Assessing and Improving the Quality of Engineering Education Program

Survey report for Dayalbagh Educational Institute, Dayalbagh, Agra

Ministry of Human Resource Development

National Project Implementation Unit

World Bank

Research Team from Stanford University

New Delhi

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Survey Report: Dayalbagh Educational Institute, Dayalbagh, Agra

Assessing and Improving the Quality of Engineering Education Program

Background and Motivation:

A major goal of university systems is to produce skilled graduates. Specifically, their goal is to help students gain higher levels of *academic skills* (e.g. maths and physics) and *higher order thinking skills* (e.g. critical thinking and quantitative reasoning). Such skills contribute towards productivity and innovation and help students compete in the global knowledge economy.

Despite the importance of improving students' academic and higher order thinking skills during college, there has been no direct and representative evaluation in India of whether students are learning these skills.

In view of this critical gap in knowledge, the NPIU has collaborated with researchers from Stanford University to implement the "*Assessing and Improving the Quality of Engineering Education*" program at TEQIP III institutions. The program is designed to measure and benchmark levels and gains in academic and higher-order thinking skills of students in undergraduate technical programs and to understand the various factors that affect skill development. Ultimately, the study will enable TEQIP III institutions to assess the competitiveness of their students and to create a more effective system of technical higher education.

Objectives:

The program has two main goals:

1) Assess university student skills (levels and gains) and compare student skills across institutions

2) Examine which types of factors (institutional, faculty, instructional, curricular, student behavioral) help students develop skills

Please note that this report is confidential and is only being shared with your institute. We would like to take this opportunity to extend our sincerest gratitude to the students, faculty, and administrators at your institute who participated in the study. We are also deeply grateful to the staff who helped us smoothly administer the survey. We greatly appreciate both your enthusiasm and support.

Approach:

We have surveyed 118 TEQIP III colleges that offer CS/CSE/IT[1] or EE/EEE/ECE[2] programs across India. We randomly chose 1 CS/CSE/IT department and 1 EE/EEE/ECE department to survey from each college.

Altogether, we have assessed and surveyed:

- Approximately 27500 Year 1 and Year 3 students
- Approximately 4300 of the students' faculty
- Approximately 200 department heads (HoDs)

We assessed students on their academic skills (mathematics and physics) and higher-order thinking skills (critical thinking, quantitative literacy, and relational reasoning).

The assessments we used have the following properties:

a) Desirable psychometric properties – reliability, validity, and fairness;
b) Where possible, the ability to measure skill gains over time (vertical-scaling);
c) Comparability of skill levels and gains across institutions

Results:

Our results describe the 'mean scaled score' for your college on each of the five assessments administered to the students. The 'mean scaled score' for your college is the average score of all surveyed students on a particular assessment, adjusted to a scale of 0 to 100. All scores have been scaled in line with preservation of desirable psychometric properties. As a result of scaling, the mean score for India on a 0-100 scale is 50 for each assessment category. These scaled scores should *not* be confused with percentage scores.

[1] Computer Science/Computer Science Engineering/Information Technology
[2] Electrical Engineering/Electronics and Electrical Engineering/Electronics and Communication Engineering

Figures 1-5 compare average skill level of students at your college with the average skill level of students nationally on academic skills (mathematics skills and physics skills) and on higher order thinking skills (critical thinking skills, quantitative literacy skills, and relational reasoning skills).

Figure 1. Comparison of Mathematics Skill Levels

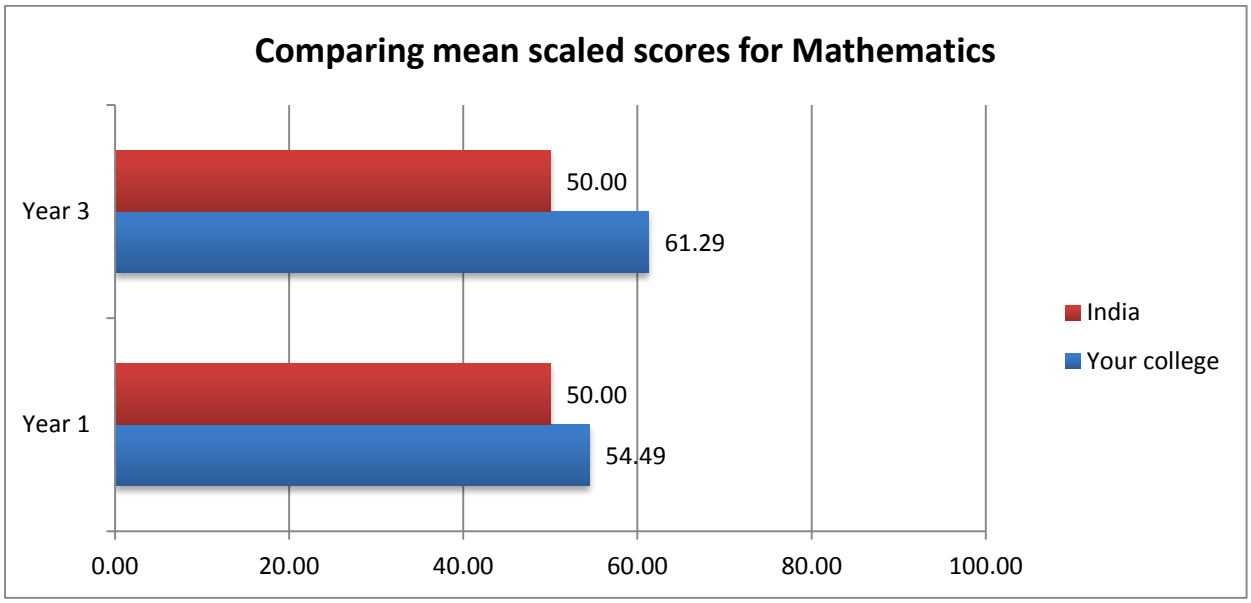


Figure 2. Comparison of Physics Skill Levels

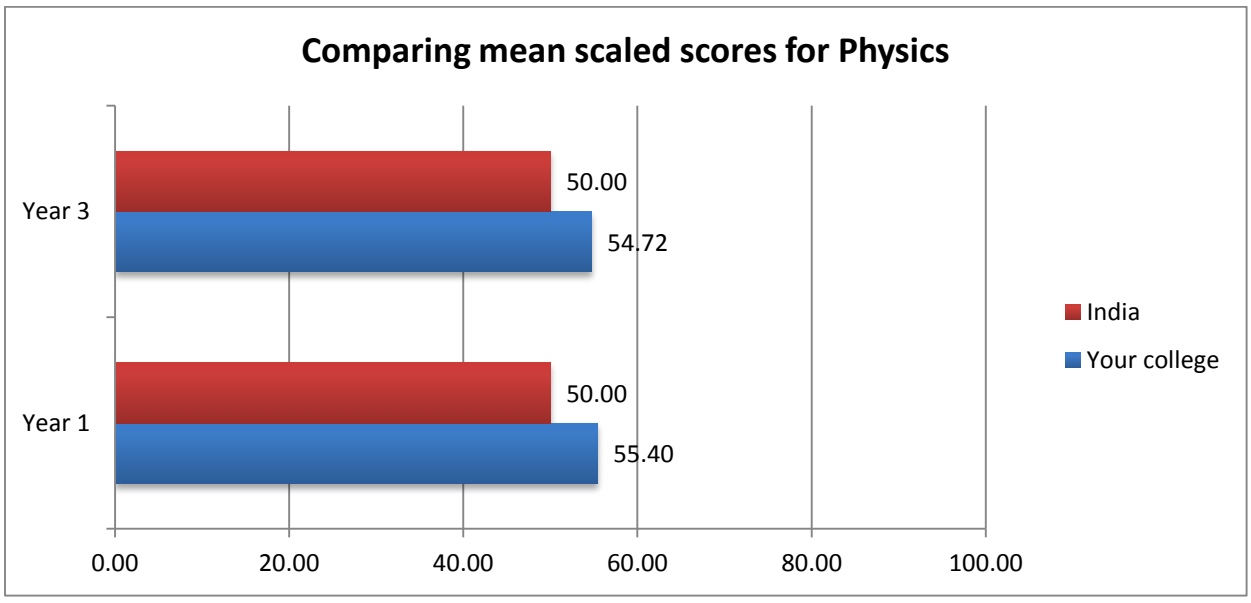


Figure 3. Comparison of Critical Thinking Skill Levels

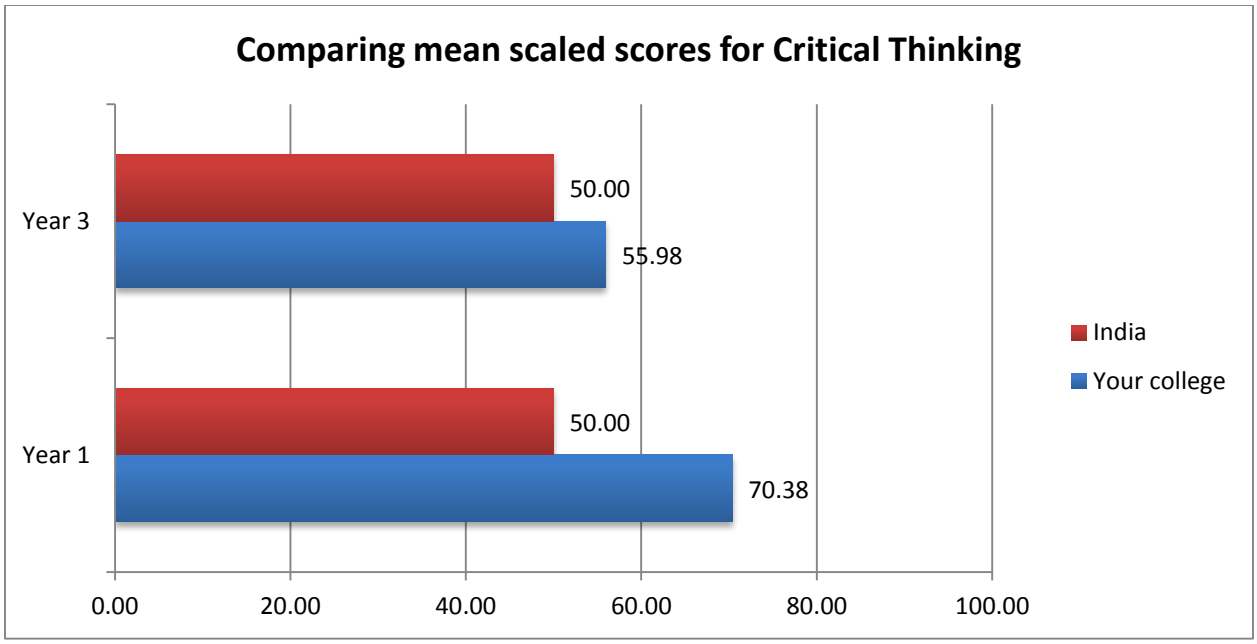


Figure 4. Comparison of Quantitative Literacy Skill Levels

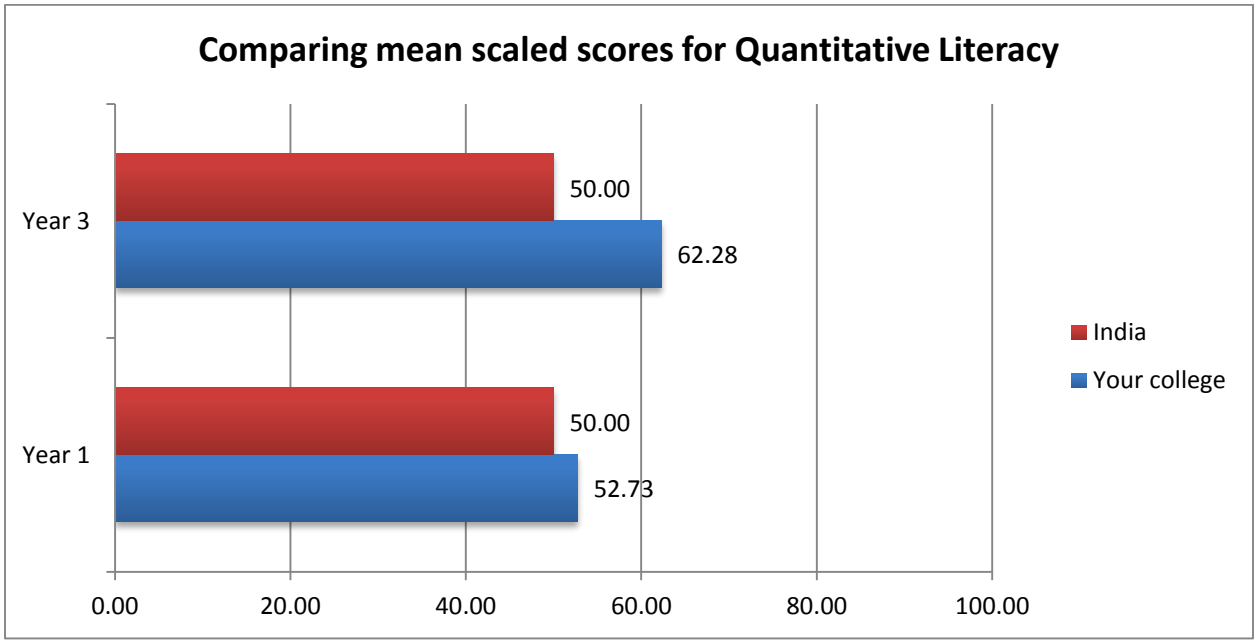
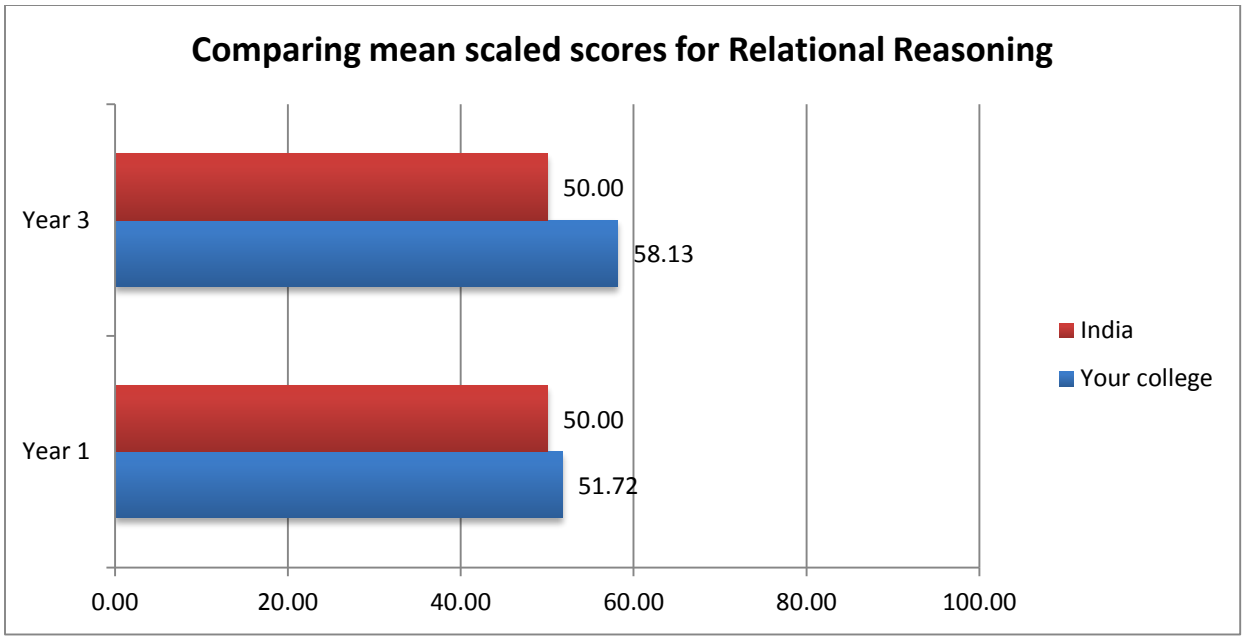


Figure 5. Comparison of Relational Reasoning Skill Levels



Figures 6 & 7 represent the mean scaled scores for different assessments for first and third year students at your college and how they compare nationally.

Figure 6. Mean Scaled Scores for 1st Year Students at your College versus the National Average

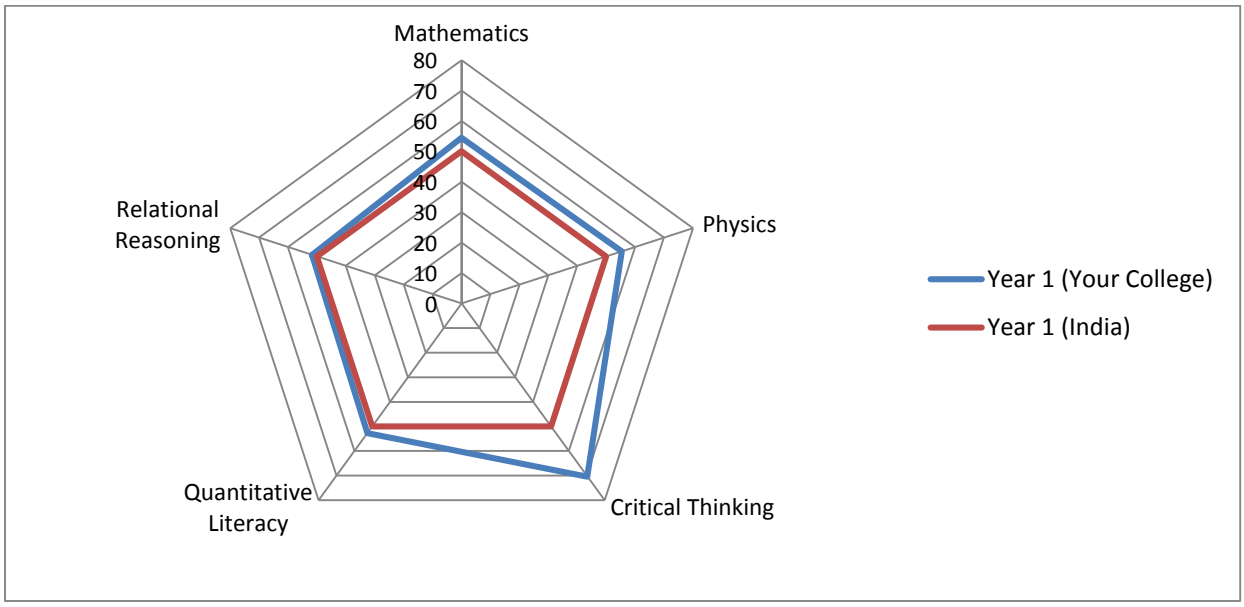
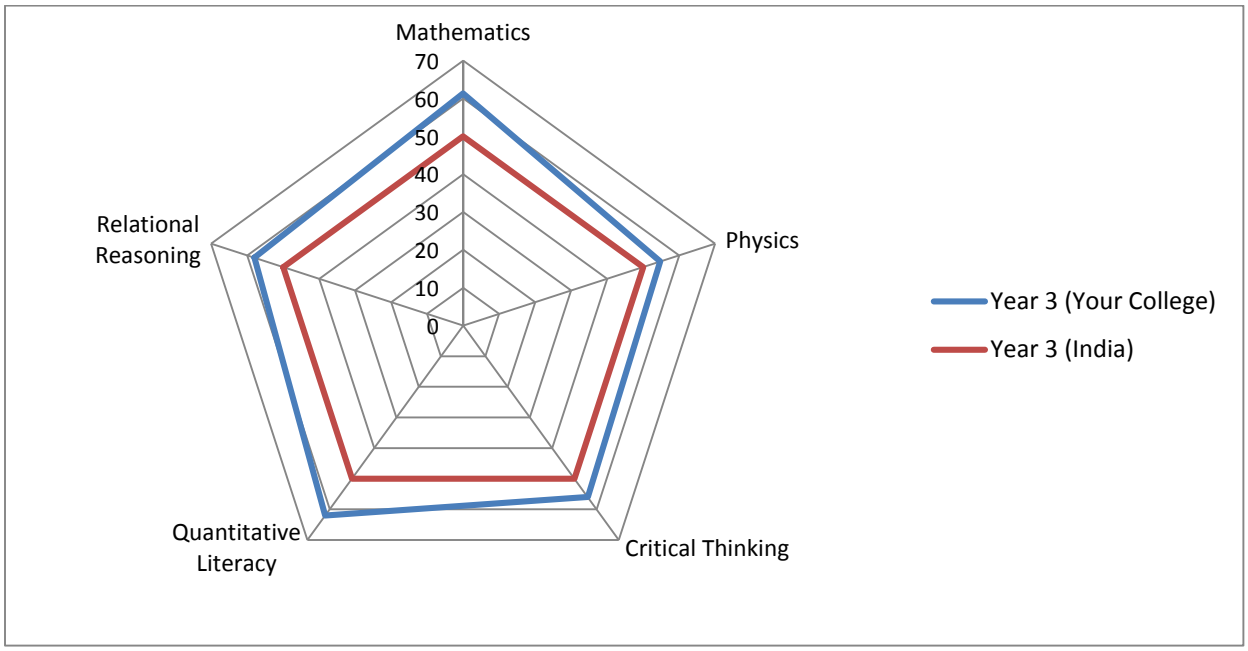


Figure 7. Mean Scaled Scores for 3rd Year Students at your College versus the National Average



Tables 1 & 2 provide the mean scaled scores for different topics (content areas) in Physics and Mathematics for students at your college alongside the national average.

Table 1. Mean Scaled Scores by Topic, Physics

	Topic	**Mean scaled score for your college**	**Mean scaled score for India**
Year 1	Circuits	51.57	50.00
	Electric Fields	52.76	50.00
	Electromagnetic Induction	63.21	50.00
	Mechanics	48.73	50.00
	Oscillation and Mechanical Waves	60.17	50.00
	Optics	56.01	50.00
Year 3	Electric Fields	56.53	50.00
	Magnetism and Magnetic Fields	52.79	50.00
	Electromagnetic Induction	52.72	50.00
	Mechanics (including oscillation and waves)	53.85	50.00
	Optics	51.07	50.00
	Relativity and Quantum Physics	56.44	50.00

Table 2. Mean Scaled Scores by Topic, Mathematics

	Topic	**Mean scaled score for your college**	**Mean scaled score for India**
Year 1	Single Variable Differentiation	75.96	50.00
	Derivatives and their applications	52.33	50.00
	Equations	51.46	50.00
	Functions and Domains	52.26	50.00
	Inequalities	45.18	50.00
	Mathematical Reasoning and Logic	61.92	50.00
	Trigonometric Functions and Equations	60.14	50.00
Year 3	Single Variable Differentiation	56.23	50.00
	Single Variable Functions	59.87	50.00
	Single Variable Integration	60.89	50.00
	Linear Algebra	61.55	50.00
	Multivariate Differentiation	66.67	50.00
	Mathematical Reasoning and Logic	59.61	50.00
	Differential Equations, Probability, Statistics, and Series	44.61	50.00
	Trigonometric Functions and Equations	66.45	50.00