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Communication Inadequacies among students of Biotechnology in developing 'Lab-To-Field' Strategies: An Empirical Study

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***Abstract*:**

Biotechnology as a multi disciplinary subject in both undergraduate and postgraduate studies developed after the late 80's and more precisely in West Bengal since the early 90's. Many landmark inventions and innovative technologies although have emerged since then but most of them have remained confined within research papers and thesis dissertations. Amid the present societal scenario it has also been observed that core biotechnology based industry has hardly developed in West Bengal. Though reports of few developing industries are there but a severe lack in communication and service marketing pose a hurdle to their popularization and progress. This inadequacy contributes further to develop liaison between the academic institutions and the industries where these technologies are developed and standardized. The other inadequacy that perhaps forms the base for the other two, rises with the farming in of students in graduate and postgraduate courses both in degree and technological Institutes. Students in classrooms are seen to be coming from vernacular mediums (Bengali and Hindi); and while delivering lectures it becomes an acute problem for the faculty members to communicate with the lingua franca, that is English. The present paper attempts to focus on these inadequacies in general and poses to question on how to alleviate them in particular.

Keywords: Communication, Inadequacy, Biotechnology Industries, Biotechnology Courses.

Introduction:

Biotechnology, as the name suggests is the technology of biology and the scope of both put together. On one hand, it has concepts of biology explored in depth; on the other the subject explores the impact and the influence of technology on the subject matter.

Biotechnology is the answer to many of the challenges the world faces today. From finding solutions to climate changes through green technologies and discovering novel drugs to addressing health concerns, modifying crops to meeting food security concerns and tackling the energy crisis through biofuels – Biotechnology is doing it all.

In the last decade and a half, Biotechnology has been making steady progress in India. The areas where biotechnology has grown in India includes Agricultural Biotechnology, Animal Husbandry, Bioinformatics, Bio fertilizers and Dairy development. Growth has also been seen in the area of Bio-resource Development, Plant Biology, Marine Biotechnology, Microbiology and Genetic research.

Biotechnology therefore assimilates in itself a number of disciplines. There is a great demand for biotechnical experts in countless industries and sectors. Career opportunities for students in biotechnology are abound. Those specializing in different sub-disciplines of this field can easily find jobs in both private and government sector undertakings.

Like any other job profile, the pay package largely depends on the academic qualification, the area of specialization and the institution from where one has earned the degree. Fresh graduates in this field can generally bag a monthly salary in the range of Rs 10,000 to Rs 25,000 where as candidates with a Masters degree in Biotechnology get a better starting salary. With an increase in the level of experience, there is abundant scope for getting fatter pay cheques in this exciting and inspiring profession.

On the supply side, technical colleges are trying their best to meet the growing demand for 'skilled' professionals; however once these students complete their research work they tend to stay and work abroad. Despite the presence of quality research institutions and investments in this field, India still doesn't have the substantial number of skilled manpower. It is time to develop such 'skills' to fill this gap.

Survey of Literature

Development of Science &Technology is crucial for mankind, but even the most advanced science is rendered ineffective, if its importance and results are not effectively communicated to the public. There has more been the work of research on Biotechnology as a core subject & its related fields but very few on Communication & Biotechnology. There has in fact not been any work done on the issue of "communication inadequacy" among adolescent students studying Biotechnology in the state of West Bengal.

Review works on 'effective communication 'or passing comments on the communication approaches which need to be taken to make Biotechnology relevant in the field of science (*Archita Bhatta and Kinkini Dasgupta Misra*, 2016) or investigations made on strategies for enhancing communication between students, academics and researchers participating in large-scale undergraduate research projects (*Karen Mate, Carlos Riveros, Jude Weidenhofer, Belinda Goldie, Judith Scott, Pablo Moscato, Dan Johnstone, Elizabeth Milward*, 2014) or teachers' concerns about Biotechnology education (*Lisa A. Borgerding Troy D. Sadler Mary Jo Koroly, 2013*) have been undertaken; passing works on promoting biotechnology through communication or books on several strategies for communication on food technology (*Sibylle Biefang*,1998) or Agri Biotech communication (*Gary Wingenbach, 2009*) have been researched for articles but specifically papers on setting 'lab-to-field' strategies through adequate communication skills as implemented by Biotech students have hardly been investigated or recorded.

The present paper will try to exhibit the communication inadequacies that generally the students of Biotechnology, both at graduate & post graduate level, face while implementing 'lab-to-field' strategies.

Objectives

The objectives of the paper are:

- To identify one major issue that makes India in general and Biotechnology in particular inefficient in setting proper 'lab-to-field' strategies, that is the 'skills deficit'.
- To figure out the communication inadequacies that make India still a country which doesn't have the considerable number of 'expert manpower'. It is time to develop such 'inadequacies' to fill this gap.
- To justify the prevailing trend in the sector of Biotechnology, that is, lack of technology transfer: 'skilled manpower' to 'industry' and lack of technology transfer: 'lab-to-industry'.

Methodology

The methodology or the technique that has been adopted while preparing this paper is the descriptive survey method. It has been used to gather 'communication' problems and difficulties students encountered during classroom learning of the subject Biotechnology. Descriptive research describes and interprets what is. It is concerned with conditions of relationships that exist; practices that prevail; beliefs, processes that are going on; effects that are being felt, or trends that are developing (Calderon, 2013).

The study focused on conditions of students studying Biotechnology at graduate level with various communication deficiencies that in the long run restrict them in developing proper and successful 'lab-to-field' strategies.

Respondents

The participants composed of 200 B.Tech and 60 M.Tech students who have undergone classroom learning during the college year 2013-2016. The B.Tech students are majors in

English, General Science and Biotechnology. Stratified total of 260 composed the participants of the study. In the choice of participants, no sampling technique was used because all the students were included as participants of the study.

Instrument

The instrument used to gather data was the instrument developed and used by Dr. Pacita L.Samson (2007) on the problems and difficulties encountered by students during classroom learning and teaching. The instrument is in the form of an 'interview questionnaire' and has undergone reliability test and validation by faculty members with student teaching load. The instrument consists of two parts. Part I deals on 'personal profile' or 'background' of the students. Part II relates to problems and difficulties met by student such as personal problems, class participation problems, class management problems, instructional problems, emotional problems, problems in adjusting to pupils/students, problems with school adjustment, problems arising from culture, and problems in guidance. In the confinement of this study, the problem areas included are: personal problems, class management problems, instructional problems, emotional problems and problems in adjusting to pupils/students, cultural problems.

Data Collection

The participants were informed of the purpose of the research in writing. They were convened in one venue during their vacant or free period for response to the instrument and to further retrieval. The directions were read and explained to avoid any problems or questions that may arise during the answering of the interview questionnaire.

Discussion

There was a time, not long ago, when soft skills in general and communication skills in particular were thought of as poor cousins of the technical skills. While investing considerable time and resources to acquire the scientific and technical skills, promising and talented students ignored

the soft skills. Once they mastered the technical skills, they thought , the lowly soft skills would follow without any special effort; just as eating is fundamental to our biological existence so is communication to our social existence was the thought of most of us. Without any special training we developed proficiency in it. Why then do we need to 'communicate'? Why then do we need to read books or listen to lectures on 'communication'? For the same reason we need books or guidance that advise us on eating. If we ignore the expert advice and let our instincts prevail, we may develop faulty eating habits and ruin our heath. Something similar may happen with our communication and repertoire. We may be able to articulate words but not communicate well. We may listen or read and recognize words but not comprehend well. If we do not master communication skills and let our lacunae invade we may mar our social and professional relationships.

In the modern globalised world, 'technocrats' are realizing the harsh reality that technical skills without soft skills would make them knowledge workers and not managers or leaders. Hard skills are perhaps perishable and machine or computer replaceable. Those who lack in soft skills, that is, communication skills face various lacunae and hence various challenges. They will perhaps, in the long run, get much less credit for their achievements than they deserve.

The sources of inadequacy or lacunae that initially affect technical students' communication skills are:

- Students' attitudes towards communication.
- Insufficient course content.
- Deficient or inappropriate teaching methods.
- Lack of opportunity for practicing communication skills.
- Inability to grasp the subject matter.

To build up a positive image in public, these lacunae are kept generally under control; these help people to win in every situation. People are 'impulsive' but they project themselves to be 'measured'; people are 'nervous' at times but the reflection is of 'confidence'; people sometimes have a 'happy-go-lucky' attitude towards life but they represent themselves to be 'calculative'; the list of lacunae perhaps go on.

Physical	Psychological	Linguistic	Cultural
Noise	Emotional Disturbance	Improper decoding of message	Cultural difference
Discomfort	Dilemma	Improper encoding	Values' difference
Distraction	Anxiety	Ambiguity	Social norms' difference
Distance	Over arousal of emotions	Syntax & Jargon	Ethics difference

From the above mentioned table of different communication inadequacies that people face in general, it has been observed that these deficits also prevail in developing lab-to field strategies in particular; they can, in this paper, concisely be classified into three major heads:

- Lack of 'interpersonal communication'.
- Lack of technology transfer: 'skilled manpower' to 'industry'.
- Lack of technology transfer: 'lab-to-industry'.

This scenario prevails among technical students in general in India and among students of Biotechnology in particular. If we have a look, through certain private engineering colleges in West Bengal that offer B.Tech in Biotechnology in particular we shall be able to understand how these lacunae become major and prominent.

The colleges offering B. Tech in Biotechnology in West Bengal are:

- Bengal College of Engineering & Technology (BCET), Durgapur
- Bengal College of Technology (BIT), Kolkata
- Haldia Institute of Technology, Haldia
- Heritage Institute of Technology, Kolkata
- Neotia Institute of Technology, Management & Science (NITMAS), Kolkata

Along with private Universities like

- Amity University, Kolkata
- Techno India University, Kolkata
- University of Engineering & Management (UEM), Kolkata

Personal responses through one-to-one interview of the students in the form of questionnaire were recorded to reach to the objective of the paper. These interviews can broadly be classified as case studies under three categories indicating specifically to the inadequacies of communication in setting proper technology transfer. The categories are:

Linguistic	**Psychological**	**Societal**
'Mother Tongue Influence' (MTI)	Inconfidence	Adjustability problem
Lack of proper arrangement of thought	Hesitation	Socialization problem
Lack of vocabulary in English	Anxiety.	Introvert Attitude
Lack of fluency in English for effective Communication	Dilemma	Impractical Attitude

There are approximately 50% students out of 260 students interviewed from 5 private engineering colleges offering B.Tech in Biotechnology in West Bengal whose medium of instruction in school remained 'vernacular' and not English. The lacunae which the subjects faced in their initial semesters were (1st to 4^{th}):

Total incomprehensibility in [Listening (L), Speaking (S), Reading (R), Writing (W)] the language English.

- Inability to communicate in any language other than mother tongue, Hindi.
- Inability to comprehend the language English due to 'mother tongue influence' (MTI).
- Inability to speak due to inconfidence, hesitation and anxiety.

The lacunae that still prevail in the final year of the subjects:

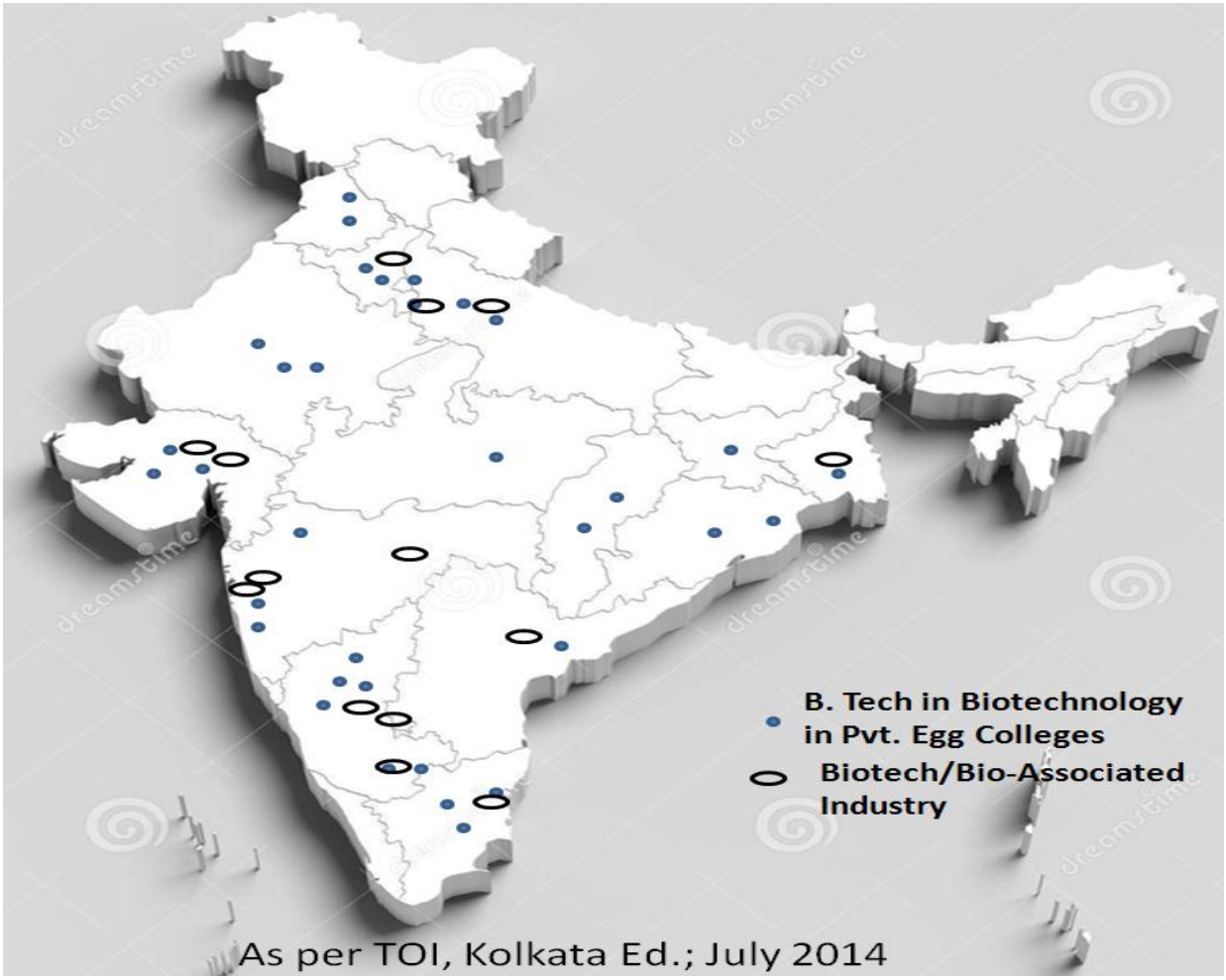
- Inconfidence, hesitation and anxiety still persist along with lack of thought and lack of vocabulary in English.
- Inability to adjust and socialize due to introvert and impractical nature of the subject.

On the other hand students studying Masters or M.Tech in Biotechnology though are comparatively better than their juniors yet they also experienced initial communication inadequacies during 1st semester- 2nd semester :

- Basic understanding of the language English
- Inability to write in English well
- Inability to speak in English fluently.

5% of these subjects by the end of their M.Tech courses, however, gained confidence, overcome the lacunae and got placed in a reputed MNC and achieved a high GATE score as well; presently they are preparing for 'on site' visit.

The above mentioned interview case studies of well renowned private engineering colleges in West Bengal justified the first inadequacy, lack of 'Interpersonal communication', as per our observation' which we have already mentioned earlier in this paper; the following discussion along with the figure will justify the other two inadequacy, i.e. , Lack of technology transfer: 'skilled manpower' to 'industry' & 'lab-to-industry'.



The fast growth of technical knowledge is prevalent in the fields of 'biotechnology' all over India; according to a recent survey, India is stated to become an international focal point for development of biotechnology.

From the above figure of the map of India, it can be seen that, there are lot of private engineering colleges offering B.Tech in Biotechnology in the Southern & South Western parts of India; however very few colleges are there in the Eastern parts of India. These colleges every year prepare 'skilled manpower' for the 'industries'. They develop them to get deputed to the various companies spread all over India but the 'manpower' cannot be deputed to the core industries.

Why? Well due to several reasons; two major reasons, as per our observation, are:

Skilled manpower, even if, are developed cannot be employed to the Biotechnology/ Bio-associated industries because of the location drawbacks. Most of the industries, as per the figure, are situated & getting developed in the Southern & South-Western parts of India and not at all in the Central or Eastern zones of India.

Even if the Southern bound industries in India are targeted for recruitment of skilled manpower of the Eastern zones, the industries themselves do not encourage because hiring or deputing the equivalently skilled manpower from the local vicinity give them an advantage of "lesser" pay packages. On the other hand, hiring similar manpower from the Eastern or Central parts of India would incur the industries with "higher" costs, both during the 'recruitment' process itself as well as at the time of offering high pay packages assured with more fringe benefits and other allowances. Thus, the second major inadequacy, lack of technology transfer: 'skilled manpower' to 'industry' gets justified.

Further from the above figure the third inadequacy, lack of technology transfer: 'lab-to-industry' can also be understood; as told earlier that, there are very few colleges in the Eastern & Central parts of India; these colleges like other colleges in India have scientific technologies, sophisticated laboratories and research facilities; every year they carry out various research & development activities to analyze, organize and deliver essential scientific information successfully.

These activities, however, remain confined within the boundaries of laboratories & libraries in the form of proceedings, journal & thesis dissertations; they hardly get implemented in industries due to scarcity and scope; 'lab-to-field' strategies hardly get associated or collaborated due to very less presence of industries in & around. The states of West Bengal, Orissa and Madhya Pradesh are such examples where promising research works are left in dust & rust because of dearth of industries.

Recommendation

Biotechnology is a knowledge-driven technology, which needs to be driven by a flow of new skills, new communication, ideas and concepts in the development of new tools for research, new processes for manufacturing and innovative business models. Rapid responses are needed to meet the challenges as they unfold and there is a requirement for specialized personnel and centers of excellence for R&D.

At present, there is a wide gap between the quality of Biotech education and the needs of the industry. If the biotechnology sector is to sustain its growth of 20 per cent CAGR and attain a size of $100 billion by 2025, we will need to ensure that there is a good talent pool in the country. About 40,000 biotechnology students pass out every year from various colleges across the country. However, the lack of requisite skills means that not many can be employed by the 500-odd biotech companies in India.

On an average, 300-500 hopefuls apply for every new Biotechnology-related job, but most are rejected as they are not industry-ready. A lack of necessary laboratory equipment and space at many Indian colleges means many graduates would probably not have seen a basic biotech tool such as a gel apparatus. Such inadequacies make their knowledge insufficient for an industry structure.

In order to build a successful biotechnology sector, large talent pools are required in multiple scientific disciplines to meet the 'inadequacies'.

The strategic and step wise recommendations that can be implemented are:

(i) National Task Force on Education & Training

A National Task Force must be created to formulate model undergraduate and postgraduate curricula in Life Sciences keeping in view, the future needs. The said curricula must address the underlying need for multi-disciplinary and inter-disciplinary learning and the appropriate stage for communication training for the field of Biotechnology.

(ii) Need assessment

- There would be need assessment for every five years and close monitoring during the period for interim changes.
- A 10-year perspective plan for human resource with reference to pedagogy must be prepared every five years.

(iii) Curriculum development

- Course curricula will be reviewed and improved in consultation with industry and research establishments and standard e-learning modules will be developed for specific skill areas such as IPR, regulations, and bio enterprise.

- Hands on exposure to M.Tech & M. Sc Biotechnology students should be enhanced through an extended industry internship as well as through short-term placements at CSIR and other appropriate National Institutes.

- Dual degree programs in biotechnology that include regulatory matters, IPR and Communication skills management should be encouraged and supported by the Department of Biotechnology.

- Emphasis will be given on training of high quality technicians and technologists in both 'hard skills' & 'soft skills' required by the industry by establishing Regional training centers at diploma, graduate and postgraduate levels.

(iv) Quality improvement

An accreditation mechanism must be put in place for ensuring minimum standard of education and training at the post graduate and undergraduate levels. Base requirements for teaching and laboratory infrastructure will be specified and enforced.

(v) Strengthening of teaching and R&D in life sciences and biotechnology in the university system

Strengthening R&D in Life sciences and biotechnology in the university system will be accorded high priority. This is considered important for improving the quality of education and providing exposure to new technologies for students at various levels.

(vi) Attracting talent to life science and biotechnology

- Special scholarships must be introduced to attract promising students to take up careers in biology and biotechnology.

- Women scientists should also be encouraged to take up careers in biotechnology. Service conditions will be liberalized for women to be able to return to research/academics after maternity breaks.

(vii) Creating Science & technology leaders for the industry

- The number of PhD fellowships offered by the Department of Biotechnology should be increased.
- Masters degree level professionals in industry will be encouraged to undertake Ph.D. programs while retaining their jobs through industry-university tie-ups.

These steps will ensure that the large available resources of human talent in biotechnology are supported and this will guarantee the progress of the biotech sector.

Conclusion

Many students after graduating with a B.Tech degree or a B.Sc degree in biotechnology, choose to pursue M.Tech, M.Sc or PhD degrees to develop their skills further and understand the industry. Numerous Indian Biotech students who can afford the fees choose to go abroad for higher studies, attracted by the possibilities of working in state-of-the-art labs and the aspiration of working for leading biotech innovators.

For engineering graduates and science postgraduates in India, job hunt can be daunting. Every year, thousands of freshers' knock on the doors of biotech and pharmaceutical companies or universities and research institutes in India. Only a handful finds jobs.

But among the successful candidates there are many who find themselves trapped in underpaid technical, marketing and administrative roles. Starting salaries are often unattractive as local biotech companies have to invest in training freshers' for 1-2 years before they are job-ready.

In India, there are a few finishing schools for Biotechnology, and most of them were started in the recent past either by educational institutions or by various State governments. These schools seek to equip students not only with soft skills, but also help them specialize in their chosen field of biotechnology through a rigorous multidisciplinary approach.

Beyond finishing schools, a lot still needs to be done to address the acute deficit of industry-ready talent in India. Students aspiring for a career in biotechnology need to be exposed to various aspects of applied biotechnology. This is possible only with industry-academia

partnerships so that the industry can spell out what is required in the real world and the academia can provide the required training. Rigorous, industry-relevant training can equip graduates and postgraduates with the skills needed to make them employable and overcome the lacunae in the Biotech industry.

The need for an integrated Biotech education with concurrent attention to academia, social communication, organization and regulation is considered to be an essential pre-requisite for an orderly progress of the Biotech sector. Synergy between technology and effective communication is essential for us to achieve a necessary mobilization of the tools of new biology for adding both years to life and life to years.

References:

1. B. France, John K. Gilbert. 2006. *A Model for Communication about Biotechnology* ISBN:90-77874-75-5; Sense Publishers ; The Netherlands.
2. Bhatta Archita and Kinkini Dasgupta Misra. *Biotechnology communication needs a rethink.* Current Science, Vol.110 NO.4 2016; New Delhi
3. Borgerding, Lisa A; Sadler, Troy D; Koroly, Mary Jo. 2013. *Teachers' Concerns About Biotechnology Education;* Journal of Science Education and Technology, Volume 22, Issue 2, pp.133-147
4. Calderon, J. & Gonzales, E. 2013. *Methods of research and Thesis Writing. Manila,* National Book Store
5. Gary Wingenbach, 2009. *Media source impacts Ag Biotech Communication*, Journal of Natural Resources and Life Sciences Education.
6. Hans-Günter Gassen; Biotechnology. J. 2007. Perspective: *Why Communication in Biotechnology is Important*; 2, 1051–1052
7. Mate, Karen; Riveros, Carlos; Weidenhofer, Jude; Goldie, Belinda; Scott, Judith; Moscato, Pablo; Johnstone, Dan; Milward, Elizabeth 2014. *Strategies for enhancing communication between students, academics and researchers participating in large-scale undergraduate research projects.* International Journal of Innovation in Science and Mathematics Education Vol. 22, Issue 5, p. 14-29
8. Samson, P. 2007. *Problems and difficulties encountered by student teachers of Philippine Normal University, Alicia, Isabel*
9. Sibylle Biefang, 1998, *Strategies for Communication on Food Biotechnology l+G Health Research*, Munich, Germany
10. Xavier Seuba and Carlos Correa; December 2010; *Biotechnology in India: Its Policy and Normative Framework* ACC1Ó Passeig de Gràcia, 129 – 08008 Barcelona.