

Weaving Research & Innovation with Academics

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9 August 2017

IIT(BHU) Faculty Orientation

Outline

- I. Research & Innovation
- II. Academic Programs – Weaving Research & Innovation
- III. Technology Transfer and Other Dimensions
- IV. Guiding Students about Life

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But first, some guiding principles...

Some Guiding Principles

- Strive for excellence
 - In research, in academics, in life
- Connect with societal needs – to get research problems
 - Inter-disciplinarity, trans-disciplinarity needed
- Weave research & innovation in academic programs
- Produce holistic human beings – not uni-dimensional ones

Holistic education and impactful research

I. Research & Innovation

Current State of Research in India

Research at good Indian institutions:

- Research not connected with real life problems
- Students are good, but not exposed to project work
- Faculty even when active - mostly do individual research
 - A lack of group culture, consequently
 - A lack of critical mass

As a result, research in Indian academia makes very little impact!

Current State of Innovation

Innovation: Means putting existing ideas together to build fruitful objects/products. *Watchword is: DESIGN.*

- Very little design work in academic institutions
 - Left to small scale industry and artisans who build "jugaad"

Research and innovation have to link up ultimately, to be sustainable.

Research and Innovation – Approach

Approach towards research and innovation:

- *Approach*: Choose substantial societal problems
 - Promote group work at faculty level
- *DNA*: Weave research into academic programs
 - Even the UG program should be research/innovation oriented
- *Collaboration*: with best groups in India and the world
 - Setup fruitful partnerships with relevant people, at faculty level
 - Complementarity in relationships

Some meta-themes, reflecting the above, follow...

1. Meta-theme: Look at Problems around Us

Identify from our own environment the problems. Connect with real life

- Real life always a hard test.
 - Forces one to think differently, and come up with creative solutions.
- Academia in India has a larger role than in the West, where industry connects research with practical use
 - Academia in India has its challenges, but also opportunities!

For technology to be successful, it should fit into society

Challenges and Opportunities

- *Challenges:* Eco-system that converts research into products/objects is missing in India
 - Currently, we are building a 8-lane bridge across a river. But towards the end, 10 metres are missing.
And no way to build it!
 - Shouldn't we build even a 1-lane bridge, which is complete
- *Opportunities:* Technology needs to be re-invented at the world level
 - *Climate change:* Greatest technological successes of the past are creating the spectre of climate change
 - *Mass use:* Reaching the bottom 80% of world population. Ultra-low cost technology needed (for our society and for the rest of the third world)

If willing to accept the challenge, a great opportunity

2. Meta-theme: Recognize Our Own Strength

- Identify our own strength, and build starting from there
- Also be aware of our weaknesses, and try to rectify them

Take the best from everywhere, but do not be swept away

3. Meta-theme: Connecting with Community

- Recognizing strength of community – artisans, common folk
- Working with community
 - Free software has shown that a large loosely-knit community of developers out performs smaller closely-knit teams of professionals

*Gandhian vision - Technology should empower people
and not just make them into users or consumers*

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- When team work starts, issue of *ego* comes
 - Burying ego is difficult! But high goals help

II. Academic Programs

Weaving Research & Innovation

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We should be able to answer:

- Yes you can (if we have the expertise in the area)!

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- To hook the students to projects at an early stage.
 - Have independent projects in the curriculum with academic credits,
 - But the courses should also come to the aid of the projects!
- Curriculum should not only permit students to pursue projects, but aid them through supportive course work
 - Choice based flexible curriculum becomes a necessity!
 - It is the enabling power of such a curriculum

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What about them?
- Curriculum design is not easy, but can assure you that it is doable. And in fact has been done!

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- 5-year IDD program can become a superset of B Tech (Honours) program to carry the research momentum further

*Above is the concept of Layered Learning –
practice-theory- practice*

Inter-disciplinarity

Projects require inter-disciplinarity, naturally. Possibilities:

- BTech(Honours) program with research/innovation
- 5-year IDD program with research/innovation momentum
- M Tech program
- PhD thesis work, of course

*Most importantly, it allows you to form strong research teams
with continuity.*

III. Technology Transfer

1. Technology Transfer Dimension

Research to products/technologies

- Set up *engineering* and *productization* groups
 - Engineering and productization are different from research
 - But synergy needed with research
- Entrepreneurship etc. for productization

Research link up with society ensures that resulting technology is needed and useful.

Group with Critical Mass

Group with critical mass, a pre-requisite for technology development and subsequent transfer:

- Choose important problems
- Have people in the group with different expertise (research, productization, technology transfer, etc.)
- Make societal impact

IV. Guiding Students about Life

Student Dimension

- Motivating students towards research and innovation for nation building
 - Currently narrow motivation in many students - only jobs and money
- Developing holistic individuals
 - Developing sensitivity towards others, and larger society
 - Induction Program and Human Values courses
 - Offering Humanities courses – Developing larger world view

All round development, not just technology specialist!

V. In Conclusion

Moving Forward

We need to move forward by

- Group research – Faculty working together with student group
- Inter-disciplinarity – Across departments, including with BHU
- Serious teaching with project work in courses

- Working with *fairness* and *firmness*
- Building systems that work and reasonably quickly
 - Simplify processes
 - Rapid computerization

Faculty Dimension

Faculty dimension is most important!

- Taking a holistic view of our situation and our own life
- Creating a harmonious environment in Department and Institute

A feeling of being on a journey together !

Summary

- Meta-themes are important in choosing problems and working together
 - Looking at problems around Us
 - Recognizing our own strength
 - Connecting with community
 - Team work without ego
- Faculty is the key to choosing substantial problems
 - Working in groups rather than individually
 - Individual students can be given parts of the larger problem
 - Students get inspired by the larger goal, and work hard
- Flexible curriculum enables projects and thru it research/innovation
 - Project work for UG students
 - B Tech (Honours) adds focus – choosing a stream
 - PhD students in good numbers
 - Form multi-dimensional research teams