Representative participant (5) from Nutrition Food Service Management and Dietetics who is identified for her good publications, stated that there is awareness about this interdisciplinary collaboration but has to be accelerated in terms of publishing. Her observation revealed that faculty is willing to learn and interested to collaborate with other disciplines. She highlighted the need for the intervention of interdisciplinary experts in terms of guidance, seminar, and workshops. She stated those faculties are capable of gaining conceptual understanding about any discipline with proper guidance. She emphasized the need for curriculum intervention for interdisciplinary studies. She insisted on the ethical need for equal weight age among the

collaborating authors in academic publishing. Heavy-day-today work schedule, time factor, funding are the main challenges as identified by the participant.

The opinion of the representative participants is considered in the strategic planning for implementing collaborative IDR.

**Triangulating of quantitative and qualitative study**

It is not enough to decide upon the conclusion based on one method of research. Hence both quantitative and qualitative study and the data on IDR publication were triangulated. The data about publication identified the gap in a particular college. The quantitative research studied the perception of the faculty which was cross-validated by the representative participants in the qualitative study. This has identified the significance of Collaborative IDR in Multidisciplinary education and Interdisciplinary study is also identified as thrust area providing a lot of scope for future development.

Specific Suggestions for Implementing Collaborative IDR

1.   The research findings strongly recommend the need for Policy making which is the foundation for collaborative IDR.

2.   All the participant experts have recommended for Curriculum Integration and Assessment for effective functioning.

3.   Advisory Committee formation with Interdisciplinary experts would steer ahead implementation

4.   Availability of time is the challenge cited by almost all the experts. Hence colleges can identify potential candidates for doing IDR and their day-today schedule can be lightened.

5.   In academics IDR is lagging whereas industry/ business is thriving with Collaborative Interdisciplinary Research. Hence more funding could be allocated in budgets.

6.   Policy for Interdisciplinary Journals publishing can be framed at national and college level.

7.   Awards, incentives for staff and Cash prize for the students, credits, certificates can be given.

The strategic design given below captures the major implementation strategies.

Strategic design for implementing Collaborative Interdisciplinary Research (IDR)
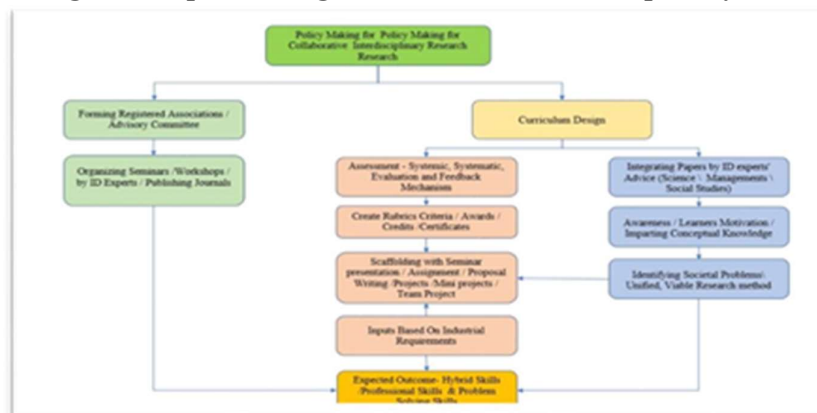
Suggestions and Implications for policy making decisions for implementing IDR and in Academics.

Advanced countries have given concrete model for IDR. For example, the University of Sydney's Handbook on INTERDISCIPLINARY STUDIES 2022lists opportunities for interdisciplinary study, novel skill-building, coursework and projects and for Higher Degree by Research students. This gives comprehensive information as below:

• A shared pool of more than 100 majors, minors, Advanced Coursework and Honours units of study available to all students undertaking an undergraduate liberal studies degree and selected other degrees.

• The Open Learning Environment (OLE) exposes students to work in multidisciplinary group son issues related to authentic problems.

• Projects run in collaboration with a broad range of industrial, communal and government organizations.

• For graduates who wish to update knowledge and skills in specialized and emerging areas within their professional area are offered with short qualifications of professional training and skill development.

• Meritorious students with an additional study built on their undergraduate studies equip themselves to carry out a self-directed research project.
(Courtesy:https://www.sydney.edu.au/handbooks/interdisciplinary_studies/)

Policy making decisions can be drawn based on this model considering the strength and challenges involved in our educational system with experts' intervention. While implementing the suggested strategic design, some degree of flexibility and variations can be adopted based upon the demands and needs of the Institution.

Limitations of the study

1. This study could obtain Collaborative Interdisciplinary Research articles within the college where the researchers are working whereas the data may differ between colleges, with Arts college and Engineering college and also between national and international level. So, it can't be generalized.

2. Obtaining data about existing IDR and article publication at national and international envelopes a lot of challenges. This is also a major limitation of the study.

3. The quantitative data size is less as this paper was worked in a short duration.
This can be taken as a pilot survey and in more data can be collected from different colleges and at national and international level.

4. Exploratory studies do not give conclusion but gives direction for future researches.

Conclusion

Interdisciplinary studies exist at school and college level to some extend but it needs to be methodically integrated into curriculum and pedagogy. The expected outcome of collaborative interdisciplinary research is addressing societal problems and providing solutions. This equips the learners to develop professional and hybrid skill as there is fluidity in the workplace. Though the concept of Inter disciplinarity is innovative in many ways, it has some disadvantage

also as Donald Richards is quoted a sarguing" team-taught courses that lay a claim to interdisciplinary often fail to achieve their objectives precisely because the individual members of the instructional team themselves never really begin to under stand their common concerns in a fashion that may properly be called interdisciplinary" (as cited in Jones, p. 76). This paper being an exploratory one paves way for more future researches which can be on policy making on IDR, Assessment, curricular intervention and Journal publishing.

References

1.   Brodin, E.M., & Avery, H. (2020). Cross-Disciplinary Collaboration and Scholarly Independence in Multidisciplinary Learning Environments at Doctoral Leveland Beyond. Minerva 58, 409–433.https://doi.org/10.1007/s11024-020-09397-3.

2.   Brodin, E.M., Avery, H. Cross-Disciplinary Collaboration and Scholarly Independence in Multidisciplinary Learning Environments at Doctoral Level and Beyond. Minerva 58,409–433(2020). https://doi.org/10.1007/s11024-020-09397-3.

3.   Busetto,L.,   Wick, W.&Gumbinger,   C.Howto   use   and   assess   qualitative

researchmethods.Neurol.Res.Pract.2,14(2020).https://doi.org/10.1186/s42466-020- 00059-z

4.   Effat Zeidan Hatoum,Inter disciplinarity: A Meaningful Approach in Preparing for Future Careers, Integrative Pathways 44-1 Future Careers published by Association of Interdisciplinary Studies. Retrieved from https:// interdisciplinary studies.org /integrative -pathways-44-1-future-careers/

5.   Jakobsen, C.H., Tove H., and William J. M. (2004). Barriers and facilitators to integration among scientists in transdisciplinary landscape analyses: A cross-country comparison. Forest Policy and Economics6(1):15–31.

6.   Jones, C. (2009). "Interdisciplinary Approach - Advantages, Disadvantages, and the Future Benefits of Interdisciplinary Studies," ESSAI: Vol. 7, Article 26.P, 76-81http://dc.cod.edu/essai/vol7/iss1/26

7.   Meek, J. W., Ladurantey, J. D., & Newell, W. H. (2007). Complex systems, governance, and policy administration consequences. Emergence: Complexity and Organization, 9(1-2),22-33.

8.   Newell,W.H.(2001).Atheoryofinterdisciplinarystudies.IssuesinIntegrativeStudies,19,1 -25.

9.   Nicolescu,B.(2002).Manifesto of trans disciplinarity. Suny Press. https: // www. sydney.edu.au/handbooks/interdisciplinary_studies/

10.   Rosenfield, Patricia L. 1992. The potential of transdisciplinary research for sustaining andextendinglinkagesbetweenthehealthandsocialsciences.SocialScience&Medicine35(1 1):1343–1357.

11.   Sandhusen,R.L.(2000).BarronsEducationalSeries,2000- Business & Economics- 559pages

12.   Szostak, R. (2007). How and why to teach interdisciplinary research practice. Journal of   Research   Practice,   3(2),   ArticleM17.Retrieved   [dateof   access],From http://jrp.icaap.org/index.php/jrp/article/view/92/89.

13.   Szostak,R.(2003)."Comprehensive" curricularre form: Providing students with an overview of the scholarly enterprise. Journal of General Education, 52(1), 27-49.

14.   Tobi, H., Kampen, J.K. Research design: the methodology for interdisciplinary research frame work. Qual   Quant 52,   1209   1225   (2018) .https://doi.org/10.1007/s11135-017-0513-8

15.   Townsend, T., John, P., and Jamila, R. (2015). Fostering interdisciplinary research in universities: A case study of leadership, alignment and support. Studies in Higher Education 40(4):658–675.

16.   Welch, J IV (2018). The Impact of Newell's "A Theory of Interdisciplinary Studies":Reflection and Analysis ISSUES IN INTERDISCIPLINARY STUDIES; Vol. 36(2), pp.193-211

17.   Wickson, F. Carew, A. L. Russell, A. W. (2006).Transdisciplinary research: characteristics, quandaries and quality, Futures, Volume 38, Issue 9,2006, Pages 1046-1059, ISSN0016-3287,https://doi.org/10.1016/j.futures.2006.02.011.