Alternate Admission System for Engineering Programmes in India

Expert Committee

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Ministry of Human Resource Development
Government of India

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Background

The current system based on multiples of entrance examinations for admission into engineering programmes has no parallel in other parts of the world. Most nations employ just one test, mostly, for assessment of scholastic aptitude instead of a plethora of evaluation tests.

The current selection systems in India have, no doubt, resulted in visible benefits; but, the future of Indian youth might need a paradigm shift in admission systems in engineering programmes for ensuring opportunity for larger sections of the society.

The extreme level of competitiveness in the screening processes employed for deciding access to professional education is not without its psychological or sociological implications for the society. They do influence the mindset and behavioural changes among the youth.

The Ministry of Human Resource Development is grappled with the need to design and develop an alternative to the current systems of multiple examinations for deciding admission of students to the engineering programmes in the country. A committee was constituted under the Chairmanship of Professor D Acharya, Director IIT Kharagpur. The Acharya Committee presented in its interim report an alternative to the present examination system for admission into engineering colleges, including IITs. While there was unanimity that the present examination system of JEE and AIEEE etc has to change to reduce the burden on students on account of the multiplicity of entrance examinations, there was emphasis that any new system has to recognize the diversity of learning within the country.

In order to address comprehensively the reality of diversity of learning within the country, the Ministry enlarged the committee with Dr T Ramasami, Secretary, Department of Science and Technology, Government of India as the Chair and Prof Acharya as the expert member from IIT. The enlarged committee consisted of some alumni of IITs including one who passed from an IIT within the last five years. The composition of the committee is as given in **Annexure 1.**

Underlying Philosophy behind Alternatives to current Test Scheme

"Unity in diversity" is the Indian brand value. Unification, while retaining the diversity of educational and learning systems in the country is the underlying strategy of the proposed alternative Test Scheme for deciding admission into engineering colleges, including IITs in the country. An overarching philosophy behind development test schemes taking for reducing the multiplicity of entrance examinations is presented in **Annexure 2.**

Lessons from Acharya Committee Report

The interim report of the Acharya Committee **Annexure 3** formed the main basis on which this alternative test scheme for engineering colleges including IITs has now been developed. Some key recommendations of Acharya committee are:

- Screening based on normalized Board scores at Standard X and/or Standard XII and Multiple Choice examination replacing the two stage JEE from 2006.
- Entry barrier is to be raised to 60% in the +2 examinations.
- Factors, other than the Standard XII marks and All India Rank (AIR) based on Physics, Chemistry and Maths (PCM) testing, such as raw intelligence, logical reasoning, aptitude, comprehension and general knowledge need to be considered.
- Need to factor in school performance more significantly into the selection process.

From the discussions held by this committee the following additional desirable features of the admission process were identified:

- Decision based on one time test needs to be re-examined. Opportunities to improve must be built in.
- Students must be relieved of the pressure of multiple JEEs. Currently a student appears on an average at 5 JEEs all within a few days of the Board Examinations.
- Influence of coaching for JEE needs to be minimised.

- Urban-rural and gender bias has to be eliminated or at least minimised.
- The objective type of examination lends itself to undue influence of coaching. The conventional pen and paper examination with well designed long and problem solving oriented questions should be revived by keeping numbers in any JEE within reasonable limits.
- JEEs, especially the IIT-JEE, have become a huge money spinning activity for coaching centres with attendant undesirable consequences.

Recognising the realities of the current situation in admission system in engineering programmes

The present system of multiple competitive examinations, as observed by Acharya Committee has emerged because of the large demand-supply gap in access to high-quality education in engineering discipline and unevenness in levels of excellence in education in various centres. Diversity challenge associated with various school boards is one of the reasons for the emergence of multiples of entrance examinations for deciding admission into engineering programmes.

It must be recognised that some competitive examinations, such as for example, joint entrance examination conducted by the IITs have proved their process integrity and gained global acclaim. IIT-JEE is a proven system that works. AIEEE is another large scale entrance examination which has gained social acceptance of high levels. Any alternative proposed should match the process integrity and robustness of JEE and AIEEE.

Since millions of talented youngsters compete for less than tens of thousands of slots in elite engineering institutions, the use of high band filters like IIT-JEE or AIEEE may, perhaps, seem essential.

Nevertheless, even while it must be recognised that most high performers in such competitive examinations are extremely talented, it is not clear as to whether IIT-JEE type examinations are not missing a section of talent base, which should not be missed.

Concerns are expressed that the guessing behaviour could be promoted among students seeking admission into engineering programmes by the models being employed by the current examination systems. Psychological and sociological dimensions of such testing and evaluation systems that focus on extremely narrow-width high band-filters are not unimportant. The unintended consequences of asymmetries in the types of clientele and challenges of social behaviour mooted by such extremes cannot be discounted.

Vast majority of youth living in smaller towns and far flung places as well as economically weaker segments of society are not able to join the competitive stream today. For the youth, the future seems to be decided just by success or otherwise in one competitive examination or other. The present system seems to be unwittingly promoting a societal behaviour and a mind set towards differentiation rather than integration.

Alternative test schemes for admission: What should they aim at?

The Alternative Test Scheme should ideally

1. evaluate the ability of the learners rather than their preparedness and competitiveness

2. reveal in a transparent, the latent potentials of the learners to match the emerging opportunities in engineering education sector and link to the development of National economy

3. aim to provide for more proportional representation of various regions and parent income levels without causing rural-urban divides

4. reduce the burden of education administration on faculty in elite engineering institutions so that their higher participation in research and academic roles could be further facilitated

5. match the rigour and process integration of best global models into the currently employed admission systems in engineering programmes in the country and

6. Offer opportunities to retain the “unity in diversity” principle of the country by permitting scientific methods of providing allowance to scholastic performances in various board examinations into deciding admission criteria into engineering programmes in the country.

Process adopted for the developing the Alternative Test Scheme

Education is much too important for any committee to overlook the consequences of inadvertent errors in decision making. Therefore, the committee chose to engage as many stakeholders as possible in designing the Alternative Test Scheme for admission into engineering programmes.

There are many state school boards which conduct their own examination for assessing their students for issuing certificates. Shear diversity of these examinations pose challenges of normalization and deciding eligibility for admission into national centres of excellence.

The multiplicity of competitive examinations leading to duplicity of efforts may be a direct result of diversities and complexities involved in the evaluation of inter-comparison of scoring systems of various school boards. As a result, most elite institutions disregard the performance in school examinations. They develop their own competitive test methods and depend too heavily on ranks and scores. Consistency of performance in different examinations is not considered necessary. Performance in single examination starts to influence the entire career opportunities leading to social implications.

While competitive examinations of the types of IIT-JEE etc based on multiple choices and negative scoring are celebrated, a recent analysis points out inherent limitations

of such systems on the one hand and the benefits of non-negative scoring methods on the other. (See Karandikar, Current Science, 99, No 8, 25th October 2010)

Alternative admission systems for engineering programmes should find innovative ways of retaining the diversity of many school boards and yet derive value from the test scores for making decisions by educational institutions. Such an innovation seems now possible and realistic. In order to select best possible alternatives, a wide spread consultations and a research study were undertaken.

Consultation

Several consultations with stake holders were made. The process of consultation included those with

1. Public through opinion poll
2. States and school boards
3. Educators from elite institutions like IITs
4. Professional Experts in Evidence-based criteria selection and
5. Statistical experts for a Modeling Study for reconstruction of past Scenario

Research Plan

Past data of scores in examinations of different school boards were sourced and analyzed for designing methods for normalization based on sound statistical tools. Evidence based and objective criteria for assessing the inter-operability of test scores of various school boards have been examined by availing the professional help of experts. Different statistical models have been constructed and investigated for reliability and ease of implementation. Systems of evaluation based on technology tools have been prioritized.

Interim report of the Acharya committee has made some important observations and recommendations on Alternative Test System (**Annexure 3**) after their own research findings. Some attempt has been made to reconstruct past scenario using data on students who have passed entrance examinations of IIT-JEE during the last five years.

The committee recommends also a research study involving a pilot test among a select group of students and evaluation of various test models for minimizing number of examinations but not rigor and challenge. It is considered necessary to consult also experts in social sciences in devising a system of reporting test results which ensures sufficient inputs to institutions for decision making and selection of the candidates without leading to negative psychological and sociological outcomes on the youth.

Public Participation in Opinion Survey

On-line opinion survey was carried out among the people of India and public opinions were sought on current competitive examination systems, employed for admission into engineering programmes. Specific views were sought on:

- Multi parametric grading system as against single test models and
- Screening out as against selection strategies

A special questionnaire, presented in **Annexure 4,** was designed and hosted on the national portal of India website maintained by NIC. The survey period remained open for three weeks during 1st and 21st June 2011. More than 2000 people responded to the study. Social network through face book was also established. There were about 400 hits for face book. Detailed report of findings from public opinion has been presented in **Annexure 5.**

The survey sought also information on responder profiles and opinion polls on various models and suggestions for alternative national test systems and on risk mitigation strategies for implementation. Suggestions received are complied in the report on public opinion presented in **Annexure 5**.

Analysis and Internalization of Some Key Recommendations emanating from Pubic Opinion

An overwhelming majority of respondents (more than 70%) for the public opinion poll express their support for Alternative Test Schemes recommending avoidance of multiples of entrance examinations for admission into engineering education in the country. Support is evidenced from public opinion for a) weighing in some

transparent manner scores obtained in school board examinations, b) a mix of aptitude (like Scholastic Aptitude Test, SAT of USA) and advanced test (like IIT Joint Entrance Examination), c) offering more than one chance for candidates to take the National Level Test and d) conducting the national level test more than once in each year.

One of the serious concerns expressed by public with respect to both National Level Test and School Board Examinations is the level of process integrity in setting the question papers and in the conduct of the examinations. These are presented in **Annexure 5.**

Consultation and Cooperation with School Boards

Consultations were made with school boards for seeking permission for access to data access and enrolment of boards for undertaking research. An attempt was made to learn the concerns of states and school boards. The committee believes that it is necessary to build social trust for the alternative admission systems among the stake holders. Innovations are required for managing the diversity challenges of school board scores before they could be employed for deriving inputs for alternative systems to admission systems in elite engineering institutions like IITs.

Consultation with faculty of Elite Institutions and Opinion Leaders in Academic Bodies

Consultation with faculty of some elite institutions and opinion leaders in academic bodies has been made in the process of development of an alternative admission system. This consultation process, at various stages, focused on a) learning about their concerns, b) gathering experience, c) debating alternatives and d) building trust. The faculty and Directors of IITs participated in the selection of various approaches. Results of the public opinion survey were presented to a committee of Directors of IITs. A copy of report contained in **Annexure 5** was provided to Directors of IITs for their study. The committee believes that enrolment of faculty involved in some of the competitive examinations is critical because they form truly important share holders.

The consultation attempted to a) address the concerns of senior faculty, b) test some of the hypothesis, c) convince faculty with opposite views, if any, and d) enroll some of the faculty in implementation work.

Research on Examination Methodologies for Screening for Admission into engineering programmes

1. Work of experts of Indian Statistical Institute for normalization of scores of various school boards

Selection of evidence-based and objective criteria is critical for the acceptance of alternatives in preference to the currently established admission systems, which enjoy a high level of acceptance of the stake holders and share holders. Application of rigorous research methodologies based on open minded research has been considered necessary. A team of experts was assembled to work on a time bound manner. Evidence-based identification of criteria was the focus for development of alternatives to the current admission systems.

One of the most important points considered necessary by both this committee and Acharya Committee is that there should be a rigorous and scientific approach to factor-in scores of school boards into admission systems for engineering programmes in the country.

Indian Statistical Institute (ISI) the leading institution was assigned the task of developing methods for normalization of data on scores emanating from a various school boards. For the pilot testing of normalization concepts, data from Central Board of Secondary Education (CBSE), Tamil Nadu State School Board Examination (TNSSBE), West Bengal State Board examination (WBSSBE) and Indian Council for School Examination (ICSE) were selected. The findings of experts from ISI are presented in **Annexure 6 and 6A.**

ISI carried out all the required research investigations. For the same school board, data were analyzed as per equations 1 and 2.

$$\frac{X_1 - X_2}{X_3 - X_2} \qquad \textbf{eq. 1}$$

Where X_1 = is the mark obtained by each candidate, X_2 = is the mark of the selected percentile rank holder, X_3= is the maximum mark scored by any candidate. In this correlation, scores will range between 0 and 1 as shown in **Figure 1**(Anenxure-6). In the correlation of ratios of scores obtained by candidate and score of the percentile cutoff selected as in **Eq.2** seems to maintain linearity over a larger range as in **Figure 2**. (Anenxure-6).

$$\frac{X_1}{X_2} \qquad \textbf{eq. 2}$$

Stability of scores of each board over different years was first tested out by examining the profiles of percentile scores over a period of time. Experts of ISI reported that through monotone transformation, it will be possible to map the profiles of all boards onto one selected board and create a normalization routine. Profiles for the four boards are presented in **Figure 3 and 4** (Anenxure-6).

Normalized percentile ranks with different cut offs for all boards have been computed (as for example 75%) as in eq 3

$$\frac{(\text{Percentile rank of student} - 75)}{100-75} \times 100 \qquad \textbf{eq.3}$$

When normalized percentile rank is correlated against percentile rank with say cut-off at 75%, a linear relation is obtained as in **Figure 5** (Annexure-6). Experts from ISI report that the same linear correlation as in **Figure 5** (Annexure-6) will be the same for any board for any year.

2. Some Recent Work on Selection of Types of Examinations for Screening

Recently Karandikar (Current Science, 99, no 8, October 2010, **Annexure 7**) has analyzed the consequences of multiple choice tests and negative marking as practiced recently in several screening examinations. Such methods are employed also in the entrance examinations employed for admission into engineering programmes in the country. Impact of marking schemes with negative scoring and multiple choices has been examined using principles of statistics. Models were

postulated for distribution of marks and guessing behavior of the candidates when they do not know the correct answer. The work has simulated statistical outcome of such tests and probabilities of candidates who should not have been selected getting selected because of random guessing. Probabilities of gate-crashing into the selection list through multiple choice examinations with unique right answer and negative marking have been examined.

The work highlights the value of traditional question-answer tests where the candidate is required to write down the solution along with steps rather than objective tests with multiple choices and one right answer. The work recommends that if for practical reasons, screening tests were to resort to multiple choice tests where evaluation is done through the use of computers, a better alternative would be to design tests with more than one correct answers and give credits based on students selecting all right answers and not select any wrong answer.

The recent work of Karandikar further reiterates and supports the position of the Committee that some weighting of the school board examinations would be gainful. Since School boards could deploy the traditional question-answer tests where a candidate is required to write down solutions, any weighting scheme which allows considerations for the scores obtained in school boards would be valuable based on the recent work of Karandikar.

The merits of conducting objective tests based on multiple choices for testing advanced knowledge of candidates for admission into education programmes are to be evaluated in light of other factors as well. Whereas such tests are useful for assessing the aptitude, proficiency in advanced knowledge is perhaps better tested out through tests where the candidates are expected to write down the solutions, as was the case in IIT-JEE in earlier years and school board examinations currently.

General Approach Suggested for Alternative Admission System for engineering programmes

The committee suggests an approach to employ scores obtained by the same candidate in different types of examinations rather than to rely entirely upon the performance in one screening type examinations like IIT-JEE or AIEEE

Now that a reasonable model has been devised by professional experts from ISI for normalization of score from different boards, the committee recommends one of the two possible specific approaches.

Approach 1

- weighing consistency of performance in school board examinations and employ them for testing ability to write solutions and
- One objective screening test with two sections; one for testing the aptitude and the other advanced knowledge in domain areas.

Approach 2

- weighing consistency of performance in school board examinations and employ them for testing ability to write solutions and
- one objective aptitude test based on multiple choices and computer based correction systems

Objective tests for assessment of aptitude employing multiple choices and evaluation using computer assisted testing could be designed in the general pattern of Scholastic Aptitude Test of the USA.

Advanced tests for evaluating knowledge in domain areas could be designed and fashioned in the shape of Joint Entrance Examination of IITs with one improvement suggested by Karandikar, namely choices of answers bearing more than one right answer and avoiding Gate-crashing of the wrong candidates into the selection list.

Both Aptitude and Advanced tests could be included in the same paper, giving the option of choosing to take both aptitude and advanced knowledge or not to the candidate.

Each candidate might be permitted a maximum of three chances to take the National Level Screening Test. The committee recommends that National Level Screening Test could be conducted at least twice a year.

Individual institutions could be given the liberty of choosing weighting factors for different examinations within a specified guideline. For example, IITs could choose about 40% weighting for school board scores and 30% each for aptitude and advanced tests respectively whereas some other state based institution could weigh school board scores as per the revised normalized system as high as 70% and National Level Screening Aptitude test at 30%.

The committee believes that it is important to avoid multiple screening tests and proportional weighting of multiple types of tests already being conducted which would avoid outweighing one mode of testing, where preparedness and gate crashing of non-ideal candidates could not be ruled out.

Suggestions for Factorizing Normalization of board scores into screening process

Aggregate percentage scores of candidates in class XII examination of their respective boards could be first converted into percentile ranks of their own respective boards and then normalized through percentile ranks as in eq.3 for common cut off and each candidate is accorded normalized percentile rank irrespective of the board which conducted the examination. This could be expressed in the form of normalized grade for school board and termed as $\mathbf{A_1}$.

A similar exercise could be carried out also for the aggregate percentage in the subject examinations of relevance to the higher education desired by the candidate for example all science subjects for seeking admission into engineering and termed as $\mathbf{A_2}$.

By according equal weighting to both aggregate percentages and subject scores, half of (A_1 + A_2) could be computed for each candidate and $\mathbf{A_3}$ reported as corresponding to class XII performance.

Performance at the National Level Screening Test in the aptitude section could be evaluated separately and accorded a national score **A_4**.

Performance at the National Level Screening Test in the advanced section could be evaluated and each candidate is accorded a National score **A_5**.

Suggestion of different options

Option 1: Deployment of Scores as criteria based on class XII performance only

- **Equal weighting of school board scores $A_1$and A_2**
- **Equal weighting of aptitude scores A_4 and advanced scores A_5**

  Normalized score = $\{A_1 + A_2 + A_4 + A_5\}/4$

Option 2: Deployment of Scores as criteria based on class XII performance only

- **Equal Weighting of board score A_3**
- **Equal Weighting of Aptitude scores A_4 and A_5**

  Normalized score $=\{A_3 + A_4 + A_5\}/3$

Option 3: Deployment of Scores as criteria based on consistency of performance at class X and Class XII levels as well as in National Level Aptitude and Advanced Tests

- **Equal weighting for aggregate as well as subject performance at class X and Class XII levels where) 0.1X (normalized score at class X in aggregate + normalized score at class X in subjects of choice + normalized score at class XII + normalized score at class XII in subjects of choice)**
- **One third weighting of aptitude score 0.3 A_4**
- **One third weighting of advanced score 0.3 A_5**

  Normalized score = 0.1{ Normalized aggregate class X + normalized class X subject score + Normalized class XII aggregate + Normalized class XII subject score} + 0.3 $A_3$and 0.3 A_5

Option 4: Deployment of School Board Performance as screening but not as determinant for National ranks

- **Specify a Cut-off normalized percentile rank score for school performance say as 80 or 85 percentile rank**
- **50% weighting of National Level Aptitude score A_4 for candidates passing the cut off of percentile rank**
- **50% weighting of National Level Advanced Score A_5 for candidates passing the**

Normalized score **$= 0.5\ A_4 + 0.5A_5$**

Option 5: Deployment of School Board performance as subject score and National Level Aptitude Test as a combination and avoid the Advanced Testing system according freedom for the individual institutions to select mixing proportions within a pre-specified guideline

Option 6: Equal weighting of School Board performance as subject score and National Level Aptitude Test as objective test system where

Normalized score **$= 0.5\ A_2 + 0.5A_4$**

Further Work Suggested

1. There are as many as 42 school boards in the country conducting examinations at school levels. They conduct examinations in slightly varying schedules. Such differing schedules may pose challenges. Some work may be required to align the time schedules of board examinations and National Screening Tests.

2. Although ISI seems to have developed a scientific methodology for normalization of school boards' scores based on a pilot study involving four typical school boards, it may be necessary to access data from all the 42 boards and test run the findings of the experts of ISI.

3. It will be beneficial to apply the recommended methodology on candidates selected for admission into IITs, NITs during the last four years using the data on current students sourcing data from IIT-JEE and AIEEE as well as school boards scores at class X and XII levels. This will help us ground truthing and revalidation of proposed methods.

Recommendations of the Committee

The committee makes the following recommendations for the consideration of the IIT council

A. Normalization of School Board Scores

- ISI has proposed a method for normalization of scores of candidates of various school boards and demonstrated its potential to derive normalized scores. This method seems to offer possibility to factorize performance in school board examination as a criterion for merit-ranking of students for admission into higher education.
- ISI may be commissioned by IIT Council to further refine the methodology and establish it's potential by proving its utility for normalization of all board scores over a period of time based on past data.
- The method of ISI may be revalidated by some other institution as well for ease of application

B. National Screening Test Scheme

- One National Screening Test (NST) with two sections namely Aptitude and Advanced could be designed and developed.
- The test could be of 3.5 to 4 hour duration with an option for the candidates to opt out of advanced test after examining the paper for say 15 minutes.
- Aptitude test section could employ multiple choice questions which enable evaluation using a computer
- Advanced Test section could involve multiple choices with multiple right answers and minimization of Gate-crashing by candidates with limited merit
- An expert committee of educators could be constituted for designing best fit models of National Screening Test methodologies

C. Testing and Evaluation related Organizational matters

- IITs may be assigned the task of designing the Alternative Screening Test
- While question papers may be set-up by experts drawn from educational institutions like IITs, IISc, NITs etc, the logistics support for conducting and evaluating examination papers may be assigned to a specialist organization taking into account of the large scale of the operation and need for professionalization.

D. Enrollment of Policy Bodies

- A project for creating past scenario may be commissioned to IITs, NITs and leading universities based on employing methods developed through research.

E. Order of Preference of the Committee

The committee has considered various options. Some order of preference is indicated for discussion and finalization by the council of IIT for making decisions.

Recommended order of Preference of options

1st Preference: ***Option 2***

Equal weighting of school board scores at class XII (of both aggregate and science scores) A_3, national level aptitude, A_4 and Advanced A_5 scores, $\{A_3 + A_4 + A_5\}/3$

2nd Preference: ***Option 6***

Equal weighting of School Board performance as subject score and National Level Aptitude Test as objective test system;

$0.5\ A_2+0.5A_4$

3rd Preference: ***Option 5***

Deployment of School Board performance as subject score and National Level Aptitude Test as a combination and avoid the Advanced Testing system according freedom for the individual institutions to select mixing proportions within a pre-specified guideline

4th Preference: ***Option 4***

Deployment of School Board Performance as screening but not as determinant for National ranks (as for example Specified Cut-off: normalized percentile rank score for school performance say as 80 or 85 percentile rank)

Equal weighting of National Level Aptitude score A_4 for candidates passing the cut off of percentile rank and Equal weighting of National Level Advanced Score A_5 for candidates passing the cut off of percentile rank; $(0.5\ A_4 + 0.5A_5)$

5th Preference: *Option 1*

Deployment of Scores as criteria based on class XII performance

Equal weighting of school board scores $A_1$and A_2 and Equal weighting of aptitude scores A_4 and advanced scores A_5 ;

$\{A_1 + A_2 + A_4 + A_5\}/4$

6th Preference: *Option 3*

Deployment of Scores as criteria based on consistency of performance at class X and Class XII levels as well as in National Level Aptitude and Advanced Tests

Equal weighting for aggregate as well as subject performance at class X and Class XII levels where) 0.1X (normalized score at

class X in aggregate + normalized score at class X in subjects of choice + normalized score at class XII + normalized score at class XII in subjects of choice); One third weighting of aptitude score 0.3 A_4

One third weighting of advanced score 0.3 A_5 ;

0.1{ Normalized aggregate class X + normalized class X subject score + Normalized class XII aggregate + Normalized class XII subject score} + 0.3 $A_3$and 0.3 A_5

Concluding Remarks

Complexities of developing alternative test schemes for deciding admission in engineering programmes arise from a) diversity and b) scale of operations. The committee is conscious of the ground realities and the challenge of suggesting alternative methods for some test and evaluation systems, which have gained social esteem and trust. Therefore, the committee has relied on scientific tools for gathering evidence as much as possible and not on perception based approaches. The committee is of the view that changes in paradigms are essential in this phase of development of India.

One National Screening Test for admission into engineering programmes supported by methodologies for factorizing scores obtained in school board examinations while retaining their diversities seems the way forward. The committee does make a strong case for such a change in paradigm.

Some options have been recommended. The committee has consciously adopted a probabilistic rather than deterministic approach taking into account of complexities involved in the exercise. The committee is also conscious of the fact that some of the recommendations may have relevance outside the scope of admission into IITs into other engineering programmes.

As a measure of abundant caution, the committee recommends selection from among the six options by an expert committee taking into account of challenges of convincing the society of the security of normalization methodologies of scores of school board examinations developed by ISI on the basis of scientific tools.

Acknowledgement

The committee thanks the Ministry of Human Resource Development for the opportunity to participate in this important National endeavor. Members of the committee have consulted several experts and students individually and collectively. Many experts from NIC, DST, IITs, ISI, Chennai Mathematical Institute and general public participated in this study and in preparation of this draft report. Their support and cooperation is acknowledged. The help of Dr. Parveen Arora, Scientist, Department of Science and Technology in preparation of the report is gracefully acknowledged.

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Post Script

The draft report was presented to the IITs Council in the meeting held on 14th Sept, 2011 at IIT, Delhi. The Council has accepted and approved the principle enshrined in the report.

The Council has authorized a small group of IIT Directors to meet and select the preferred options while indicating the preference for Option 2 and 6.

The Committee recommended that an Internal Committee may analyse and select the preferred options from among those recommended in this report.

There is a latent potential to enlarge the scope of this work and embark upon a single National Test Scheme for admission into tertiary education after due consultations with States and other experts from the academic sector.

While the challenges involved in formulating a National Test Scheme would be enormous, the benefits to the next generation of learners could be significant. The Committee recommends a further examination of the possibility for a national test scheme for tertiary education after due consultations and examination.

ANNEXURES

Annexure - 1

F.No. 19-4/2010-TS.I
Government of India
Ministry of Human Resource Development
Department of Higher Education
Technical Section – I

Shastri Bhawan, New Delhi,
Dated 11th November, 2010

To

Dr. T. Ramasami,
Secretary,
Department of Science & Technology,
Technology Bhavan, New Mehrauli Road,
New Delhi – 110 016.

Subject: Constitution of a Committee to assess the examination and admission system in engineering programmes

Sir,

Please refer to the discussion during the 41st meeting of the Council of IITs held on 10.09.2010, *inter-alia* deciding to constitute a Committee headed by you to assess the examination and admission system in engineering programmes. Hon'ble HRM has approved the inclusion of following persons / experts in your team.

(1) Prof. Damodar Acharya, Director, IIT Kharagpur
(2) Dr. B.K. Gairola, Director General, NIC
(3) Shri Vineet Joshi, Chairman, CBSE
(4) Shri Hari Bhartia, Co-Chairman & M.D. Jubilant Organosys (IIT alumni)
(5) IIT alumni who has passed out recently (to be selected by Dr. Ramasami)

Yours faithfully,

(Ashok Thakur)
Additional Secretary to the Govt. of India
Tele. # 2338 3202
e-mail : athakur.edu@nic.in

Annexure 2

National Test Scheme for admission into Tertiary Education in India

Underlying Philosophy and Principles

Prepared by

T Ramasami
Committee for Designing National Test Scheme
and
Secretary Department of Science and Technology
Government of India

As a Document for Public Consultation

April 2011

Background

It is needless to state that provision of equal access to higher learning for all regions of the country and all sections of population is both a social and economic necessity.

Right to education is an enunciated public policy of the Government of India. It is a commitment of the nation to her citizens. It is not just a lofty principle nor is it merely a legal provision.

To realise this underpinning philosophy, there is a need for an ecosystem that connects the talent of the youth with equitable opportunity for tertiary education.

The document is prepared and placed in the public domain for making clear to the citizens of the country the spirit and objective of designing and establishing a National Testing System for selecting students for admission to tertiary education.

The current system based on multiples of competitive examination has no parallel in other parts of the world. Most nations employ just one test for assessment of scholastic aptitude instead of a plethora of evaluation tests.

The current selection systems have, no doubt, resulted in visible benefits. But, the future of Indian youth might need a paradigm shift that ensures opportunity for larger sections of the society.

The extreme level of competitiveness in the screening processes employed for deciding access to professional education is not without its psychological or sociological implications for the society. They do influence the mindset and behavioural changes among the youth.

``Unity in diversity'' is the Indian brand value. Unification, while retaining the diversity of educational systems in the country is the underlying strategy of the proposed National Test Scheme. It is motivated by the principle of inclusion for a collaborative excellence rather than exclusion through competitive excellence.

Recognising and respecting the realities of the current situation

The present system of multiple competitive examinations has emerged because the demand-supply gap in access to tertiary is large and levels of excellence in education centre are uneven.

It must be recognised that some competitive examinations, such as for example, joint entrance examination conducted by the IITs have proved their process integrity and gained global acclaim. IIT-JEE is a proven system that works. Any alternative proposed should match its process integrity and robustness.

When millions of talented youngsters compete for less than 10,000 slots, the use of high band filters may, perhaps, seem essential.

Nevertheless, even while it must be recognised that most high performers in such competitive examinations are extremely talented, it is not clear as to whether IIT-JEE type examinations are not missing a section of talent base, which should not missed.

Psychological and sociological dimensions of such testing and evaluation systems that focus on extremely narrow-width high band-filters are not unimportant. The unintended consequences of asymmetries in the types of clientele and challenges of social behaviour mooted by such extremes cannot be discounted.

Vast majority of youth living in smaller towns and far flung places as well as economically weaker segments of society are not able to join the competitive stream today. For the youth, the future seems to be decided just by success or otherwise in one competitive examination or other. The present system seems to be unwittingly promoting a societal behaviour and a mind set towards differentiation rather than integration.

What are the requirements for alternative models? What should a national test scheme aim at?

A National Test Scheme should ideally

1. evaluate the ability of the learners rather than their preparedness

2. reveal in a transparent, the latent potentials of the learners to match the emerging opportunities in tertiary education sector and the economy

3. aim to provide for more proportional representation of various regions and parent income levels

4. bridge the rural-urban divides

5. reduce the burden of education administration on faculty to ensure their higher participation in research and academic roles

6. match the rigour and process integration of be best among the available national test systems globally.

The process for the development of the national test scheme

Considering that education is a too important and a highly critical social endeavour for any one to overlook the consequences of inadvertent errors in decision making, it is necessary to engage as many stakeholders as possible in designing the system.

One can also not ignore that in the federal set up of the country the concurrent responsibilities of the States and the Centre are respected and taken on board.

There are many state school boards which conduct their own examination for assessing their students for issuing certificates. Shear diversity of these examinations pose challenges of normalization and deciding eligibility to admission in national centres of excellence.

The multiplicity of competitive examinations leading to duplicity of efforts may be a direct result of diversities and complexities involved in the evaluation of inter-comparison of scoring systems of various school boards. As a result, most elite institutions disregard the performance in school examinations. They develop their own competitive test methods and depend too heavily on ranks and scores. Consistency of performance in different examinations is not considered necessary. Performance in single examination starts to influence the entire career opportunities leading to social implications.

National Test Scheme should find innovative ways of retaining the diversity of many school boards and yet derive value from the test scores for making decisions by educational institutions. Such an innovation seems possible and realistic. This would however call for coordination and cooperation of many players. Hence consultation and enrolment of many players are essential.

Consultation

A Six-stage consultation is planned. The planned process of consultation includes those with

1. Public through opinion poll
2. States and school boards
3. Faculty and Professional Experts
4. Alumni for participation in path selection
5. Global experts in Evidence-based criteria selection and
6. Statistical experts for a Modeling Study for reconstruction of past Scenario

Research

Past data on school boards and several competitive examinations would be sourced and analyzed for construction of past scenario. Evidence based and objective criteria for assessing the inter-operability of test scores of various school boards would be

examined by accessing global expertise. Various statistical models would be constructed and investigated for reliability and ease of implementation. A transparent system of evaluation based on technology tools would be examined. The design process envisages also research study involving a pilot test among a select group of students and evaluation of various test models for minimizing number of examinations but not rigor and challenge.

Sensitive Reporting of Results

It is proposed to consult experts in social sciences in devising a system of reporting test results which ensures sufficient inputs to institutions for decision making and selection of the candidates but not lead to negative psychological and sociological outcomes on the youth.

Public Participation in Opinion Survey

It is proposed to seek public opinion on best models for National Test Schemes. On-line opinion survey among the people of India is planned and survey would largely seek public opinions on

- For multi parametric grading system as against single test models and
- Screening out as against selection strategies

Of current competitive examination systems.

The survey would seek information on responder profiles and opinion polls on various models. It would also seek suggestions for alternative national test systems and on risk mitigation strategies for implementation.

As a pragmatic approach, the survey time slot will remain open for specified periods of time and the survey results would be made available to public after statistical analysis.

Consultation and Cooperation with School Boards

Two stage consultations with school boards are planned. The first stage consultation would seek data access and gathering, board enrolment, learning the concerns of states and school boards and building social trust among the partners for

undertaking research on innovations for meeting the diversity challenges of school board results for deriving inputs for national test scheme.

Second stage consultation would focus on Testing concepts, gaining ownership of school boards, addressing the stated and unstated concerns of states, earning the will of different school boards and ensuring process integrity.

Consultation with faculty of Elite Institutions and Opinion Leaders in Academic Bodies

Consultation with faculty of some elite institutions and opinion leaders in academic bodies is considered a necessary step in the development of a successful National Test Scheme. This consultation process should take place at all stages but should focus on a) learning about their concerns, b) gathering experience, c) debating alternatives and d) building trust. The faculty should form an integral part of selection of various approaches and lead to enrolment of the faculty as share holders.

At later stages the consultation should lead to a) addressing the concerns, b) testing of hypothesis, c) convincing of antagonists, d) finalization of selected approaches and e) enrolment of faculty in implementation work.

This step could be involved and complex. Without sufficient number of champions for the National Test Scheme among the faculty of elite institutions and opinion leaders, the scheme is not likely to succeed in an environment al ready there are several competing examinations which have gained social trust and credibility. This step is vital to the future success of the National Test Scheme.

Consultation with Alumni in selection of alternative paths for National Test Scheme

It is widely believed in market force economy, brand building is all about building consumer confidence through value propositions. Some of the elite schools in engineering in the country have built their brand value through their alumni base. Strength of Alumni base for some elite institutions is large. They also form strong opinion builders in the modern society. Brand building involves projection of value proposition to users differentiated from other products. Alumni of Elite institutions in

the country have effectively marketed their educational background through their own differentiated performance. Is it is necessary to establish linkages with new National Test Scheme with informed alumni if the new system should survive in the market place.

A select group of alumni base of elite institutions in the country will be selected for on-line consultation based on quality of responses during survey of public opinion. Such an alumnus base will be used as sounding board for testing out various models and suggestions at various stages but using IT enabled tools without the need for direct face to face contact. At the stage of finalization, some select and quality responders to the study will be invited for a consultation with the committee.

Research methodologies planned

Selection of evidence-based and objective criteria is critical to the acceptance of the National Test Scheme by the stake holders and share holders. This would call for application of rigorous research methodologies and open minded researchers. A research team of experts would be assembled to work on a time bound manner and provide evidence based criteria for development of National Testing Scheme. It should be possible also to learn from the global experience of other countries in designing and developing test schemes for admission into tertiary education.

What should the National Test Scheme deliver?

The National Test Scheme should deliver for the country a) well and carefully designed testing systems, b) relative weightings of different inputs based on research data, c) a transparent Implementation strategies, d) assessment of risk factors complete with risk mitigation protocols and e) ability to gain social trust in the new approach in limited number of years of implementation.

Delivery of desired goals is not possible without an acceptable level of stake holder enrolment to the alternative models.

Concluding Remarks

We are extremely conscious of the dimensionality of the challenge of "trying to fix something that society trusts to work". It is a non-formidable challenge. Developing a transparent testing system with water tight process integrity matching at the least IIT-JEE level is not impossible, but is not likely to be easy. There is pluralistic perception of the society perception. Such a diversity of perception could be bridged through concrete scientific evidence and logic based decision support system, in our opinion.

It is true that this is not the first time in which a National Test Scheme had been proposed. There have been similar attempts earlier without success. Some times societal preferences travel backwards like lobster to take into account and advantage of new opportunities which become available with development of tools and technologies. This attempt is one such honest effort to "reduce the burden of competitive examinations on the youth of India". Psychological and sociological impact of current systems of enrollment into tertiary education may demand a change, if all the benefits of a system that works could be imbibed without sacrifice of rigor and integrity. Let is attempt to address the challenge with an open mind. India's future needs such the combined wisdom of millions and not many individuals.

ANNEXURE - 3

Alternative to IIT-JEE, AIEEE and State JEEs

An Interim Report

Submitted by the Committee

Prof. Devang V. Khakhar	**Member**
Prof. S. C. Saxena	**Member**
Prof. M. S. Ananth	**Member**
Prof. D. Acharya	**Chairman**

September 1, 2010

Content

ALTERNATIVE TO IIT- JEE, AIEEE AND STATE JEEs

The following Committee was formed vide Order No. F.19-2/2010-TS.I dated, 8th March, 2010 (Copy given in Annexure-I) to explore possible alternatives to the present IIT-JEE, AIEEE and other State Joint Entrance Examinations for admission to engineering programmes in the country:

1. Prof. D. Acharya, Director, IIT Kharagpur - Chairman
2. Prof. M. S. Ananth, Director, IIT Madras - Member
3. Prof. Devang V. Khakhar, Director, IIT Bombay - Member
4. Prof. S. C. Saxena, Director, IIT Roorkee - Member

The Committee also had the mandate of streamlining and rationalizing other examinations such GATE, JMET, JAM etc. The Committee was advised to invite / associate Chairman CBSE, COBSE officials and Chairman CCB for AIEEE.

The Committee met six times:

(1) On 16th March, 2010 in IIT Madras. Chairman, COBSE, COBSE officials, Chairman CCB, AIEEE, JEE Chairman of all IITs were present. The Committee took cognisance of the report of the IIT-JEE reform committee set up by the Directors in 2007 with Prof. V. G. Idichandy, Deputy Director, IIT Madras as Convenor and the findings of Prof. A. N. Samanta, Chairman, JEE, IIT Kharagpur in 2010. Prof. M. Anandakrishnan, former VC, Anna University, shared the experience of Tamil Nadu in the abolition of JEE in the state and admission based on the normalized +2 results with the Committee. The Committee discussed the JEEs and their impact on school education in general and technical education in particular and prepared a document suggesting alternatives.

(2) Four different consultations were held with the stakeholders in different zones.

- In Kolkata (East Zone) on May 17, 2010
- In Delhi (North Zone) on May 19, 2010
- In Hyderabad (South Zone) on May 25, 2010 and
- In Mumbai (West Zone) on May 31, 2010

The stakeholders included the Vice Chancellors / Directors of the Universities, Secretaries of Technical Education and Directors of NITs and one of the Directors of IISER. The MHRD was represented by the Additional Secretary and a Director in some of the consultations. While the Chairman of IIT Delhi participated in Delhi consultation, the Chairman of IIT Kanpur participated in both IIT Madras and IIT Hyderabad consultations. The Directors and senior colleagues of IIT Delhi and IIT Bombay

participated in the consultation meetings held in these Institutions. Director IIT Hyderabad participated in the consultation held in Hyderabad. Representatives of the Directors of IIT Patna, Guwahati, Bhubaneswar and Ropar participated in Kolkata consultation.

(3) The outcome of these consultations was discussed by the Committee on 15th June in Kolkata and a draft proposal was prepared. The proposal was then circulated in IITs for wider consultations.

(4) The Directors of the IITs met in IIT Kharagpur on 11th July 2010 to deliberate on the proposal and arrived at a consensus on the proposal on a subject test for select few and on making the merit list available to all those Institutes who have research and innovation focussed education.

(5) The proposal was discussed with the members of COBSE in Delhi on August 27, 2010 to ensure the full support and cooperation of School Boards in bringing in desired reform in Plus 2 education.

1. Joint Entrance Examinations

Joint Entrance Examinations are being conducted to admit students to a group of Institutions offering degree programmes in Engineering, Medicine, Pharmacy, Architecture, Management, and Computer Applications. Students from various Boards at XII level whose curriculum, syllabus and standards vary appear at All India, State and Institution level JEEs. Each JEE prescribes its own syllabus which may be different from or similar to a Board's syllabus. Each JEE serves as a common base to evaluate students from various Boards and rank them in the order of their test score.

The JEEs differ in terms of the syllabus and the method of examination and evaluation. This calls for extra preparation and coaching. The performance in the JEE is the sole basis of ranking. Other inputs such as XII performance, aptitude, teachers' feedback etc. to judge the merit and suitability of a student are conspicuously absent in the admission process.

The Common Entrance Examination (CEE) for admission to IITs in 1961 evaluated students on a common curriculum and syllabus. CEE did away with the multiplicity of tests, minimised costs and inconveniences to the students. The test format was designed to evaluate the higher analytical skills and ability to use combination of concepts in solving problems. Test of English, General Knowledge, Engineering Drawing etc. helped to evaluate the communication, aptitude and general awareness of the students. The

students were ranked based on CEE Score and Institution – Branch of study allocation was done as per the choice of the student and availability of seats.

Institutions like IITs used the All India Rank. The State conducted JEEs used the State level rank for admission to State level Institutions. AIEEE used both All India and State level ranks to facilitate admission to Institutes having both State and Central quota. Other Institutions also used these ranks to admit students as per their requirement. All JEEs also prepared ranks category-wise (General, SC, ST, OBC, Female and Physically Challenged etc.) to facilitate category-wise admission to Institutions.

With the increase in number of Institutions and number of candidates appearing at JEE, pen and paper mode of examination gave way to answering Multiple Choice Questions and their evaluation through use of OMR sheets.

2. Current Status

The IIT JEE is considered to be one of the toughest examinations. Nearly 500,000 students appear at IIT JEE and compete for about 10,000 seats. The number in terms of both the candidates and the available seats is likely to grow by 10% every year.

Nearly 11 lakhs students appear in the AIEEE for admission to about 20 NITs, some of the Deemed Universities and over 100 Private Colleges. This number is also expected to grow by about 10 percent a year.

For admission to State level Government and Private Engineering Institutions, State level JEE is conducted, practically in every State except Tamil Nadu. Tamil Nadu has dropped State level JEE and admits students to their Engineering Institutions based on normalized +2 marks. Though a student now appears at 3-5 Entrance Examinations to get an admission into a Technical Institution, the total number of students appearing at one Joint Entrance Examination or the other is around 25 lakhs.

A student is offered admission to the Institution and discipline of his / her choice based on his / her rank. The rank of the students in the JEE is determined by his / her score in the JEE. Some JEEs prescribe an eligibility criteria based on +2 examination result. For instance, IIT JEE prescribes 60% mark for General candidates and 55% mark for SC/ST candidates. Some State JEEs also insist on minimum of 40-45% mark in +2 Examination. Some States like Gujarat and Andhra Pradesh gives 50% and 25% weightages respectively to the +2 performance in preparation of the Merit List.

The number of students appearing in the JEEs in many States is less than the number of available seats. Therefore, the qualifying mark for inclusion in the Merit List of the Joint

Entrance Examinations even goes down to below zero! Some of the States such as Bihar, Jharkhand and North-Eastern States do not have many Government or Private Institutions. Students of these States appear at either AIEEE or State Level JEEs of other States to seek admission to Technical Institutions.

The JEEs are limited to multiple choice questions in Physics, Chemistry and Mathematics (PCM) for Engineering or Bio-Science (PCB) for Medicine and Pharmacy,. For admission to Architecture, in addition to a test in PCM, one has to take Aptitude Test. For lateral level admission to Engineering, the syllabus for the JEEs is limited to that of the discipline specific diploma programmes.

3. Evolution of JEE Patterns

As noted earlier, the "Common Entrance Examination" was started in 1961 for admission to 4 IITs for nearly 700 intake at both First Year and Second Year level. Nearly 15,000 candidates appeared. CEE used long answer, problem-solving, manual evaluation format to search for talent. In the early 60s, the name of the examination was changed to the JEE. In the late 70s Engineering Drawing and General Knowledge were dropped and in 1988 English was dropped. Coaching for JEE started in 70s. The perceived competition between coaching classes and paper setters made the examination more tougher and the students became more dependent on coaching. IIT JEE remained a low scoring tough examination. To cope with the increase in number of candidates, two stage JEE was introduced in 2000: an objective Screening Test followed by a Main paper that was evaluated only for those who qualified in the Screening Test. Objective testing alone was introduced in 2006.

With expansion in Engineering Colleges JEEs at State level started in late 80s. The AIEEE was introduced in 2002. RECs / NITs opted for AIEEE while deemed Universities and Colleges opted for AIEEE for some percentage of their seats. Multiple Choice Test is being followed in AIEEE and State JEEs from the beginning. Most JEEs have focused only on testing PCM or PCB neglecting other attributes.

4. Variations among the JEEs and Admissions

The country has large number of Institutions with widely varying capabilities, focus and standards. Institutes like IITs and IISER are on the top of the ladder. These Institutions offer research and innovation focused education that requires higher analytical abilities and problem solving skills using multiple concepts. Therefore the IIT-JEE tests higher analytical abilities and concurrent use of multiple concepts even from multiple disciplines

in solving problems. Though the syllabus is at the +2 level, the test is well above the XII examinations. It is considered to be one of the toughest examinations and a time-tested filter of talent for admission to the IITs. It has earned a well-deserved reputation for fairness and for the integrity of those organizing the examination.

NITs and several Government and Private Institutions offer quality technical education. They admit students through the AIEEE. AIEEE tests the students on clear understanding and application of concept covered at standard 12 level in PCM. The syllabus used for the AIEEE is primarily the CBSE syllabus with suitable modifications to take care of the needs of other Boards.

The State level JEEs are used to admit students to the large number of State level Government and Private Institutions. The tests are designed based on the State Board syllabus for PCMB.

For admission to B. Pharm Courses, the States conduct Joint Entrance Examination along with the JEE for Engineering Courses. For B. Pharm, normally the States conduct tests on Physics, Chemistry and Bio-Science. However, for admission to Pharmacy Courses, IITs conduct test on Physics, Chemistry and Mathematics. Deficiencies in Bio-Science is made up through bridge courses.

In addition to the above at State level JEE, Entrance Examinations are conducted for lateral entry of Diploma holders in Engineering and Architecture to Degree programmes. Here, the Test syllabus is same as the State level Diploma syllabus.

For admission to many leading Institutions in Medicine and Central quota on State level Medical Colleges, CBSE conducts a Medical Entrance Test. The test is on PCB and the syllabus is CBSE XII level plus. This test is considered to be very tough requiring extensive memorization and coaching to crack.

JEE Merit List is used as the sole criteria not only for admission to an Institution but also for the allocation of the branch of study to a student in that Institution. Institution and branch allocation requires assignment of distinct ranks to individuals. The number and difficulty level of the questions that have to be answered in a limited time have been increased to make the tests more discriminating. Bunching is minimized by the design of the questions and by the use of several tier tie-breaking rules.

5. Impact of JEEs in the present form

- Since the success in JEEs is the sole criteria for admission to many technical Institutions, the focus of the better students has shifted from +2 Science education in School to Coaching for the JEEs.
- School attendance has become a casualty.
- Many coaching classes concentrate on teaching students tricks that help crack Multiple Choice Questions.
- Some students suffer from burn-out syndrome; some think they have “arrived” just because they cracked the JEE; some who failed to get admission to the disciplines of their choice feel frustrated.
- JEEs are urban centric and rural students without access to coaching fail to qualify.
- Girl students fare worse than boys in the JEEs despite their superior Board performance.
- Dearth of quality Institutions has increased the competition for admission to the few available ones beyond desirable limits.
- Increase in number of students has led to Multiple Choice ORS based examination, which is pedagogically not as effective as the long answer format.

6. Expectations from Joint Entrance Examinations

A student seeking admission to Engineering, Pharmacy, Architecture etc., has to have (1) good knowledge and clear understanding of Science subjects and (2) reasonable level of intelligence, analytical reasoning skills, general awareness and communication skills.

Joint Entrance Examinations currently assess the students in the former. Later competencies are not tested. There will be no need for the JEE in the present form if we have (i) only one Board in the country, and (ii) we conduct examinations and have assessment in fair and transparent manner. Present form of JEE in State or AIEEE level only assesses the performance on a common base through one time test. The Board Performance in the subjects is not taken into consideration.

Exception is the JEE conducted by IITs where one tests the higher analytical and problem solving skills using multiple concepts. Such skills are essential to admission to the Institutions having research and innovation focus in their education. Therefore, IIT JEE test items are distinctly different from the other JEEs.

For vast majority of the Institutions who focus on producing engineers for routine jobs in industry and government, a good knowledge and understanding of the basic science concepts is enough. A good XII examination and evaluation system should be able to assess the same. A method to reduce variations from Board to Board and equalization of the score should suffice.

A test needs to be organized to assess the second component as they are not currently being evaluated at the School level.
For research and innovation focused Institutions in Science and Engineering, an add on test is essential to test the higher competency level in Science subjects of Physics, Chemistry and Mathematics. Similarly Architecture will require a special Aptitude Test.

7. Analysis of JEEs and Suggestions for Change

An analysis of the performance of the relatively few students admitted to the IITs over the last decade in the IIT-JEE and subsequently in the IITs (2 tier JEE was conducted between 2000 and 2005 and a single objective-type examination has been conducted since 2006) leads the following broad and somewhat expected conclusions:

- There is a strong correlation between the Standard X and Standard XII marks and CGPA including the final performance in IIT.
- Both AIR and percentage marks at Standard XII are better correlated to the CGPA only upto the end of the first year.
- There is poor correlation between AIR and the CGPA of GE and OBC candidates from 2nd year onwards.
- Percentage of marks at XII level better explains group performance in later years.
- Students with high AIR (less than 1000) have higher score at XII level while aberrations are more prominent at lower AIRs.
- An analysis of the performance of students in the screening and main tests of IIT

JEE between 2000 and 2005 showed a considerable overlap between the sets of top 5000 students although their ranks within the sets showed little correlation. Hence it would be expedient to settle for a completely objective single examination.

The studies recommended (some already implemented)

- Screening based on normalized Board scores at Standard X and/or Standard XII and Multiple Choice examination replacing the two stage JEE from 2006.
- Entry barrier to be raised to 60% in the +2 examinations.
- Factors, other than the Standard XII marks and AIR based on PCM testing, such as raw intelligence, logical reasoning, aptitude, comprehension and general knowledge need to be considered.
- Need to factor in school performance more significantly into the selection process.

The last two recommendations are applicable to all JEEs. From the discussions held by this committee the following additional desirable features of the admission process were identified:

- Decision based on one time test needs to be re-examined. Opportunities to improve must be built in.
- Students must be relieved of the pressure of multiple JEEs. Currently a student appears on an average at 5 JEEs all within a few days of the Board Examinations.
- Influence of coaching for JEE needs to be minimised.
- Urban-rural and gender bias has to be eliminated or atleast minimised.
- The objective type of examination lends itself to undue influence of coaching. The conventional pen and paper examination with well designed long and problem solving oriented questions should be revived by keeping numbers in any JEE within reasonable limits.
- JEEs, especially the IIT JEE, have become a huge money spinning activity for coaching centres with attendant undesirable consequences.

8. Recommended Alternative

- Scores in a well-designed National Aptitude Test (NAT) should be used to capture parameters of interest such as raw intelligence, aptitude, general awareness, comprehension and written communication skills.
- NAT should not require extensive preparation and coaching. The questions in the test should be so designed that it would not require inputs beyond the +2 level.
- *Ideally candidates should be able to take NAT any time in a year. One can also have the option to improve over (say) 3 attempts. The test could be an online test and the highest of the 3 scores shall be considered.*
- Standard XII Scores normalized appropriately across Boards, considering PCM for Engineering, Science and Architecture and PCB for Medicine and Pharmacy should be used to capture the School Science Performance (SSP).
- A Composite Weighted Performance (CWP) Score may be computed as follows:

  CWP Score = X (SSP Score) + (1-X) (NAT Score)

  An X value of 2/3 is recommended to begin with. This may be revised after a few year's experience.
- There is wide variation in requirements and standards of admitting Institutions. While CWP Score should be compulsory for all. Some Institutions whose curriculum and syllabus is research and innovation oriented require students with higher analytical skills and problem solving competence using multiple concepts. Such students only can contribute effectively to research and innovation. An add on test need to be conducted in order to meet the specific needs of such Institutions of National Importance and Universities. In these Institutions the CWP Score should be used as a screening criterion to reduce the number of candidates taking the add on test to about 1 lakh. The students qualified in such a National Test should be available for admission to Science and Engineering programmes. To encourage bright students to go for higher education and research in Science and Engineering, the Government may also consider giving scholarships to the Add On Test qualified candidates similar to INSPIRE scholarship for education in Science in leading Institutions. The National Add On Test may be named as National Engineering and Science Test (NEST).

9. The National Aptitude Test

- The test has to be a online test that can be taken by a candidate any time. A candidate must get a chance to improve, thus may have maximum of 3 chances.
- To handle about 5 millions on line test, several test centres of about 500 in number have to be created.
- Each Centre should have its own server, thin clients, printers, storage devices, security and internet connectivity. Power back up has to be ensured.
- Mock testing facility should also be made available with the Test Centres. The same, however, could be made available online.
- The test system has to be designed and test items are to be created to make sure that large number of unique test with identical difficulty level could be administered. This will eliminate chance of malpractice. Instant evaluation and reporting of score have to be done.
- To have necessary credibility, the test system has to be created, administered and managed by the Government through a statutory agency**.**
- The facilities thus created could be used for other tests such as GATE, CAT, PMTS and UPSC for their preliminaries.
- The credibility of National Aptitude Test has to be high. Active involvement of Institutions like IITs is required at initial stage to make the test credible.
- Implementation of the scheme requires broad consensus building and commitment of the State Government and Boards to improve School education, examination and evaluation system. They must also adhere to strict time schedule for publication of result in a form that can be used by the Central Agency and admitting Institutions.
- Central Government must commit to the creation of Test facilities, consensus building through CABE and giving statutory status to the credible Agency.

•To organize 5 million tests a year, 25,000 test seats are to be created to conduct one test of three hours a day for 20 days in a month. The number of tests could be doubled or even tripled to take care of the peak load. Each Test Centre should have 50 test seats and 20 mock test seats. Thus there will be 500 Test Centres. Depending on the load, one city may have several Centres. **Annexure II** gives typical configuration of a Test Centre. Designing, validating and administration of

NAT is crucial to the success of the system. **Annexure III** gives their salient features.

10. Adjusted School Science Performance Score and Ranking

The country has 30 Boards for conducting examinations and evaluation of performance of the students in the Science subjects of Physics, Chemistry, Mathematics and Biology. Currently, the performance evaluation across the Boards vary considerably as they differ in their curricula, syllabi, the setting of the question papers, the conduct of examinations and the evaluation of answered scripts. The variation in performance evaluation can be minimized by adopting a common curriculum and syllabus, by using common format for the question papers, by developing model answers and by adopting model evaluation schemes.

Despite all the above steps, it is not possible to completely eliminate the differences in the performance evaluation across the Boards. It is, therefore, essential to "adjust" the performance evaluation in Science subjects of the students from various Boards by comparison with a reference Board (hereafter referred to as the "Anchor Board") using the concept of "equivalence". The score in a Board and the score in the Anchor Board are equivalent if they represent the same relative position in the group of examinees. This will call for "adjusting" the individual Board's scores by "equating" them to the Anchor score. Choosing the entire population to represent the Anchor Board is the best impartial choice. i.e The Anchore Board will include all the Boards. The following linear equating scheme can then be used for "normalization".

If X represents a score in a Board and Y represents a score in the Anchor Board, then X and Y are equivalent in a group of examinees when

$$\frac{Y - \text{mean}(Y)}{SD(Y)} = \frac{X - \text{mean}(X)}{SD(X)}$$

where, mean (Y) = the mean of performance in a subject in the Anchor Board

mean (X) = the mean of performance in the same subject in a Board

SD (Y) = Standard Deviation of performance of all students across in the Anchor Board in a subject

SD (X) = Standard Deviation of performance of all students in a Board in the same subject

$$\text{Adjusted } (X) = \left[\frac{SD(Y)}{SD(X)}\right] X + \left[\text{mean}(Y) - \left\{\frac{SD(Y)}{SD(X)}\right\}\text{mean}(X)\right] = Y$$

The School Science Performance Score will be based on the adjusted scores in the individual subjects. The performance in each subject could be measured in a scale of 0 – 200. Thus, the School performance will be measured in a scale of 0 – 600. As the Adjusted Score is unlikely to be an integer form, we may compute upto 3 places of decimal for ranking purposes.

The score in the National Aptitude Test (NAT) may be obtained on a scale of 0 – 300. The Adjusted SSP score should be added to the scale of NAT score. This will give 2/3 weightage to SSP and 1/3 to NAT scores.

Ranking of the students will be based on the Composite Weighted Performance Score (CWPS). The choice of Scale and computation upto 3 places of decimal will reduce bunching to a great extent. However, some bunching will occur as the number of students involved is large. In such cases the ties can often be broken by using such tie breakers as (i) SSP score, (ii) NAT score in Mathematics, (iii) NAT score in Physics, and (iv) NAT score in Chemistry. Despite such tie breakers, two candidates with the same CWPS will be given the same rank.

11. Plus 2 Reforms

The Committee felt it was advisable to articulate a few necessary reforms in the +2 system in this context:

- *Common curriculum for PCMB across all Boards should be introduced. (According to COBSE, most of the Boards will implement common curriculum and syllabus in Physics, Chemistry, Mathematics and Bioscience by 2012).*
- *Efforts need to be made to ensure free and fair examination and evaluation at the +2 level in all the Boards.*
- *The Board examination results could be brought to a meaningful common base if all Boards use the same question paper for examination and common model answer for evaluation. This can facilitate use of raw SSP scores for computation of the CWP Score. Till then normalized scores can be used to compute CWPS.*
- *An agency to conduct NAT online test should be created. Necessary infrastructure has to be created to conduct test for about 5 million candidates. The physical infrastructure shall include servers, thin client, printers, broadband connectivity,* standby generators, security etc. Adequate administrative support infrastructure has to be provided.

- The availability of Board result in time is critical to the success of the alternative. It was agreed that +2 results could be made available by May 1 in all Boards by 2012.
- The issue of unique identity of a candidate was discussed. It was generally agreed, the Unique Identification Scheme would be operational by then and each candidate would have a UID number.
- The COBSE Members have agreed to the above. They, however, require the support of the States.

12. Some Deadline Dates

- Standard XII results should be available by 1st of May.
- All India Rank based on CWP Score shall be prepared for all candidates by 10th of May.
- All India Rank Certificates shall be made available category-wise : General, SC, ST, OBC, Male, Female and Physically Challenged to all candidates by end of May. This rank shall be used for admitting students to Universities and Institutions who admit students based on All India Rank.
- State and Category-wise Rank Certificates shall be made available for admission of candidates to State Government and Private Colleges to all candidates by 31st of May.
- Based on CWP Scores candidates shortlisted for add-on test for admission to Institutions of national importance and Universities focusing on research/innovation shall be available by 10th of May.
- These add-on tests shall be held by the end of May and the Rank based on the test shall be available by 20th of June.
- Online counseling shall start by 1st of July and be completed by 15th of July. Online counseling can be done at State level for State and Private Colleges and centrally for admission to IITs and NITs based on CWP Score.

13. Expectations from Boards

1. Uniform Curriculum and Syllabus for PCMB.
2. Common structure of Question Paper.
3. Fair conduct of Examination.
4. Model Answer.
5. Model Evaluation Scheme.
6. Allocation of UID to all students admitted to 11th Class.
7. All references to Performance based on UID.
8. Separation of internal and Board Examination Scores.
9. Result Publication by May 1.
10. Common Software for result preparation and processing. This may be developed and distributed to all Boards and portability.
11. Passing of raw scores to the Testing Agency.
12. Encouraging the students to take more than once NAT over two years i.e. 11th and 12th

14. National Testing Agency

(1) National Testing Agency is to be created by an Act of Parliament. Only a statutory agency can ensure independence, transparency in testing of the magnitude that is being envisaged. It will have the necessary credibility and confidence of the people. To start with, NTA will conduct NAT and prepare State level and National level merit list for admission to the Science, Engineering and Pharmacy programmes. The same agency could prepare merit list for medicine. Later it may be empowered to prepare merit for other examinations such as GATE, CAT, MAT etc.

(2) The Agency should be run by a Commission with few members of high academic stature and a Chairman.

(3) Creation, running and maintenance of Test Centres will be the responsibility of the Commission.

(4) The Commission will have a unit to develop testing plans and test items. Testing and validation of test items will be the responsibility of the unit.

(5) A research unit attached to the Commission will be responsible for generating several unique test sets with equal difficulty levels besides validating and equalization of test scores.

(6) The Commission will have a Technology Support Unit to take care of IT needs of the Test Centres, creation of Data Centre, Networking of the Test Centres etc.

15. Conclusion

This Interim Report gives the views expressed after wide consultation with the stakeholders on evolution of an alternative to IIT-JEE, AIEEE and State JEEs. Members of COBSE requested for State level consultations to ensure smooth implementation of teaching, examination and evaluation reforms at +2 level. It is also necessary to work out the nitty-gritty of conducting NAT, design of test system, equalization of Board scores, unique identification of candidates etc. If the alternative is in principle accepted, the details will be worked out and final report will be submitted.

Annexure – I

F.No.19-2/2010-TS.I
Government of India
Ministry of Human Resource Development
Department of Higher Education
Technical Section – I
*****

Shastri Bhawan, New Delhi
Dated the 8th March, 2010

ORDER

Consequent to the decision in the Retreat of IIT Directors and Chairpersons held at Manesar on 4th February, 2010, it has been decided to constitute a Committee having the following composition, to look into the streamlining and rationalizing JEE, GATE, JMET, JAM, etc.

1. Prof. D. Acharya, Director, IIT Kharagpur - Chairman
2. Prof. M. S. Ananth, Director, IIT Madras - Member
3. Prof. Devang V. Khakhar, Director, IIT Bombay - Member
4. Prof. S. C. Saxena, Director, IIT Roorkee - Member

2. The Committee will explore the possibility of having one exam in place of the present IIT-JEE, AIEEE, and other State Joint Entrance Examinations for admission to engineering programmes. While doing so, due weightage would be given to performance in Board exams and the entrance exam. The CET should consist of an aptitude test which gauges the raw intelligence of the students on the lines of GRE, SAT and lays less emphasis on PCM (Physics, Chemistry and Mathematics), as these are already tested at the Board level.

3. The Committee is advised to invite/ associate Chairman CBSE, COBSE officials and Chairman CCB for AIEEE in the deliberations of the Committee.

(Rashmi Chowdhary)
Director
Telefax 23070987

Distribution :

1. Prof. D. Acharya, Director, IIT Kharagpur
2. Prof. M. S. Ananth, Director, IIT Madras
3. Prof. Devang V. Khakhar, Director, IIT Bombay
4. Prof. S. C. Saxena, Director, IIT Roorkee

9-3-10

Copy for information to :

1. Director, NIT Nagpur, Chairman CCB/ AIEEE) with a request to attend the first
2. Chairman, CBSE) meeting of the Committee scheduled
3. Prof. D.V. Sharma, General Secretary, COBSE) to be held on 16.03.2010 at IIT Madras

Annexure – II

Test Centre Design

Each test centre should consist of a reception area and multiple testing rooms. The space designs will be created to efficiently manage test centre operations, minimize disruptions to the candidate testing experience and assure the highest levels of physical security and test integrity. A Centre should also have a mock test area.

Waiting Area

The test centres will have a waiting area for candidates so that once examinees have been checked in, no unauthorized persons—including children, family members, co-workers or friends of the examinee—remain in the waiting area or any other part of the test centre. Only candidates and authorized visitors would be permitted in the test centre. It is proposed to provide a storage facility to the candidates to place their personal belongings before entering the testing area. Within this area all check-in formalities would occur, like image capture, biometric and physical identification document verification, before the candidate is allowed inside to take the test.

Test Area

It is proposed that each testing station will be separated by sound and light absorbing privacy dividers and the computer stations would be placed in a formation restricting visibility of other computer screens. Surveillance cameras will be strategically located in testing rooms to allow viewing and recording at all times when testing is in progress.

It is proposed to take several steps to ensure that the test administrations are consistent and provide a pleasant experience to the candidates. These testing venues conform to local municipality requirements, and provide adequate parking facilities for candidates. Additionally, measures will include:

- **Ensuring Quality Candidate Services—**The TCAs, proctors and other staff will be trained to be courteous, candidate friendly, disciplined and efficient.

- **Ensuring Test and Environmental Quality--**by regularly checking the cleanliness of all test stations and testing that the quality of the monitors and test delivery output is of acceptable standards by launching demo tests.

- **Ensuring Security—**by certifying TCAs and conducting security audits on a regular basis.

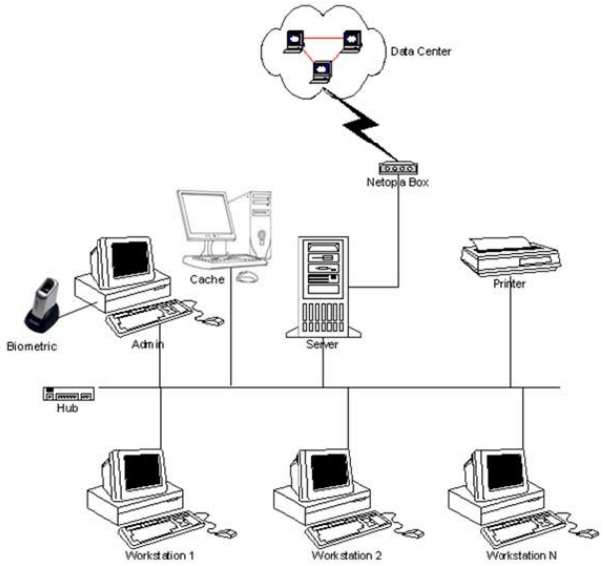
- **Ensuring Consistent Client Policy Adherence—**In the 'Client Practice' manual, (a manual where all exam policies will be documented) we instruct the test centre staff as to what needs to be done in certain situations, so that there is standardization in the conduct of tests all across the country.

- **Deter and Detect Test Fraud—**There will be use of video cameras, their live monitoring and recording, physical proctoring, etc.

Mock Test Area

Mock Test area will be required to offer mock testing experience to the candidates. It will be exactly like the Test Area but with fewer seats. It will not have any physical or electronically connectivity to the Test Area. Candidates using Mock Test Area should have no access to the Test Area.

Test Centre system setup：



Technical Requirements

Hardware requirements

Configuration	Server	Admin Node	Testing Node	Proxy Server
CPU	2GHz or higher	2GHz or higher	2GHz or higher	2GHz or higher
RAM	**2 GB (mandatory)**	1 GB	1 GB	1 GB
HDD (Minimum)	20 GB	20 GB	20 GB	20 GB
Network	100 Mbps	100 Mbps	100 Mbps	2 * 100 Mbps NIC
Internet Connectivity	512kbps	512kbps	512kbps	512kbps
CD-ROM	CD / DVD ROM (Bootable)	CD / DVD ROM (Bootable)	CD / DVD ROM (Bootable)	CD / DVD ROM (Bootable)
Network Cards (NIC)	1 NIC	1 NIC	1 NIC	2 NIC
Monitor	15” Flat Screen / 17” CRT, 24Bit/32Bit color	15” Flat Screen / 17” CRT , 24Bit/32Bit color	15” Flat Screen / 17” CRT (screen resolution 1024 * 768) , 24Bit/32Bit color	15” Flat Screen / 17” CRT, 24Bit/32Bit color

Cabling	Standard CAT5/CAT5e/CAT6 Cables to be used
Printer	Laser printer
Crossover Cables	To be provided by the college wherever required

Software Requirements

Software / Application	Server	Admin Node	Testing Node	Proxy Node
Operating System	Windows Server 2003 SP2 Standard Edition (100% patched)	Windows XP SP2 (100% Patched)	Windows XP SP2 (100% Patched)	Windows XP SP2 (100% Patched)
Antivirus	Trend Micro (from IT x.x Media)	Trend Micro (from IT x.x Media)	Trend Micro (from IT x.x Media)	Trend Micro (from IT x.x Media)
CC proxy	No	No	No	Yes
Windows Installer 3.1	Yes	Yes	Yes	Yes
Microsoft Net 2.0 Framework SP1	Yes	Yes	Yes	Yes
MDAC 2.8	Yes	Yes	Yes	Yes
MSXML 4.0 SP2	Yes	Yes	Yes	Yes
Adobe Acrobat Reader 9.0	Yes	Yes	Yes	Yes
Internet Explorer 7.0	Yes	Yes	Yes	Yes

Note: The Windows Operating System software for Server, Admin, Testing and proxy node need to be 32-bit only.

Internet connectivity

- Primary wired Internet Connection with one internet IP / Public IP for each proxy which will be configured on the outside (site facing interface).
- Outbound Internet access to ports (TCP 80, 443, 11001 and 11002). Bi-directional traffic on both firewall and router, allowed for the IP assigned in step 1.
- Backup Internet connection using a wireless / broadband internet provider, with demonstrated bandwidth capability to transmit 30 MB of data within 1 min; must be demonstrated per lab.

Network Configuration

- TCP/IP network
- 100 MBPS Switch
- Server, Admin and Testing Stations has to be on the same VLAN (with same subnet)
- The lab Network should be physically / logically isolated.

DVR Requirements

- Cameras should be placed so that all workstations and workstation numbers can be clearly seen.
- There needs to be audio recording capability and microphones in the test rooms.
- Need to ensure that the audio from these microphones can be heard on playback.

- For sites that have high ceilings (10 feet or higher), the cameras should mounted to the walls at 10 feet or lower.
- A camera with microphone should be placed so that the Proctor Desks can be clearly seen and heard upon playback.
- A camera with microphone should be placed so that the Biometric Capture station can be clearly seen and heard upon playback.
- A camera with microphone should be placed so that the Server can be clearly seen and heard upon playback.
- Need to program the DVRs so that the lab number, current date and time is evident on playback.
- Signs will need to be placed in the cameras view indicating which lab is being recorded.

Technical staff to install, maintain and support the test centres

Trained workforce is required to install, maintain and support this network. The technical staff will undergo rigorous training.

These dedicated technical engineers will help in troubleshooting any technical issues arising at the test centre for a seamless test delivery. They would further be supported by a dedicated helpdesk network running 24x7. These technicians would also be required to pass a re-certification exam after every one year. This helpdesk network will have adequate number of level 1 and level 2 support engineers for resolving the technical issues.

Annexure -iii

Test Development

The mandate is to develop an aptitude test that can be applied universally to the wide array of engineering entrance examinations (like AIEEE etc). To do so while also introducing non-cognitive measures into the exam raises the bar still further. The selection methodology employed could very well become the new standard for all undergraduate level entrance examinations.

The test development process consists of several steps as outlined in the chart below and encompasses all aspects of continued exam maintenance. Though every step listed is not necessary, the activities included in the chart explain the types of work. The test development plan will produce a robust item bank with new items that are designed for the unique needs of H.E.T. **Attributes of Raw Intelligence, General Awareness, Aptitude and Comprehension & Communication have to be taken to prepare H.E.T.**

Test Design	**Test Definition**	Define the purpose, scope, target population, general topics, duration, number of forms, number of items and types of items.
	Job Analysis	Define the tasks, knowledge, and skill important for performing the specified role.
	Test Specifications	Review the importance and determine how many items should be written to each objective.
Item Development	**Item Writing**	Provide training on item writing to meet the test specifications and amounts listed in the blueprint.
	Technical Item Reviews	Review items for language and technical accuracy
Psychometrics & Test Construction	**Item Analysis**	Compute statistics that measure item performance.
	Item Selection	Determine which items will be used on final forms and which will be discarded or rewritten.
	Form Assembly	Distribute items across forms so that each form meets the specifications of the blueprint plan and remain equally difficult.
	Standard Setting	Establish the cut score.
In-service Analysis	**Maintain Exams**	Conduct ongoing analysis of item and test statistics. Revise exams with updates periodically.

While a significant amount of analysis and design work would need to be performed before one is in a position to fully articulate a plan for H.E.T.S, a brief high-level summary of some of the key activities might prove useful to determine the course of action.

Job Task Analysis

Everything will be derived from the job task analysis. It will therefore be critical that we first validate the assumption that there is a core set of attributes and success criteria that can be used as predictors of future performance.

Test Blueprint

The data collected through the job task analysis will serve as the foundation for the test blueprint, which is an inventory of all the test objectives that will be measured by the exam. Each of the agreed upon attributed and other success criteria are converted into test objectives which are assigned various weights based on their frequency, criticality and importance. For example, an aptitude or task

that happens frequently but is neither critical nor particularly important is given a lower weight than an objective that happens infrequently but is highly critical and/or important to the goal of being a successful engineer graduate. The weights, or multipliers, are used to determine how many items should be in the finished test for each of the objectives. An objective that has a weighting of two might be assigned one item, whereas an objective with a weighting of six might be assigned three items. The specific number of items assigned to each weight can be adjusted according to the test design.

Test Design

The number and complexity of the test objectives will help determine the types of test questions, or items that will be used in the exam, the number of items that will be presented in any one test form and the likely length of the exam. The industry standard for a recall item is one minute but items that require analytical thinking skills or higher-order cognitive abilities can require more time.

Pilot Testing

It will be important to validate any assumptions made regarding the test design through pilot testing or, at an absolute minimum, stakeholder reviews. The quality of the test questions, the amount of time required for the exam and many other factors can be verified with a properly constructed and administered pilot test. A critical aspect of the pilot test will be the cohorts selected to participate.

Registration Process

The prospective student should be provided effective and flexible options as it is a critical element in any examination programme. We propose to provide your candidates with multiple options for purchasing of bulletins (with vouchers) and a convenient registration and scheduling process.

Prospective students will be required to buy the application material that will include the official application form and a unique voucher code. Various payment options available for the candidates may include:

- **Payment by cash –** students can pay at various branches of the specified Nationalised Bank or at an Authorized distribution outlet.

- **Payment by demand draft** (DD) – students may send the DD along with a self-addressed envelope of a specific size to a designated postal address or to a regional office. Upon receipt of the request, Bulletin (including the application form and the voucher code) will be sent through courier/registered post.

- **Payment by credit card** – Candidates may visit the website, and would be redirected to an e-commerce site that will feature an option to make the payment using a credit card. Once they fill in the card details and submit the same, a prompt will appear stating that the payment has been authorized. The bulletin, including the voucher, would then be sent to their mailing address.

Call centre support will be provided for answering questions in support of the programme.

Annexure 4

Public opinion poll on the proposal to design and institute a rationalized National Testing Scheme for admission into Tertiary Education in Sciences and Engineering

1. Responder Profile

Name		:
Address		:
Contact Numbers	phone	:
	e-mail address	:
Academic Background		:

Professional Background (circle appropriate box):

A. Student	B. Teaching	C. Educational coaching	D. Employed

If student, nature of studies

a. Engineering	**b. other professional**	**c. Science**	**d. Humanities**
a. School level	**b. Under graduate**	**c. graduate**	**d. other**

If teaching, level of teaching

a. primary	**b. middle and secondary**	**c. tertiary**

Length of teaching experience

Less than 5 years	**5-10 years**	**10-15 years**	**More than 15 years**

Where do you teach?

a. School	**b. college**	**c. university**	**d. national institutions**

If involved in coaching

Type of examination:	**JEE type**	**AIEEE type**	**Others (specify)**	

If employed, nature of employer.

a.Self b. Corporate c. Business d. Government

Length of professional service

Less than 5 years 5-10 years 10-15 years More than 15 years

Have you taken competitive examinations in this country? If so specify.

Consent for sharing this response with total transparency

Yes No

Signature with date

2. **Today it appears that most students seeking admission into tertiary professional education in the country are appearing in as many as five to ten different types of competitive examinations with different sociological implications. Are you in support of this arrangement? If yes, why?**

3. **Views on current multiple examination of the responder**

   In total support In partial support Recommend changes

4. **List at least three strong features in order of ranking in defence of the current testing systems**

   a. …….., b…….., c…… , d……..

5. **Views in deference to the current testing systems**

   a. …….., b……, c…….., d…….

6. **Would you be in favour of including a weighting factor for overall and consistent performance in examinations of school boards.**

   Yes No

   If no, what are the perceived constraints in weighting school board performance and other inputs?

7. **If not in favour of a multi-parametric and rationalized National Testing Scheme, what are the over-riding reasons for objection?**

8. **Would you like to consider an Indian equivalent of Scholastic Aptitude type test?**

9. **If in favour of current JEE or AIEEE type competitive examination models, what weighting would you like to give for aptitude and advanced subject knowledge?**

   A. Aptitude only b. A mix of aptitude and advanced c. Advanced test

10. If in support of an alternative model, what are the essential features you would like to build into the system?

A High filter type like IIT JEE B. Placement Type selection examination

A. Competitive ranking model B. SAT type C. Others. (specify)

11. Would you like to stay connected to the further exercise as a an interested responder?

Time lines for the National Test Scheme work elements

S.No	Work to be completed	Time schedule	Partners
1	Study of Acharya Committee report	May 2011	The entire committee
2	Public opinion poll • Design of the questionnaire • Design of the interactive portal • Mounting the interactive portal • Decisions on the response time • Positioning the study team for response • Analysis of the poll information	• 5th May 2011 • 10th May 2011 • 12th May 2011 • 5th May 2011 • 10th May 2011 • 31st May 2011	Committee members to be identified
3	Consultation with school boards • First meeting for alignment • Designing feed back schedules • Data gathering • Second meeting • Testing hypothesis • Ownership mobilization • Designing process integrity	• April 2011 • 10th May 2011 • 20th May 2011 • Late May 2011 • June 2011 • June 2011 • Ongoing process	
4	Consultation with faculty • IITs • NITs • Lead institutions in sciences and engineering • Discussions with human science experts • Social science faculty	May/June 2011	

5	Alumni bodies • PAN IIT • Some lead NITs • Some lead private institutions in art, sciences, engineering	July 2011	
6	Criteria selection • Evidence gathering • Criteria selection • Feed back gathering on criteria selected • Multiple criteria model	June July 2011	
7	Modelling study • Preliminary study based on simulated data • Model development • Model selection through correlation analysis • Revalidation of selected models through reconstruction of past results • Final selection of model alternatives	 • 1st July 2011 • 10th July 2011 • 20th July 2011 • 31st July 2011 • 15th August 2011	
8	Mock up and pilot study	• 31st August 2011	
9	Preparation of draft final report for discussions at the council meeting	• 10th September 2011	
10	Finalization of the report	September 2011	

National Test Scheme (NTS)

Public Opinion Analysis

Report

9th July 2011

Department of Science & Technology (DST)
Technology Bhavan
New Delhi

CONTENTS

NATIONAL TEST SCHEME (NTS)
Public Opinion Poll – Analysis

Introduction

The proposed National Test Scheme is designed to allow selection of students **for admission into Tertiary Education in Sciences and Engineering**. It is based on the single examination evaluation instead of the prevailing multiple competitive examination system in the country.

Most nations employ just one test for assessment of scholastic aptitude instead of a plethora of evaluation tests. The current selection systems have, no doubt, resulted in visible benefits. But, the future of Indian youth might need a paradigm shift that ensures opportunity for larger sections of the society.

The extreme level of competitiveness in the screening processes employed for deciding access to professional education is not without its psychological or sociological implications for the society. They do influence the mindset and behavioural changes among the youth.

"Unity in diversity'' is the Indian brand value. Unification, while retaining the diversity of educational systems in the country is the underlying strategy of the proposed National Test Scheme. It is motivated by the principle of inclusion for a collaborative excellence rather than exclusion through competitive excellence.

In this regard, the NTS website was launched in May, 2011 with a **Public Opinion Poll** feature to seek responses from various stakeholders. The Public Opinion Poll was kept open for a window of 21 days (01 June to 21 June, 2011).

The report presents the analysis of the responses received through the public opinion poll. It is divided into two major sections a) Responder profile and b) Detailed response on the current examination system and the proposed NTS. The findings of the NTS - Opinion Poll analysis are presented in the form of highlights.

The report has been prepared by the NSTMIS, DST research team comprising of Dr. Parveen Arora, Scientist-F and Project Associates Mr. Abhishek Kumar and Mr. Praveen Rawat under the guidance of Prof. T. Ramasami, Secretary, DST. Thanks are to the NTS Expert Committee Members for their valuable inputs and to the NIC team as well for their technical support.

HIGHLIGHTS

Responder Profile

- 2063 responses were received, out of which 98.5 % were from India. From outside India, the highest response of 0.7% was received from USA.
- 217 (10.5%) were female respondents.
- 74% of the respondents were from engineering and science academic background. Engineering respondents comprised of 65.5 % while 8.4% were having science background.
- 60% of the respondents belonged to 5 states, comprising of Andhra Pradesh (24%), Maharashtra (16%), Delhi (7%), Tamil Nadu (7%) and UP (6%).
- 80% of the total respondents have taken engineering examinations.

- Out of 2063, 59% of the respondents were students, 32% working, and 5% parents.
- Of the total students, 82% were from engineering, 9% from sciences and another 9% from medical, commerce, humanities etc.
- Female response was around 20% for the categories Student – medical, humanities, others; Working – coaching category and non-working.
- 28% of the total respondents expressed their wish to stay connected to further NTS exercises through E-mail as the most preferred mode.

Detailed Response

Part-A: Current Examination System

Supporting the argument *"Today it appears that most students seeking admission into tertiary professional education in the country are appearing in as many as five to ten different types of competitive examinations with different sociological implications"*

- Majority of the respondents (categories / sub-categories) supported the argument.
- The notable reasons assigned in agreement with the argument were: varied standards of institutions (23%), availing maximum chances (21%) followed by pressure on students (8.5%), personal experience (5.5%) and high competition (4.5%) etc.

(Response - 46%)

Reform in the current multiple entrance examination system

- The respondents in general were in favour of the reforms with 59% for major changes and 26% for change with partial support.

(Response - 46%)

Current Examination System

In -defence

- The strong features in defence of the current examination system as expressed by the respondents were - better chances / options in harmony with varying standards of institutions and also students followed by high standard of examinations, high knowledge intensity, filtration of students etc.

(Response - 30%)

Reforms

- Respondents preferred single examination system, having high knowledge intensity and features such as alignment of the examination syllabus with the XIIth Class, affordable examination fee, judicious use of time and money, increase of professional courses seats, transparency in examination result & counselling process etc for the reforms in the current examination system.
- Other prominent features cited for reform were removal of negative marking, online mechanism of application submission and examination, more centres for examination and efficient scheduling to avoid overlapping, emphasis on aptitude and extra-curricular activities including regional language etc.

(Response - 30%)

Part-B: Proposed National Test Scheme (NTS)

Weighting factor in Entrance Examination Scores for overall and consistent performance in School Boards Exam:

- Majority of the respondents (66%) were in favour of inclusion of the weighting factor.
- 34% of the respondents were against inclusion of weighting factor for NTS, the main reasons cited were – Boards Examination marks can't judge one's capability, non-uniformity across boards and changes in Board Examination System.

(Response - 32%)

Reasons for not favouring multi -parametric and rationalized NTS:

- 9% of the respondents expressed satisfaction with the current examination system while 15% of them favoured NTS and however another 28% lacked clarity in understanding the NTS.
- The main reasons cited for objecting NTS were 'restricting the scope and options to only one examination', 'balancing the heterogeneity across institutions', 'suitability of weighting factor', 'pressure on students' apart from other reasons such as 'intellectual ability cannot be tested by NTS', 'illogical & complicated process', 'partiality in board exams' etc.

(Response - 8%)

Indian Equivalent of Scholastic Aptitude Test (SAT) as the National Test Scheme:

- Majority of the respondents (73%) were in favour of Indian equivalent of SAT as NTS.

(Response - 32%)

Views on Aptitude Test (similar to SAT or current AIEEE) and Advanced Test (similar to current JEE) as part of the NTS:

- Majority of the respondents (70%) were in favour of 'a mix of aptitude and advanced test', whereas 18% favoured 'advanced test' only. A mix of '**aptitude and advanced test'** was supported primarily by parents, working category and students.

(Response - 31%)

Suggestions for Essential Features of an alternative Model:

- Respondents favoured High Filter Type like IIT JEE 17%, SAT Type 15%, Competitive Ranking Model 13% followed by Placement Type Selection Examination 12% etc. for the alternative model.

(Response – 31%)

PUBLIC OPINION POLL – ANALYSIS

PART I: RESPONDER PROFILE

PART I: RESPONDER PROFILE

1.1.1. Distribution of Respondents by Country, State and Gender

(Table 1 – 2, Figure 1 – 2)

Key Observations:

- 2063 responses were received, out of which 98.5 % were from India. From outside India, the highest response of 0.7% was received from USA
- 217 (10.5%) were female respondents.
- 74% of the respondents were from engineering and science academic background. Engineering respondents comprised of 65.5 % while 8.4% were having science background.
- 60% of the respondents belonged to 5 states, comprising of Andhra Pradesh (24%), Maharashtra (16%), Delhi (7%), Tamil Nadu (7%) and UP (6%).

Table 1

GENDER - WISE DISTRIBUTION OF RESPONDENTS ACROSS COUNTRIES

Country	Total	% Distribution	Gender		
			Male	Female	Not Specified
IN	**2032**	**98.50%**	1793	211	28
US	**15**	**0.73%**	13	2	0
SA	**4**	**0.19%**	3	1	0
AE	**3**	**0.15%**	2	1	0
DE	**1**	**0.05%**	1	0	0
HK	**1**	**0.05%**	0	1	0
IT	**1**	**0.05%**	1	0	0
JP	**1**	**0.05%**	1	0	0
NL	**1**	**0.05%**	1	0	0
SG	**1**	**0.05%**	0	0	1
TH	**1**	**0.05%**	0	1	0
TW	**1**	**0.05%**	1	0	0
UK	**1**	**0.05%**	1	0	0
Total	**2063**	**100.00%**	**1817**	**217**	**29**
% Distribution	**100%**		**88.08%**	**10.52%**	**1.41%**

Table 2

GENDER - WISE DISTRIBUTION OF RESPONDENTS ACROSS STATES

State	Total	% Distribution	M	F	Not Specified
AP	498	**24.14%**	427	67	4
MH	339	**16.43%**	309	30	0
DL	145	**7.03%**	128	13	4

Table 2

GENDER - WISE DISTRIBUTION OF RESPONDENTS ACROSS STATES

State	Total	% Distribution	M	F	Not Specified
TN	144	**6.98%**	129	14	1
UP	120	**5.82%**	102	11	7
KA	77	**3.73%**	68	9	0
UL	71	**3.44%**	65	4	2
RJ	60	**2.91%**	57	3	0
HR	53	**2.57%**	49	4	0
MP	48	**2.33%**	44	4	0
WB	45	**2.18%**	37	5	3
GJ	31	**1.50%**	29	2	0
KL	31	**1.50%**	29	1	1
AS	26	**1.26%**	22	4	0
PB	25	**1.21%**	23	2	0
JH	18	**0.87%**	18	0	0
BR	17	**0.82%**	17	0	0
OR	14	**0.68%**	12	1	1
JK	8	**0.39%**	7	1	0
CH	7	**0.34%**	7	0	0
CT	7	**0.34%**	6	1	0
HP	5	**0.24%**	4	1	0
PY	4	**0.19%**	3	1	0
CALIFORNIA	2	**0.10%**	1	1	0
DUBAI	2	**0.10%**	2	0	0
GA	2	**0.10%**	1	0	1
NEW YORK	2	**0.10%**	1	1	0
RIYADH	2	**0.10%**	1	1	0
TEXAS	2	**0.10%**	2	0	0
AR	1	**0.05%**	1	0	0
CA	1	**0.05%**	1	0	0
EASTERN	1	**0.05%**	1	0	0
HUALIEN	1	**0.05%**	1	0	0
KANTO	1	**0.05%**	1	0	0
LOUSIANA	1	**0.05%**	1	0	0
MA	1	**0.05%**	1	0	0
ML	1	**0.05%**	1	0	0
MN	1	**0.05%**	0	0	1
PENNSYLVANIA	1	**0.05%**	1	0	0
VIRGINIA	1	**0.05%**	1	0	0
WESTERN PROVINCE	1	**0.05%**	1	0	0
NOT SPECIFIED	246	**11.92%**	206	36	4
Total	**2063**	**100%**	**1817**	**217**	**29**

Figure 1

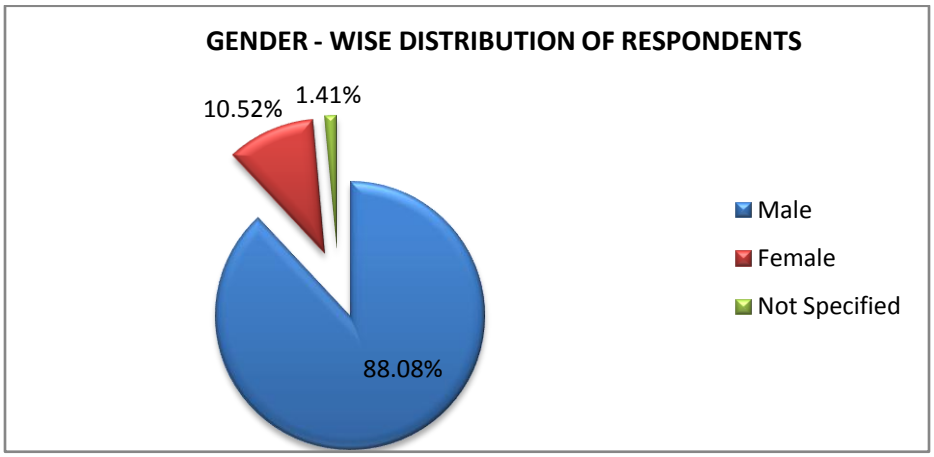
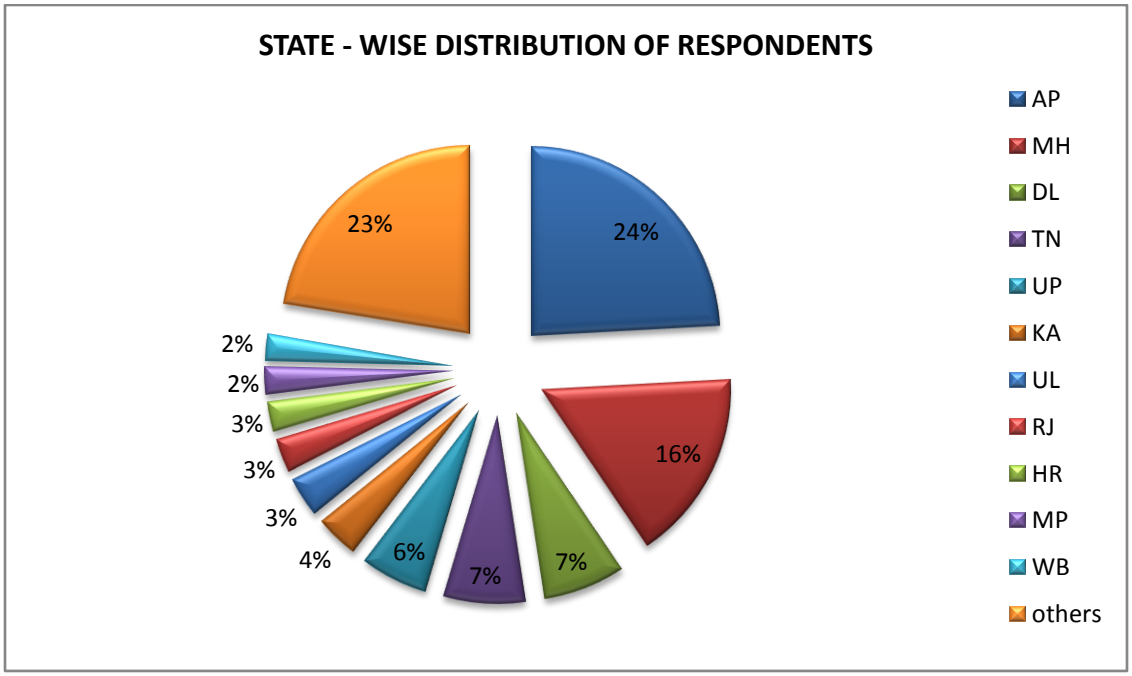


Figure 2



1.1.2. Respondents by Professional Background, Engg. Exam Taken and wish to stay connected with NTS

(Table 3 – 5, Fig.3 – 9)

Key Observations:

- Out of 2063, 59% of the respondents were students, 32% working, and 5% parents.
- Of the total students, 82% were from engineering, 9% from sciences and another 9% from medical, commerce, humanities etc.
- Female response was around 20% for each of the categories Student – medical, humanities, others; Working – coaching category and non-working.
- 80% of the total respondents have taken engineering examinations.
- Among the various professional background categories, 86% of students, 72% of working, 60% of parents, 59% of non-working and 55% of others have taken engineering examinations.
- 28% of the total respondents expressed their wish to stay connected to further NTS exercises through E-mail (91%) as the most preferred mode.
- Relatively non-student categories such as parents, working, non-working and others expressed intense desire to stay connected with the future NTS exercises. However, among the students intense desire to stay connected with the NTS exercises was expressed by the medical category.

Table 3

PROFESSIONAL BACKGROUND OF RESPONDENTS

Professional Background	Sub-Categories	Total	% Distribution	Male	Female	Not Specified
Student		**1220**	**59.14%**	**1093**	**118**	**9**
	Engg	1002	48.57%	912	87	3
	Sciences	113	5.48%	98	11	4
	Medical	27	1.31%	21	5	1
	Humanities	22	1.07%	17	5	
	Commerce	20	0.97%	16	3	1
	Others	36	1.75%	29	7	
Working		**667**	**32.33%**	**582**	**74**	**11**
	Non Teaching	482	23.36%	421	55	6
	Teaching	167	8.10%	146	16	5
	Coaching	16	0.78%	13	3	
	NA	2	0.10%	2		
Parent		113	5.48%	92	13	8
Not Working		32	1.55%	24	8	
Others		31	1.50%	26	4	1
Total		**2063**	**100%**	**1817**	**217**	**29**

Note: 'Others' under Student category includes MBA, Education, Mass Media etc.
Others under Professional Background includes not specified elsewhere (nse)

Table 4

RESPONDENTS TAKEN ENGINEERING EXAMINATION AND WISH TO STAY CONNECTED WITH NTS EXERCISE

Professional Background	Sub-Categories	Total	Taken Engg Exam	% Taken Engg Exam	Wish To Stay Connected	% Wish To Stay Connected
A	B	C	D	E = D/C	F	G = F/C
Student		**1220**	**1055**	**86.48%**	**307**	**25.16%**
	Engg	1002	954	95.21%	243	24.25%
	Sciences	113	60	53.10%	32	28.32%
	Medical	27	8	29.63%	13	48.15%
	Humanities	22	9	40.91%	7	31.82%
	Commerce	20	5	25.00%	4	20.00%
	Others	36	19	52.78%	8	22.22%
Working		**667**	**484**	**72.56%**	**209**	**31.33%**
	Employed	482	357	74.07%	150	31.12%
	Teaching	167	114	68.26%	57	34.13%
	Coaching	16	11	68.75%	1	6.25%
	NA	2	2	100.00%	1	50.00%
Parent		**113**	**68**	**60.18%**	**41**	**36.28%**
Not Working		**32**	**19**	**59.38%**	**11**	**34.38%**
Others		**31**	**17**	**54.84%**	**11**	**35.48%**
Total		**2063**	**1643**	**79.64%**	**579**	**28.07%**

Table 5

If willing to stay connected, then what should be the communication mode?		
email	**phone**	**any**
526	47	6

Figure 3

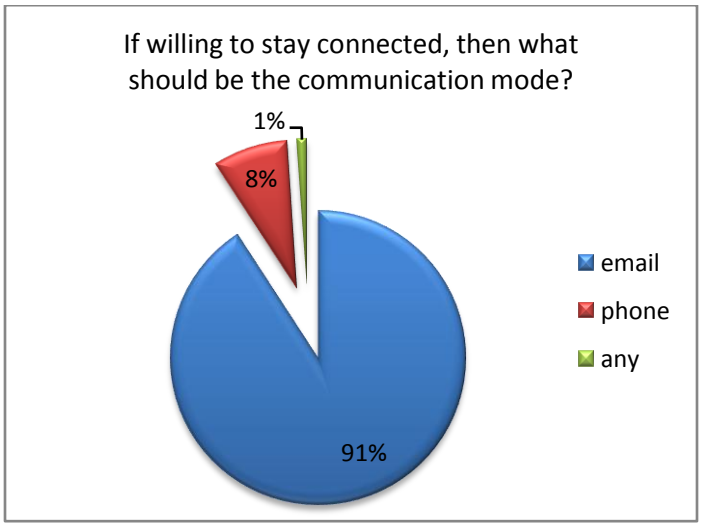


Figure 4

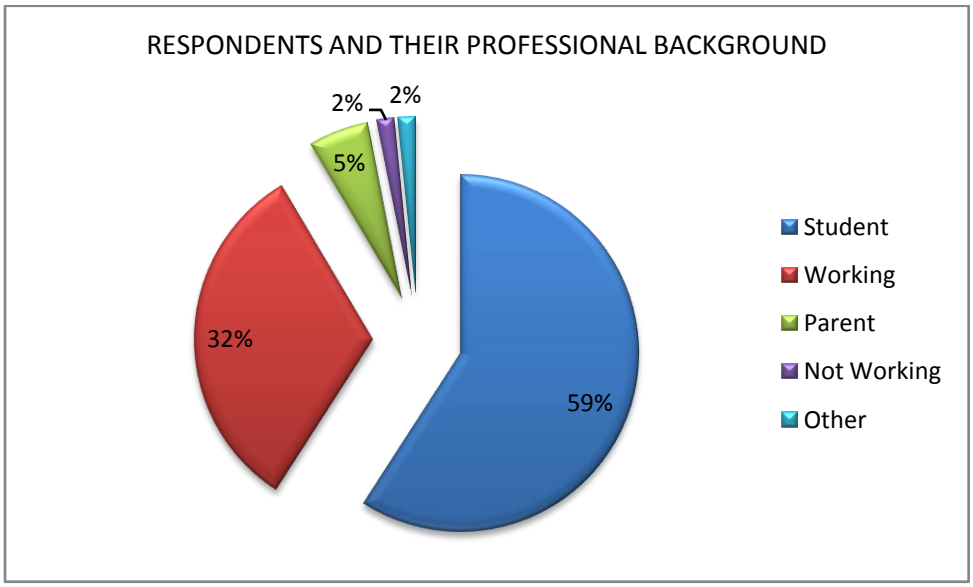


Figure 5

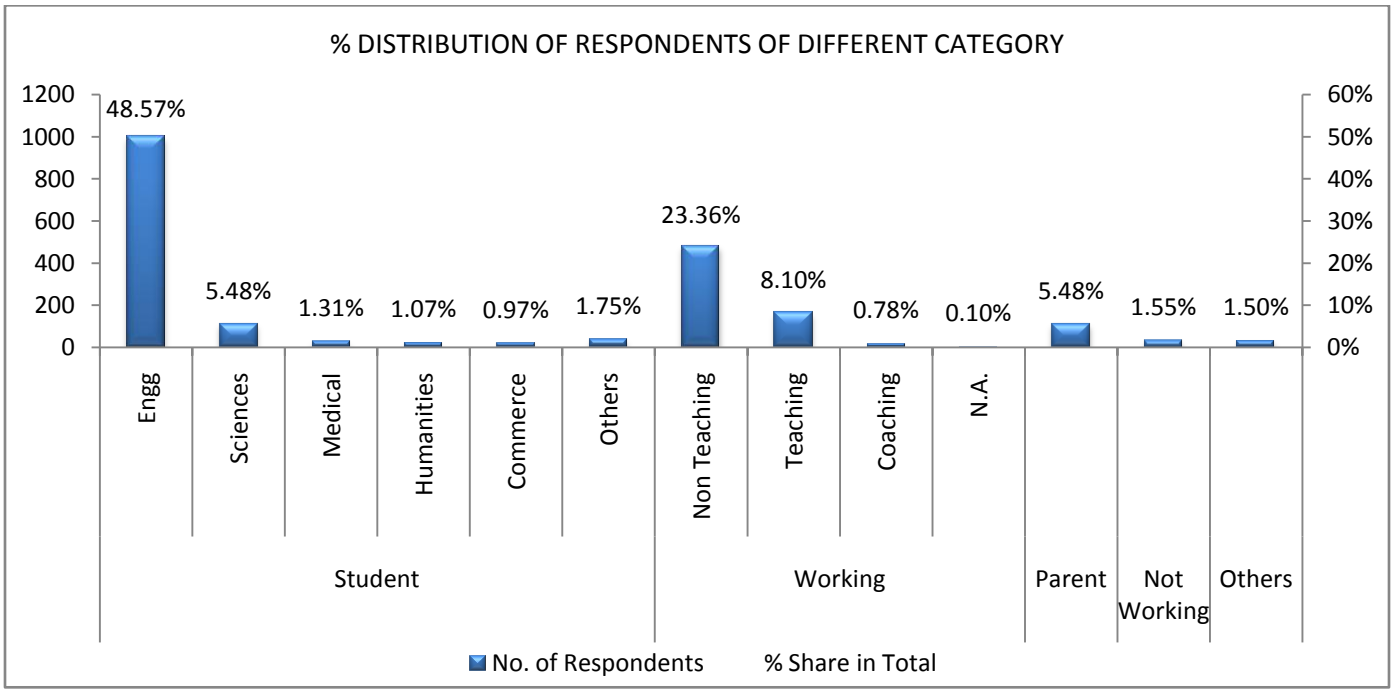


Figure 6

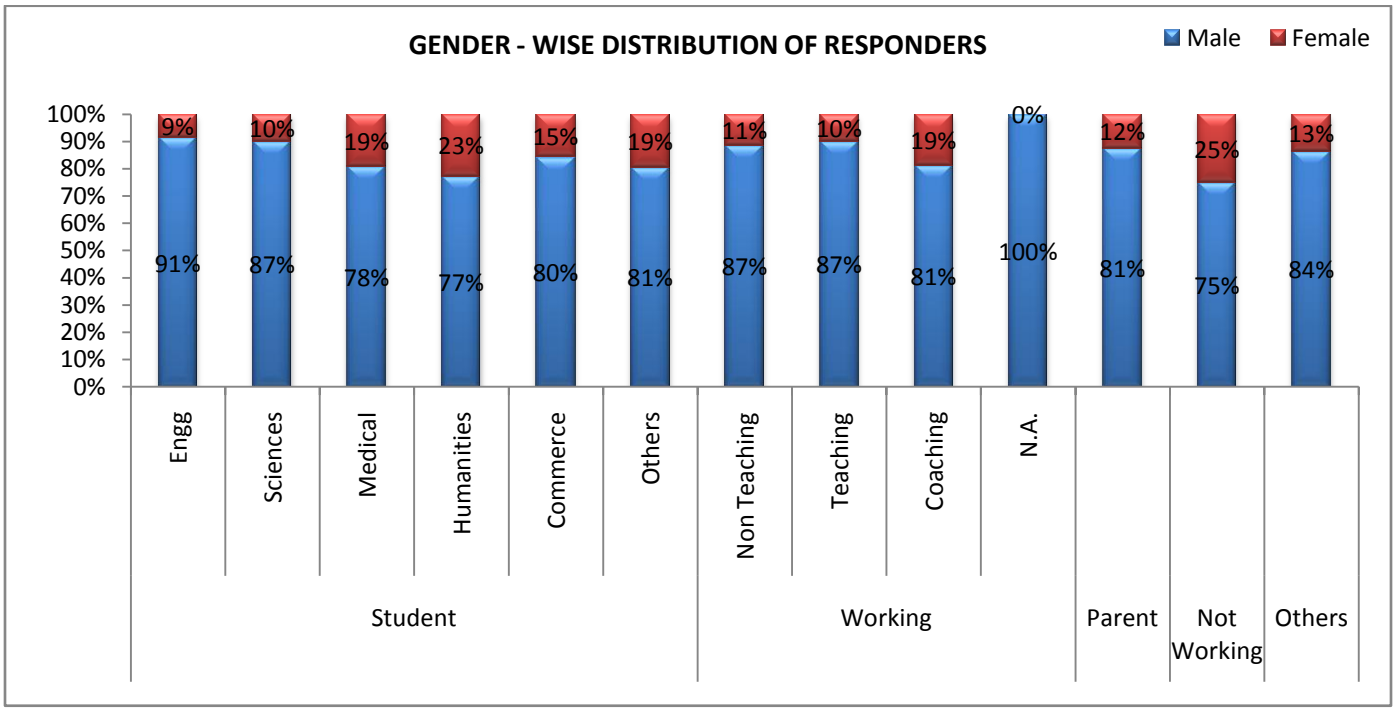


Figure 7

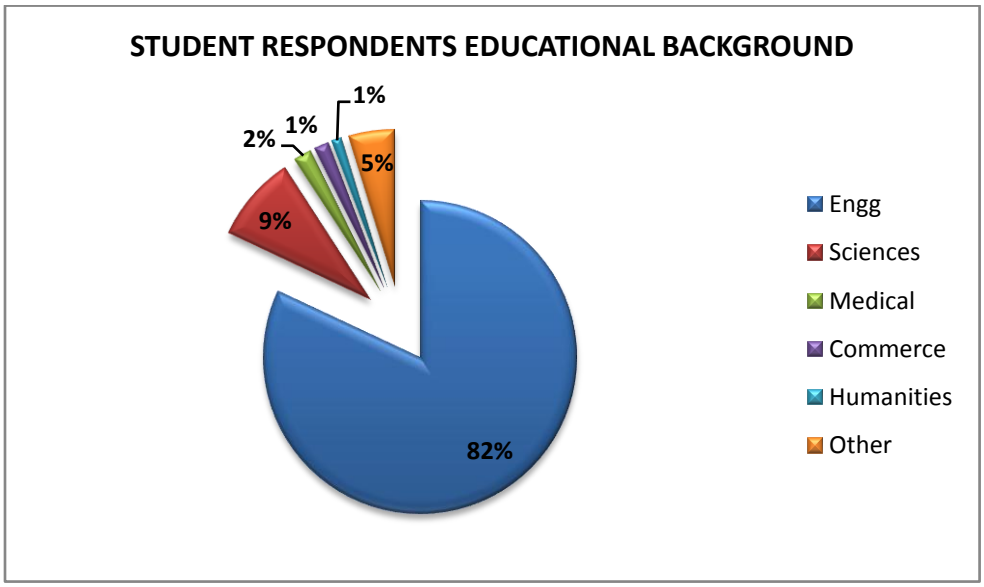


Figure 8

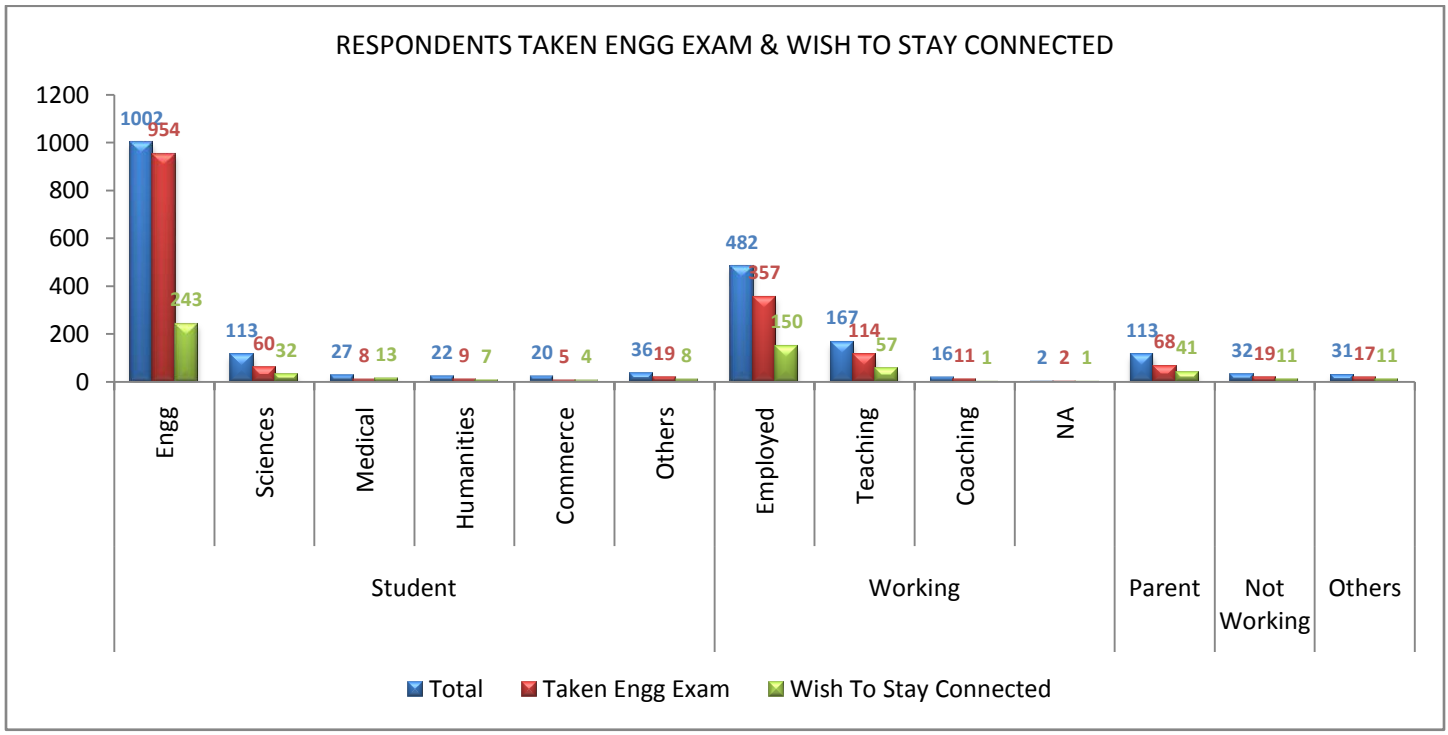
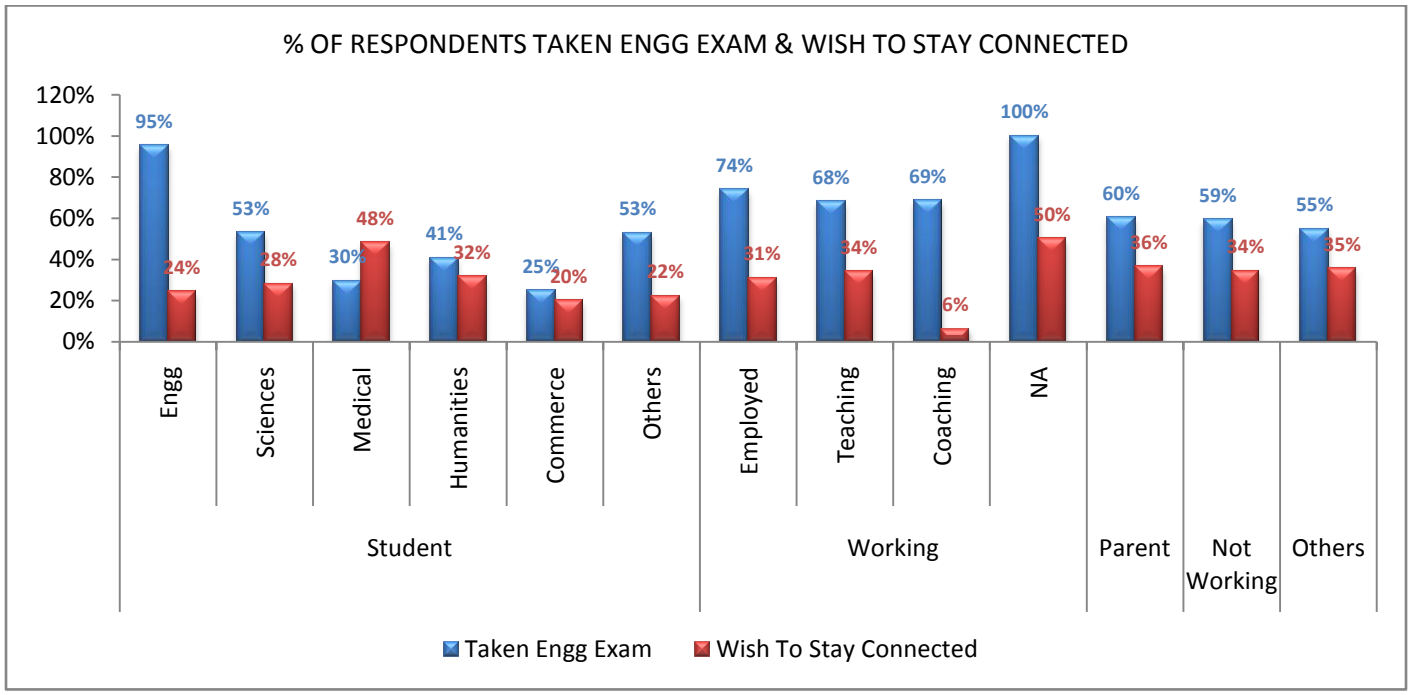


Figure 9



1.1.3. Working Respondent's Profile

(Table 6, Figure 10 – 12)

Key Observations:

- Of the total working respondents, 72% comprised of non-teaching followed by teaching 25% and coaching 2.4%.
- The 'non-teaching' working respondents comprised of the following categories: corporate (64%), government (29%) and self-employed (7%).
- Of the total working respondents (667), 484 (72%) have taken engineering examinations. Among the various sub-categories, more than 60% of the respondents have taken engineering examination with corporate being the highest (81%).
- Of the total working respondents 31% expressed their wish to stay connected. Among the sub-categories the lowest (6%) was for the coaching.

Table 6
WORKING RESPONDENTS PROFILE

Working Respondents	Sub-Category	Total	% Distribution	Taken Engg Exam	% Taken Engg Exam	Wish To Stay Connected	% Wish To Stay Connected
A	B	C	D=C/667	E	F=E/C	G	H=G/C
Non Teaching	Corporate	308	46.18%	249	80.84%	96	31.17%
	Govt.	138	20.69%	86	62.32%	40	28.99%
	Self	35	5.25%	22	62.86%	14	40.00%
Teaching		167	25.04%	114	68.26%	57	34.13%
Coaching		16	2.40%	11	68.75%	1	6.25%
NA		3	0.45%	2	66.67%	1	33.33%
Total		667	100.00%	484	72.56%	209	31.33%

Figure 10

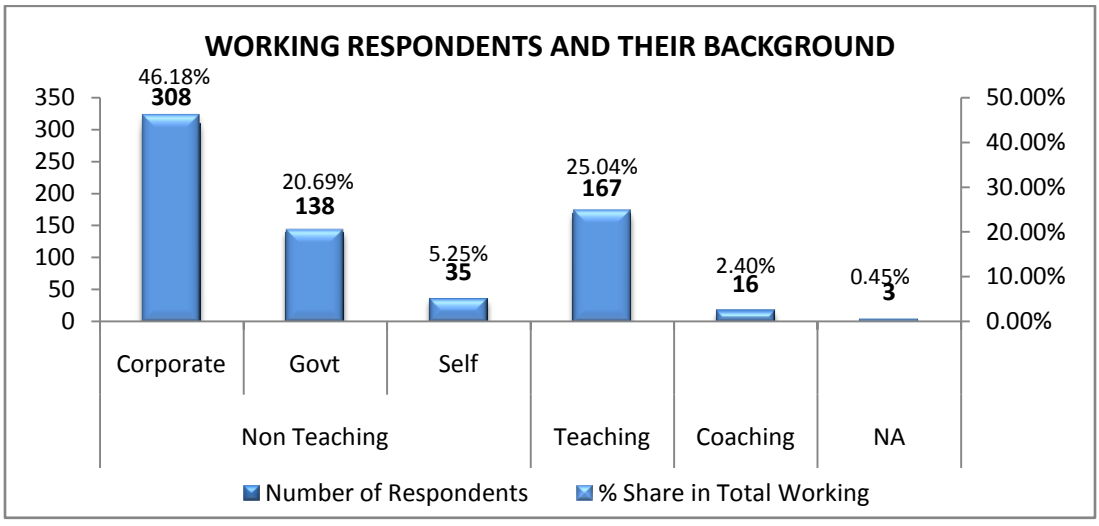


Figure 11

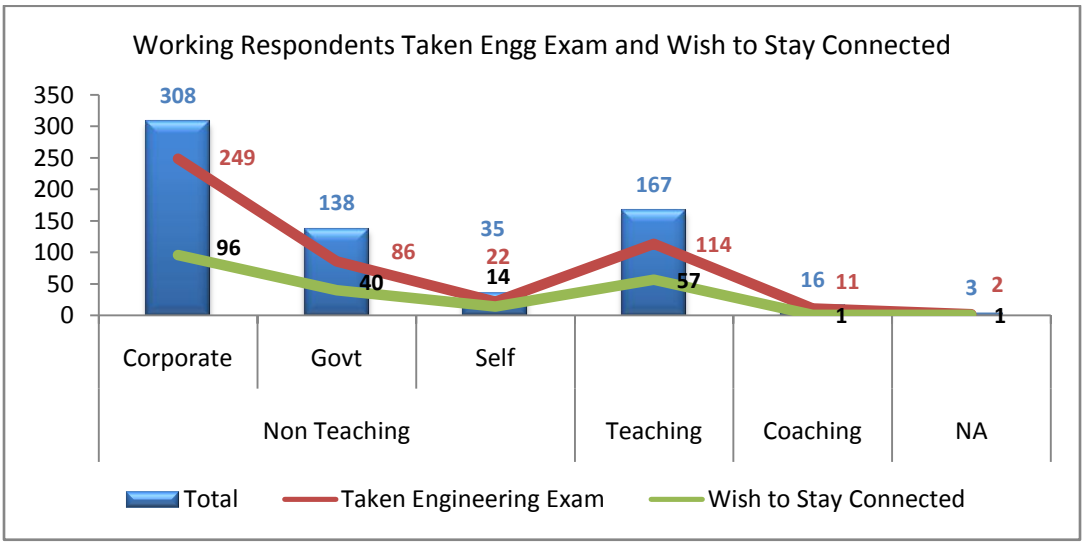
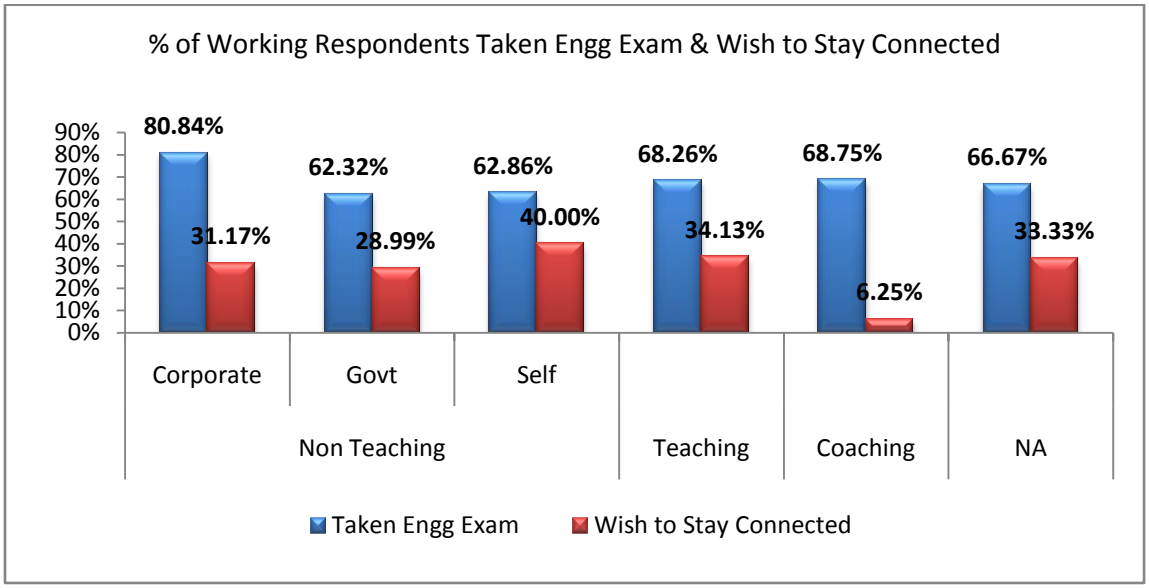


Figure 12



1.1.4. Professional Experience of Working Respondents

(Table 7 - 8, Figure 13 – 19)

Key Observations:

- 90 % of the respondents of teaching category were working at tertiary level.
- 34% of the teaching respondents had a working experience of more than 15 years and around 25% of each had an experience of less than 5 years and 5 – 10 years in respective categories.
- In case of 'non-teaching' working respondents, 56% of them had less than 5 years while 22% had more than 15 years of professional experience.

Table 7

TEACHER RESPONDENTS PROFILE TEACHING LEVEL - WISE

Teaching Level	Total	% Distribution	Teaching Experience (Years)				Teaching Place				Taken Engg Exam	% Taken Engg Exam	Wish To Stay Connected	% Wish To Stay Connected
			Less Than 5	5 To 10	10 To 15	More Than 15	School	College	University	National Institute				
A	B	C=B/167	D	E	F	G	H	E	J	K	L	M=L/B	N	O=N/B
Tertiary	**151**	**90.42%**	35	33	28	55		39	27	85	106	**70.20%**	53	35.10%
Middle & Sec	**14**	**8.38%**	5	5	2	2	9	4	1		7	50.00%	3	21.43%
Primary	**2**	**1.20%**	1	1			2				1	50.00%	1	50.00%
Total	**167**	**100%**	**41**	**39**	**30**	**57**	**11**	**43**	**28**	**85**	**114**	**68.26%**	**57**	**34.13%**
% Distribution			**25%**	**23%**	**18%**	**34%**	**7%**	**26%**	**17%**	**51%**				

Note: For additional tables see ***'Miscellaneous Section'*** at the end.

Figure 13

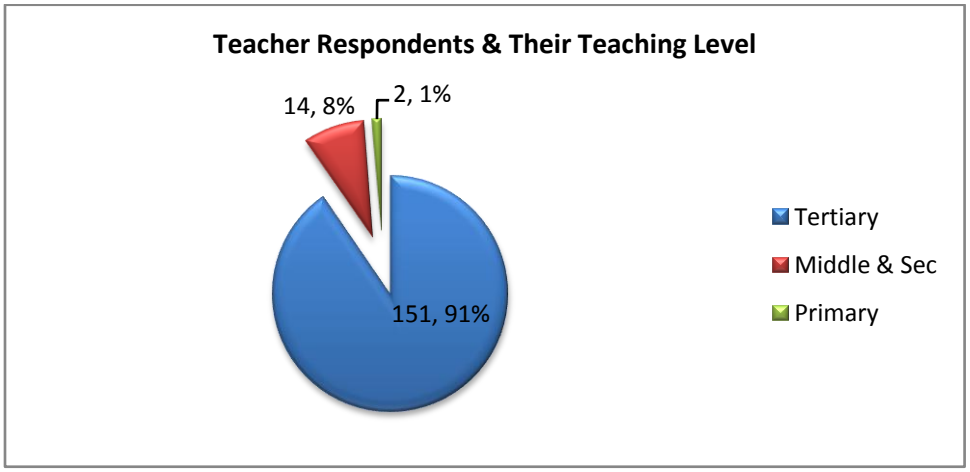


Figure 14

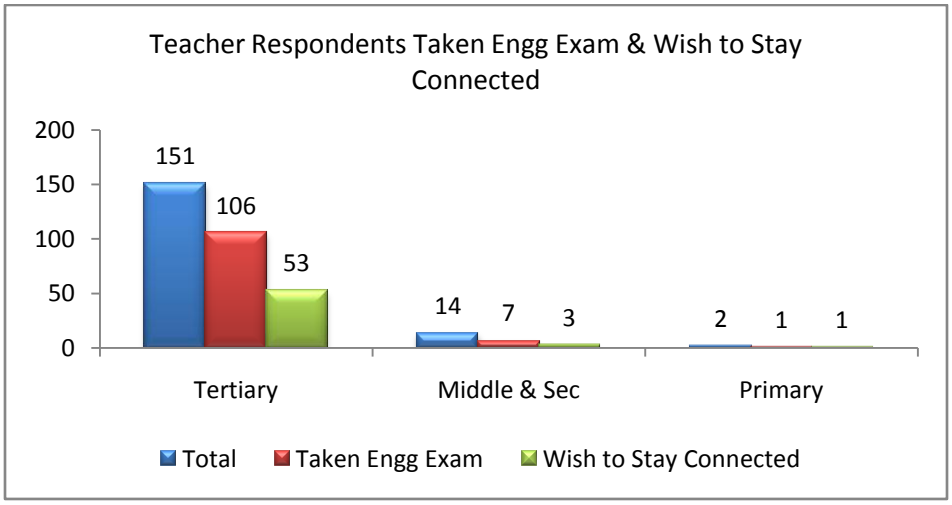


Figure 15

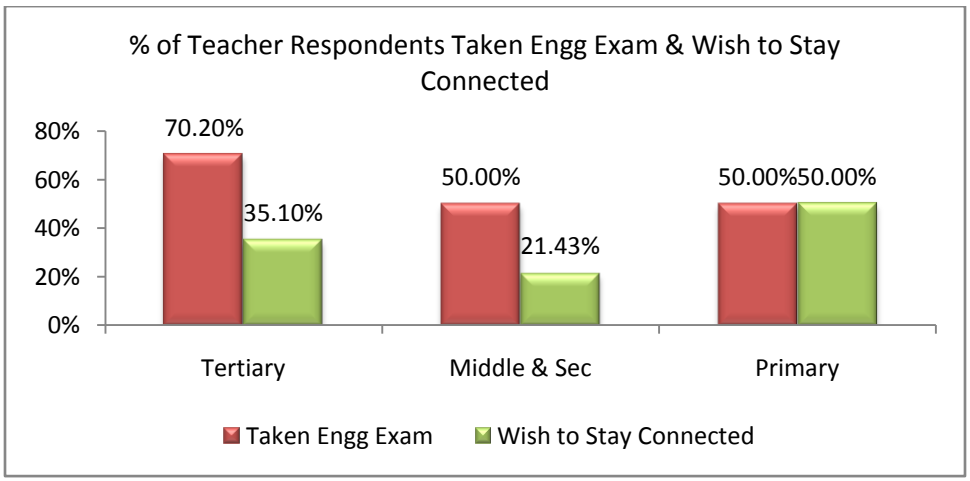


Table 8

NON-TEACHING WORKING RESPONDENTS' PROFILE

Nature Of Employment	Total	% Distribution	Professional Experience (Years)				Taken Engg Exam	% Taken Engg Exam	Wish to Stay Connected	% Wish to Stay Connected
			Less5	5to10	10to15	More15				
A	B	C=B/481	D	E	F	G	H	I=H/B	J	K=J/B
Corporate	**308**	**64.03%**	211	49	19	29	249	80.84%	96	31.17%
Govt.	**138**	**28.69%**	45	12	13	68	86	62.32%	40	28.99%
Self	**35**	**7.28%**	12	8	4	11	22	62.86%	14	40.00%
Total	**481**	**100%**	**268**	**69**	**36**	**108**	**357**	**74.22%**	**150**	**31.19%**
% Distribution			**55.72%**	**14.35%**	**7.48%**	**22.45%**				

Figure 16

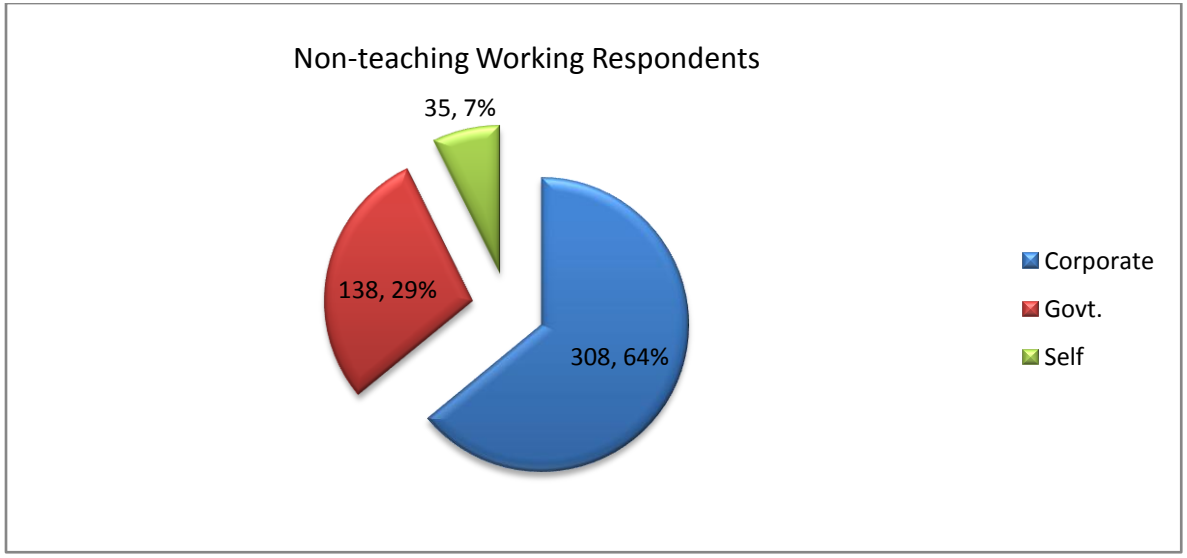


Figure 17

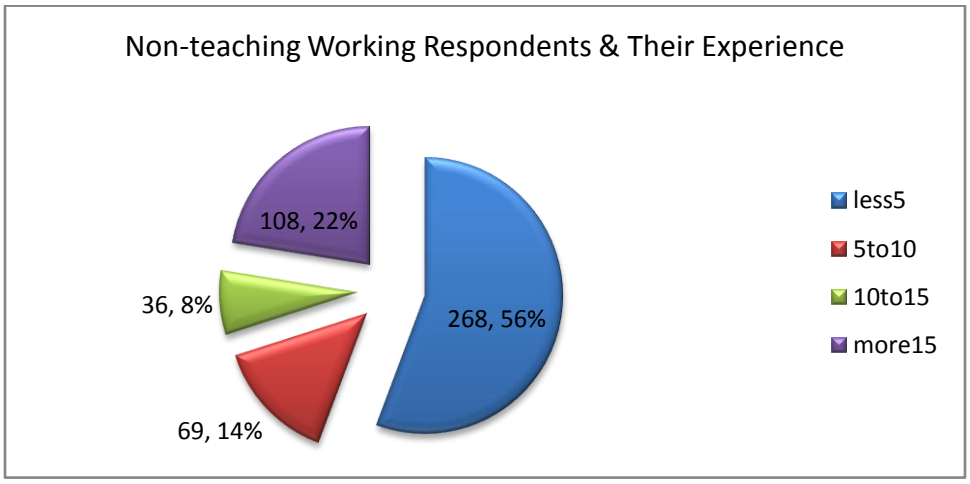


Figure 18

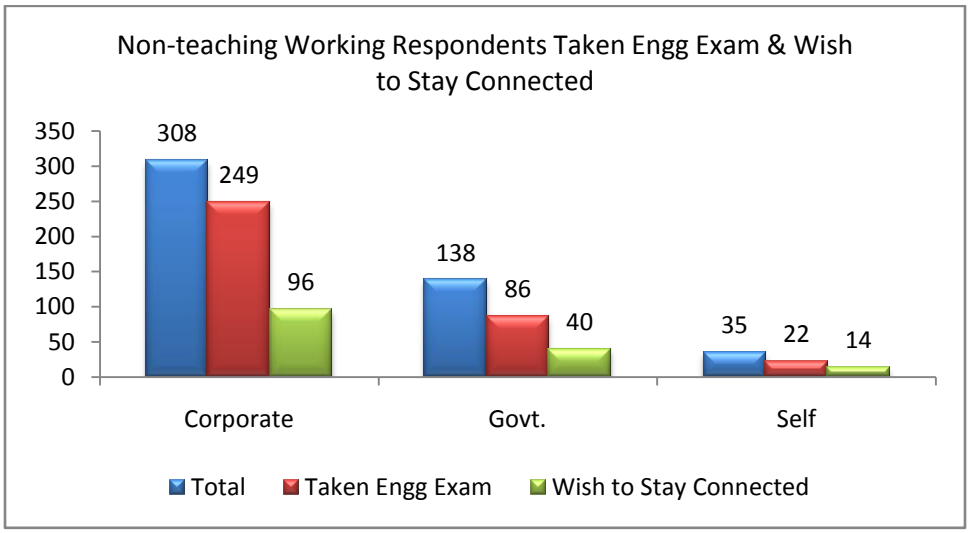
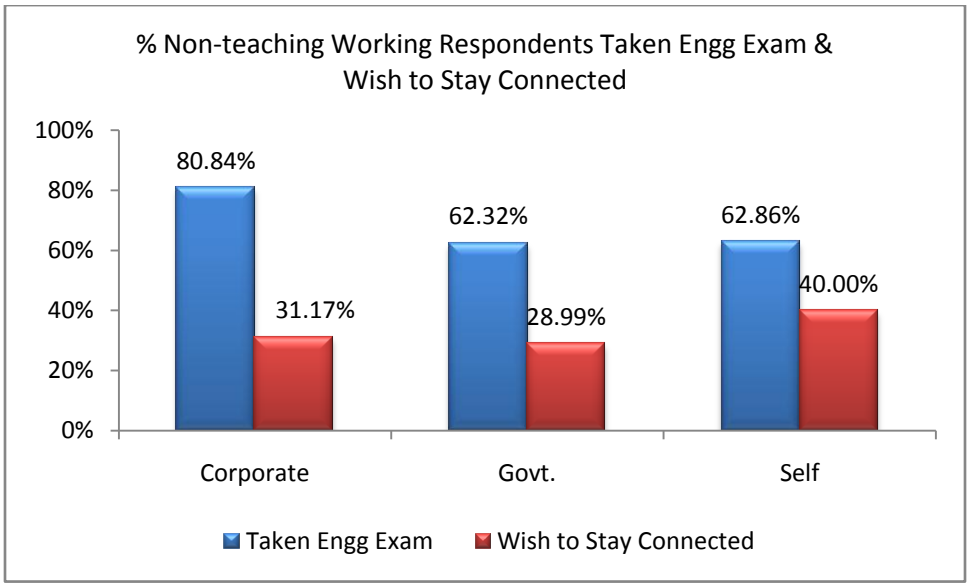


Figure 19



PUBLIC OPINION POLL – ANALYSIS

DETAILED RESPONSE

PART II

DETAILED RESPONSE

PART A: UNDERSTANDING THE VIEWS ON THE CURRENT EXAMINATION SYSTEM

1. Do you support the following argument

"Today it appears that most students seeking admission into tertiary professional education in the country are appearing in as many as five to ten different types of competitive examinations with different sociological implications"

a. Yes, I completely agree b. No, I disagree If yes, why?

Key Observations:

- 46% of the total (960 out of 2063) responded to the above question.
- 71% of the respondents (680 out of 960) agreed with the above argument.
- Among the various professional categories / sub-categories of respondents, majority of them also completely agree with the above argument.
- The notable reasons assigned in agreement with the argument were: varied standards of institutions (23%), availing maximum chances (21%) followed by pressure on students (8.5%), personal experience (5.5%) and high competition (4.5%) etc. However, in case of the 'Others' category (26%), majority of them lacked clarity in understanding the question itself.

Note: for details see (Table 9 – 10, Figure 20 – 23)

Table 9

Part A1 **Response Rate - 46%** **(960 OUT OF 2063)**

Professional Background	Sub-category	Yes	% Yes	No	% No	Total
A	B	C	D=C/G	E	F=E/G	G
Student	**Sub-total**	**359**	**69%**	**162**	**31%**	**521**
	Engg	279	67%	137	33%	416
	Sciences	40	78%	11	22%	51
	Medical	13	81%	3	19%	16
	Humanities	8	67%	4	33%	12
	Commerce	5	56%	4	44%	9
	Other	14	82%	3	18%	17
Working	**Sub-total**	**248**	**74%**	**89**	**26%**	**337**
	Non-teaching	177	71%	71	29%	248
	Teaching	66	80%	17	20%	83
	Coaching	4	80%	1	20%	5
	NA	1	100%		0%	1
Parent		**51**	**75%**	**17**	**25%**	**68**
Not Working		**12**	**71%**	**5**	**29%**	**17**
Other		**10**	**59%**	**7**	**41%**	**17**
Total		**680**	**71%**	**280**	**29%**	**960**

Table 10 – A

Part A Q 1: If yes, why?

S. No.	Reasons Category	Freq	% Distribution
1	Varied standards of institutions	107	22.67%
2	To avail maximum chances	100	21.19%
3	Pressure on students	40	8.47%
4	Personal Experience	26	5.51%
5	High competition	21	4.45%
6	To get admission in best institutions	16	3.39%
7	Waste of Time and Money	12	2.54%
8	To secure future	11	2.33%
9	To get admission without wasting year	9	1.91%
10	Flaw in education system	9	1.91%
11	Others	121	25.64%
	Total	**472**	**100.00%**

Table 10 – B

S. No.	Other Category Details	Freq	% Distribution
1	Lack of clarity	73	60.33%
2	Favoring NTS	9	7.44%
3	Money making business	9	7.44%
4	Necessity	8	6.61%
5	No reason given	6	4.96%
6	No other option	5	4.13%
7	Unique	4	3.31%
8	Affordability issue	4	3.31%
9	Large number of universities and institutions	2	1.65%
10	Students not getting right path	1	0.83%
	Total	**121**	**100.00%**

Figure 20

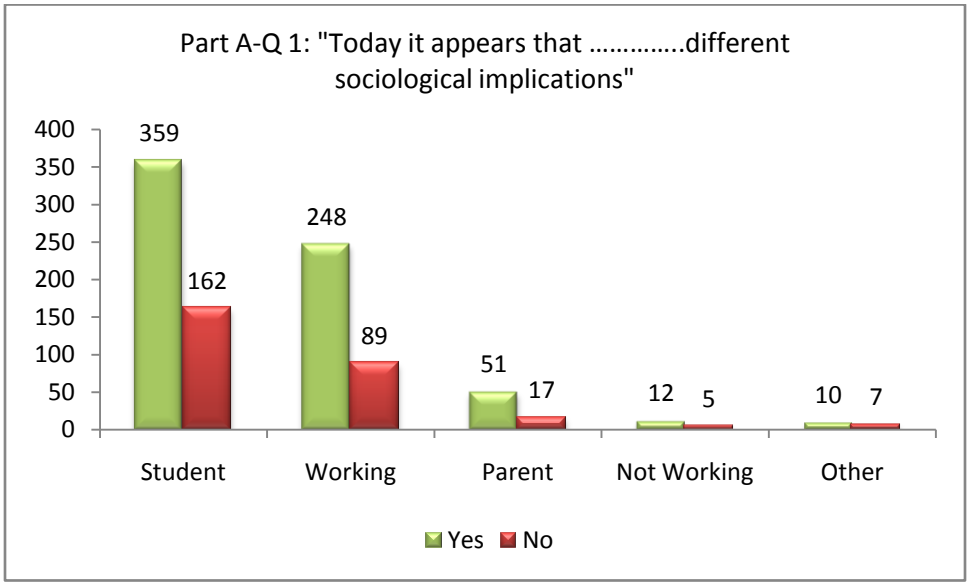


Figure 21

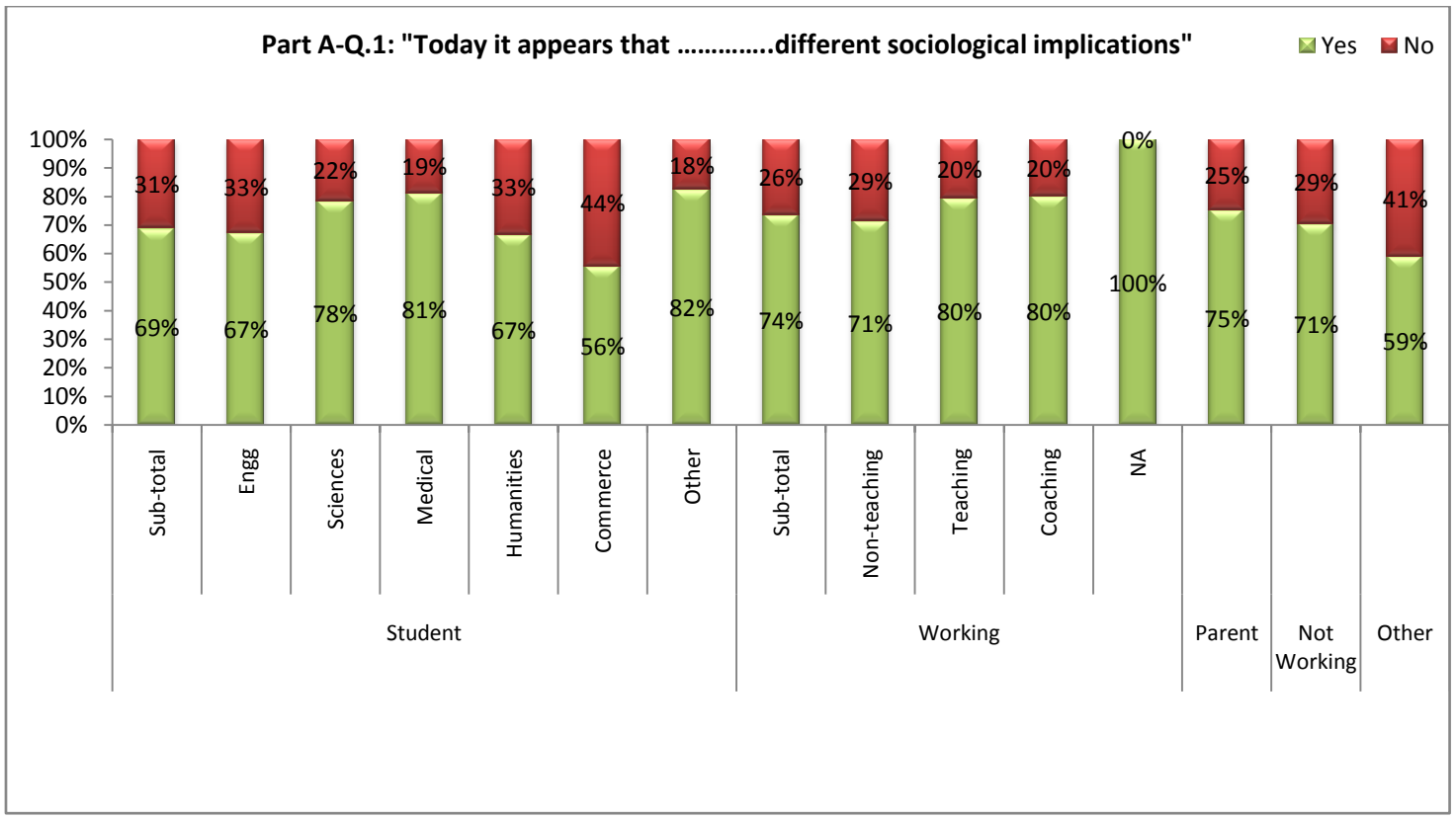


Figure 22

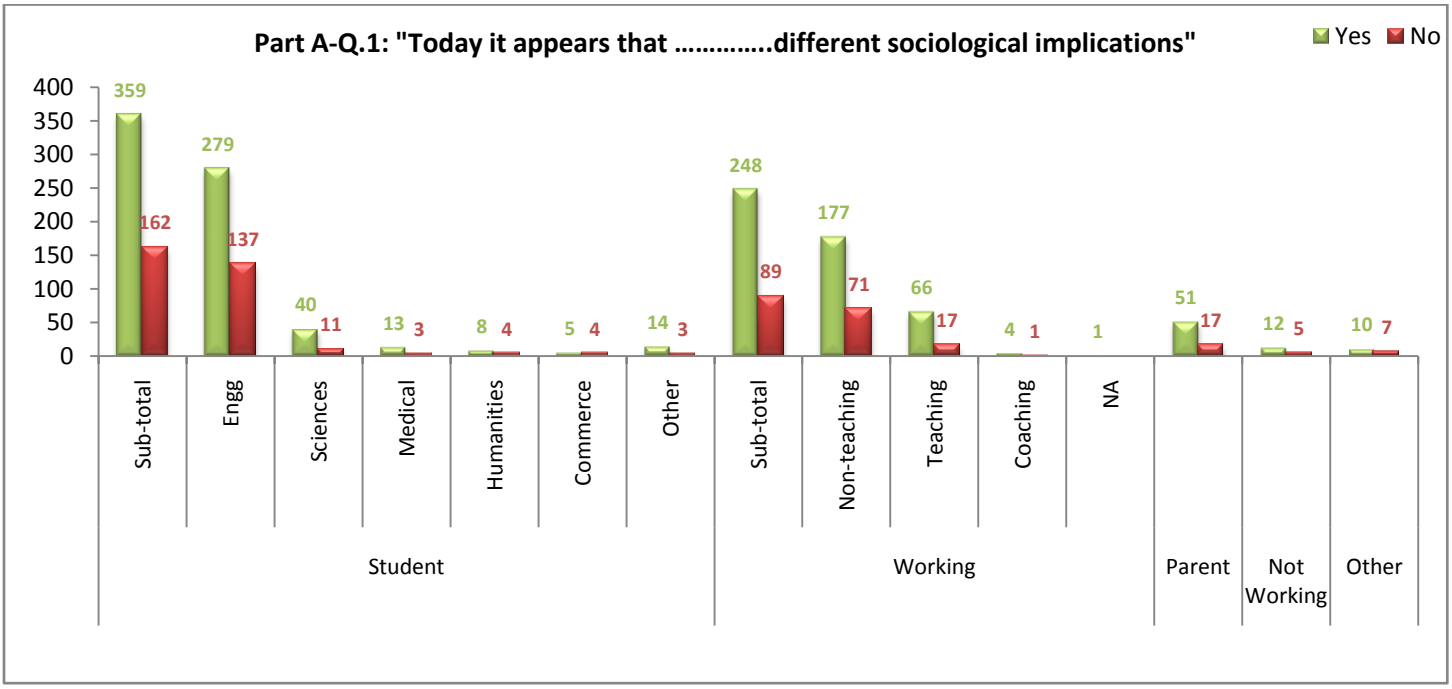
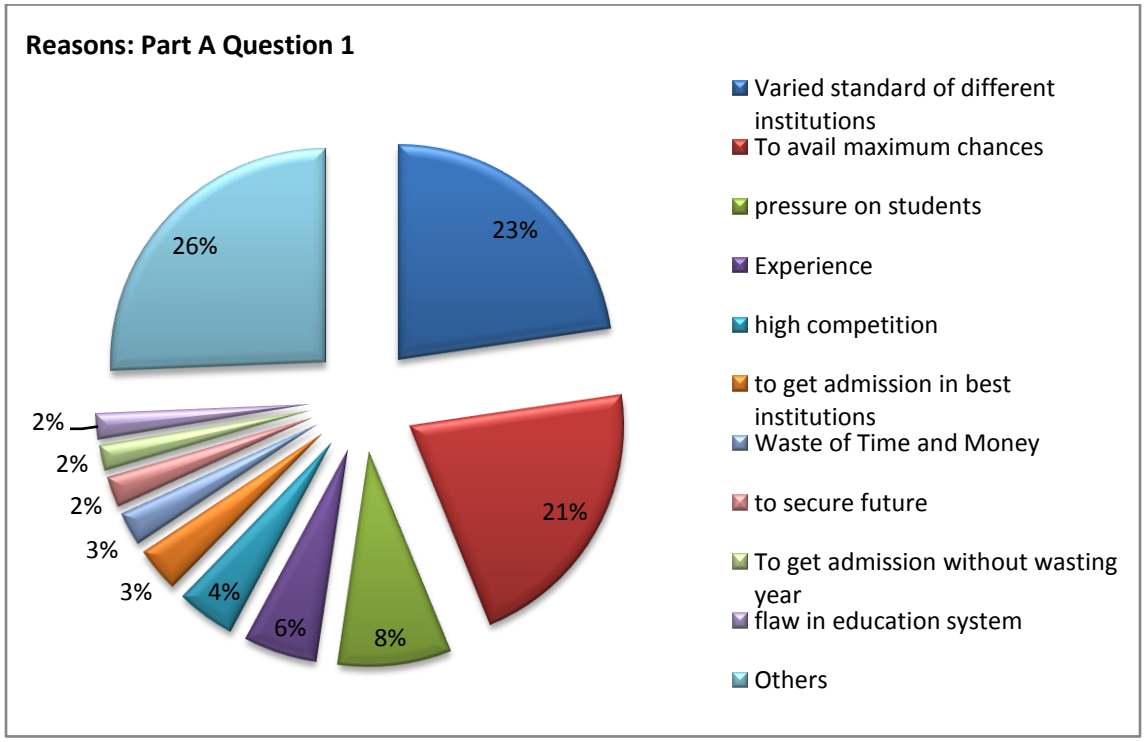


Figure 23



2. Do you think there is a need to bring about a reform in the current multiple entrance examination system

a. Essential, do not change b. Could change, but only partial support c. Needs major reforms

Key Observations:

- 46% of the total (947 out of 2063) responded to the above question.
- **Majority of the respondents (85%) were in favour of the reforms**, 59% for major changes and 26% for change with partial support.
- Around 50% of the engineering students only were in favour of major reforms with 35% agreeing for a change with partial support, while substantial support for major reforms was observed by Parent category (79%), followed by of working respondents (67%).

Note: for details see (Table 11, Figure 24 – 26)

Table 11

Part A 2 **Response Rate 46%** **(947 out of 2063)**

Professional Background	Sub-category	Essential, do not change	% Essential, do not change	Could Change, but only partial support	% Could Change, but only partial support	Needs major reforms	% Needs major reforms	Total
A	B	C	D=C/I	E	F=E/I	G	H=G/I	I
Student	**Sub-total**	**85**	**17%**	**162**	**31%**	**268**	**52%**	**515**
	Engg.	68	17%	143	35%	200	49%	411
	Sciences	10	20%	8	16%	32	64%	50
	Medical	4	25%	4	25%	8	50%	16
	Humanities	1	8%	2	17%	9	75%	12
	Commerce		0%	2	22%	7	78%	9
	Others	2	12%	3	18%	12	71%	17
Working	**Sub-total**	**43**	**13%**	**66**	**20%**	**224**	**67%**	**333**
	Non-teaching	29	12%	57	23%	158	65%	244
	Teaching	12	14%	8	10%	63	76%	83
	Coaching	1	20%	1	20%	3	60%	5
	NA	1	100%		0%		0%	1
Parents		**8**	**12%**	**6**	**9%**	**52**	**79%**	**66**
Not Working		**3**	**19%**	**6**	**38%**	**7**	**44%**	**16**
Others		**6**	**35%**	**3**	**18%**	**8**	**47%**	**17**
Total		**145**	**15%**	**243**	**26%**	**559**	**59%**	**947**

Figure 24

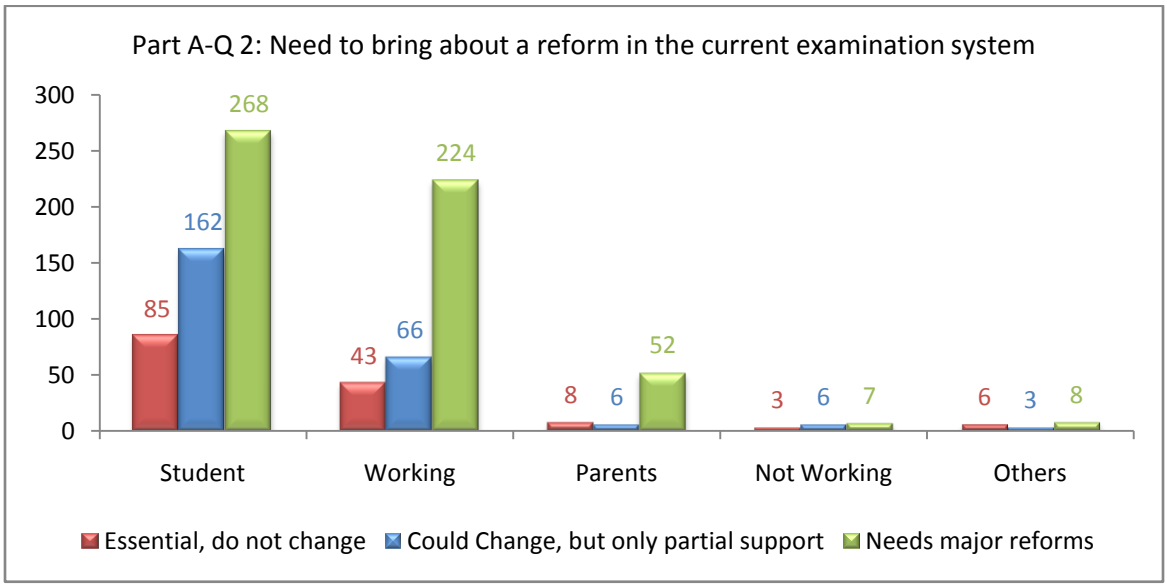


Figure 25

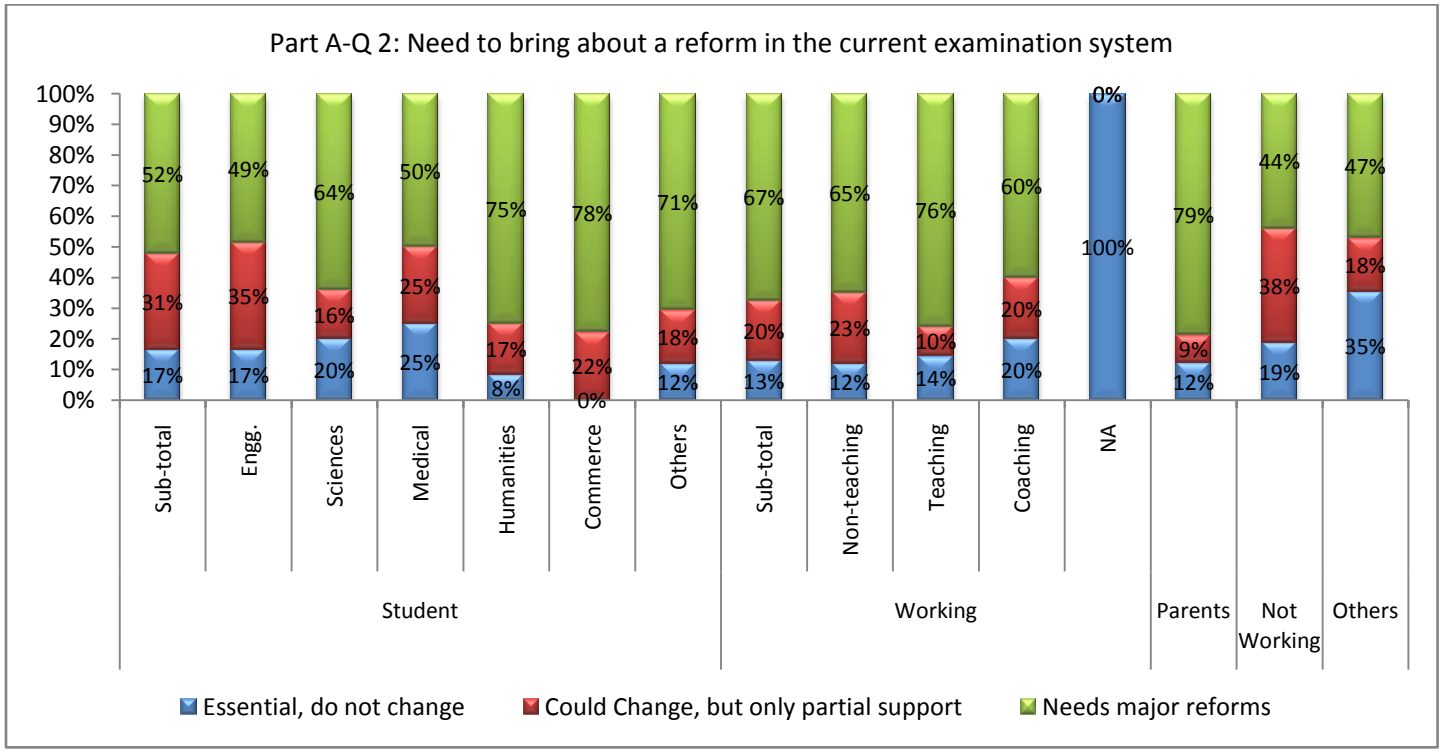
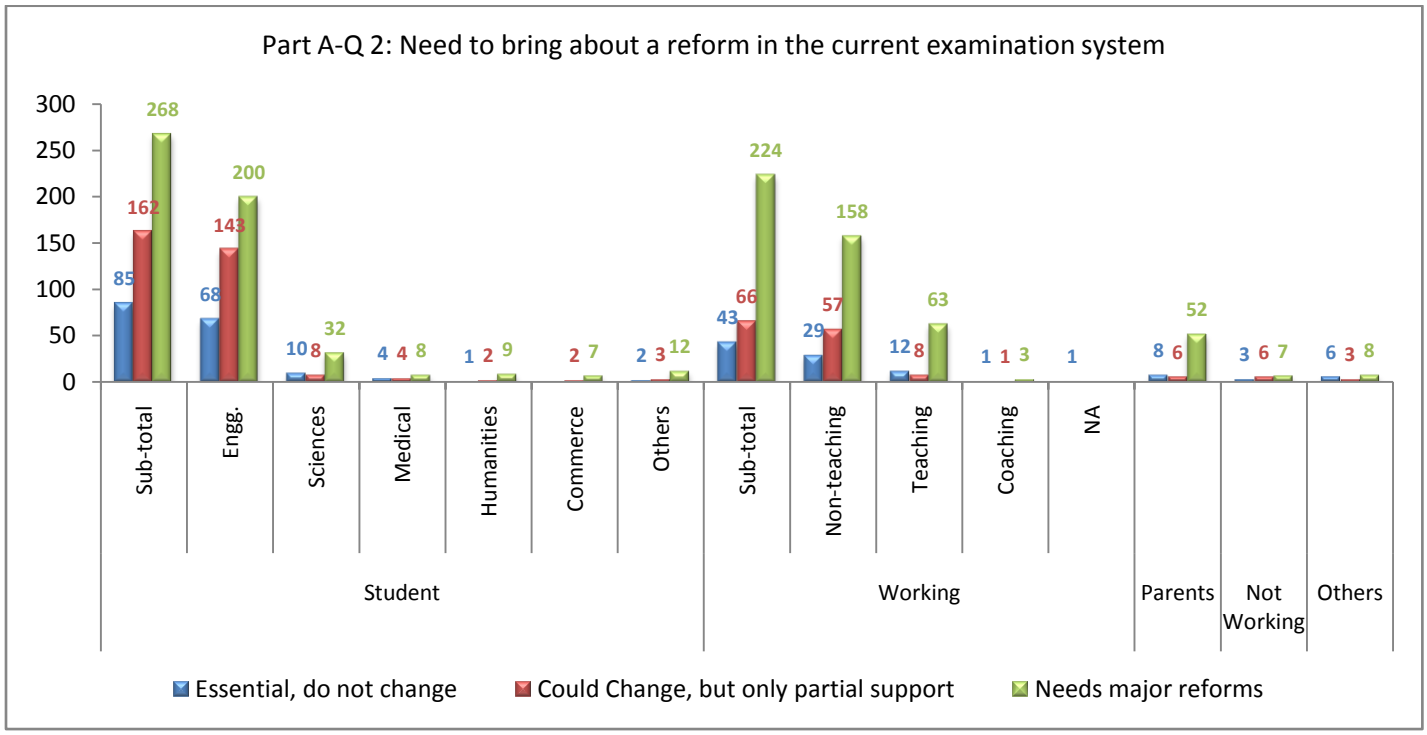


Figure 26


Part A-Q 2: Need to bring about a reform in the current examination system
300
250
200
150
100
50
0
85
162
268
68
143
200
10
8
32
4
4
8
1
2
9
2
7
2
3
12
43
66
224
29
57
158
12
8
63
1
1
3
1
8
6
52
3
6
7
6
3
8
Sub-total
Engg.
Sciences
Medical
Humanities
Commerce
Others
Sub-total
Non-teaching
Teaching
Coaching
NA
Parents
Not Working
Others
Student
Working
Essential, do not change
Could Change, but only partial support
Needs major reforms

3. List at least strong features in defence of the current examination system in order of ranking (we wish to understand the good part of the current examination system)

a. …….. b. …….. c. …….. d. ……..

Key Observations:

- 30% of the total (624 out of 2063) responded to the above question.
- Better chances / options in harmony with varying standards of institutions and also students were the strong features of the current examination system as expressed by the respondents. Followed by high standard of examinations, high knowledge intensity, filtration of students etc.
- 'Others' category occupied 46% of the response. It includes 20% of the total respondents lacking clarity.

Note: for details see (Table 12 & 12A, Figure 27)

Table 12

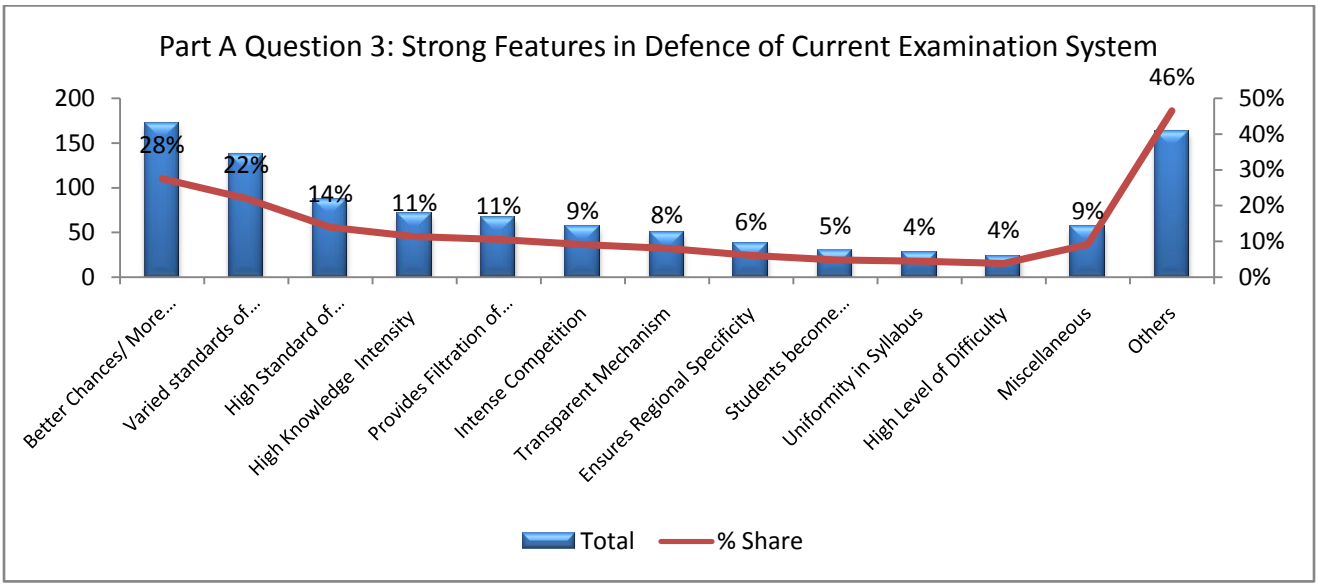
Part A 3 **Response rate - 30%** **(624 out of 2063)**

S. No.	Features Categorized	Freq	% Share
1	Better Chances/ More Options	172	27.56%
2	Varied standards of institutions/students	137	21.96%
3	High Standard of Examination	87	13.94%
4	High Knowledge Intensity	71	11.38%
5	Provides Filtration of Students	66	10.58%
6	Intense Competition	57	9.13%
7	Transparent Mechanism	50	8.01%
8	Ensures Regional Specificity	38	6.09%
9	Students become disciplined/ improves intellectual ability	30	4.81%
10	Uniformity in Syllabus	28	4.49%
11	High Level of Difficulty	24	3.85%
12	Miscellaneous	57	9.13%
13	Others	290	46.47%

Table 12 A

S. No.	Other Reasons	Freq	% Share
1	Lack of Clarity	127	20.35%
2	Less Pressure on Students	19	3.04%
3	Provides a basis for All India Ranking	16	2.56%
4	Equal Opportunity	16	2.56%
5	Prepares Students for Future	16	2.56%
6	Objective/ multiple type	15	2.40%
7	Easy to Manage/ Systematic	14	2.24%
8	Based on Merit	13	2.08%
9	Tests Ability of Students like speed and accuracy	11	1.76%
10	Favoring NTS	9	1.44%
11	Counseling	7	1.12%
11	Reduces Competition	7	1.12%
12	To Prove Point or Prestige in Society	7	1.12%
13	Reservation	6	0.96%
14	Exams at various centers/ Locations	4	0.64%
15	AIEEE covers majority of Engg. colleges	2	0.32%
16	Efficient Implementing Authority	1	0.16%

Figure 27



4. List features of the current examination system that are required to be reformed

a. ……. b. ……. c. ……. d. …….

Key Observations:

- 30% of the total (623 out of 2063) responded to the above question.
- Respondents preferred single examination system, having high knowledge intensity and features such as alignment of the examination syllabus with the XIIth Class, affordable examination fee, judicious use of time and money, increase of professional courses seats, transparency in examination result & counselling process etc for the reforms in the current examination system.
- 50% of the respondents under the 'others' category cited the prominent features for reform such as removal of negative marking, online mechanism of application submission and examination, more centres for examination and efficient scheduling to avoid overlapping, emphasis on aptitude and extra-curricular activities including regional language etc.

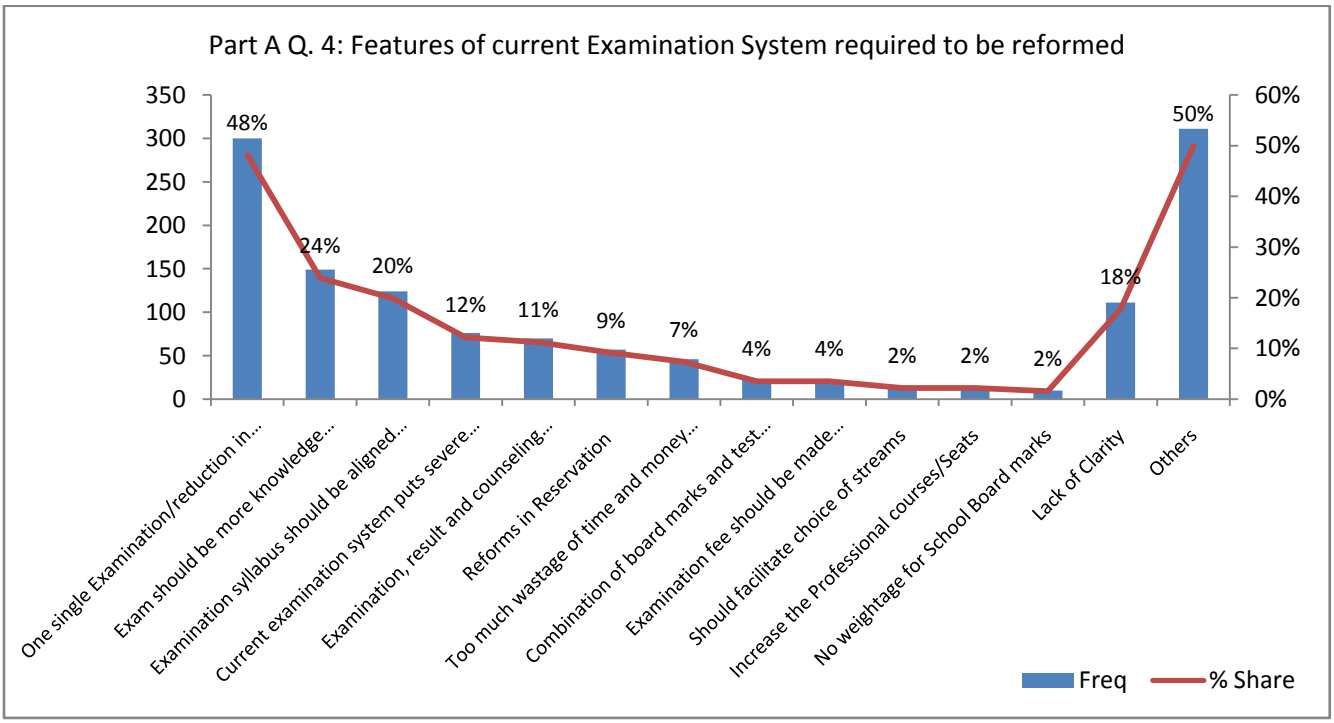
Note: for details see (Table-13, Figure-28)

Table 13

Part A 4 **Response Rate – 30%** **(623 out of 2063)**

S. No.	Reasons Categorized	Freq	% Share
1	One single Examination/reduction in number of examinations	300	48%
2	Exam should be more knowledge based/skill based	149	24%
3	Examination syllabus should be aligned with XIIth Class to reduce dependency on coaching	124	20%
4	Current examination system puts severe pressure on students	76	12%
5	Examination, result and counseling process needs to be transparent	70	11%
6	Reforms in Reservation	57	9%
7	Too much wastage of time and money as poor cannot afford it	46	7%
8	A combination of School Board marks and Test scores to be considered	22	4%
9	Examination fees should be made affordable	22	4%
10	Should facilitate choice of streams	14	2%
11	Increase the Professional courses/Seats	14	2%
12	No weightage for School Board marks	10	2%
13	Lack of Clarity	111	18%
14	Others	311	50%

Figure 28


Part A Q. 4: Features of current Examination System required to be reformed
350
300
250
200
150
100
50
0
60%
50%
40%
30%
20%
10%
0%
48%
24%
20%
12%
11%
9%
7%
4%
4%
2%
2%
2%
18%
50%
One single Examination/reduction in...
Exam should be more knowledge...
Examination syllabus should be aligned...
Current examination system puts severe...
Examination, result and counseling...
Reforms in Reservation
Too much wastage of time and money...
Combination of board marks and test...
Examination fee should be made...
Should facilitate choice of streams
Increase the Professional courses/Seats
No weightage for School Board marks
Lack of Clarity
Others
Freq
% Share

PART B: UNDERSTANDING THE VIEWS ON THE SUGGESTED NTS

1. **Would you be in favour of including a weighting factor for overall and consistent performance in examinations of school boards in the entrance examination scores?**

Yes No

If no, what are the perceived constraints in weighting school board performance and other inputs?

Key Observations:

- 32% of the total (666 out of 2063) responded to the above question.
- Majority of the respondents (66%) were **in favour of inclusion of the weighting factor** in overall test score for school boards examinations performance. Among the various categories, 63% students, 70% working and 71% parents were in favour of inclusion of the weighting factor.
- Major reasons cited by 34% of the respondents **against inclusion of weighting factor** for NTS were – Boards Examination marks can't judge one's capability (45%), Non-uniformity across boards (26%) and Changes in Board Examination System (16%).

Note: for details see (Table 14 - 15, Figure 29 – 32)

Table 14

Part B 1 **Response Rate – 32%** **(666 out of 2063)**

Professional Background	Sub-Category	Yes	% Yes	No	% No	Total
A	B	C	D=C/G	E	F=E/G	G
Student	**Sub-total**	**220**	**63%**	**128**	**37%**	**348**
	Engg.	169	61%	110	39%	279
	Sciences	24	75%	8	25%	32
	Medical	8	57%	6	43%	14
	Commerce	6	86%	1	14%	7
	Humanities	6	86%	1	14%	7
	Others	7	78%	2	22%	9
Working	**Sub-total**	**171**	**70%**	**73**	**30%**	**244**
	Non-teaching	124	69%	56	31%	180
	Teaching	46	77%	14	23%	60
	Coaching	1	33%	2	67%	3
	NA		0%	1	100%	1
Parents		**35**	**71%**	**14**	**29%**	**49**
Not Working		**7**	**58%**	**5**	**42%**	**12**
Others		**8**	**62%**	**5**	**38%**	**13**
Total		**441**	**66%**	**225**	**34%**	**666**

Table 15

Part B 1: Reasons

S. No.	Reasons against weighting factor for NTS - Part B Question 1	freq	% dist
1	Boards exam marks cannot judge one's Capability	80	45%
2	No uniformity across boards	46	26%
3	Boards exam system itself needed to be revamped	29	16%
4	Will Create Pressure on Students	9	5%
5	lack of clarity	5	3%
6	Others	10	6%
	Total	**179**	**100%**

Figure 29

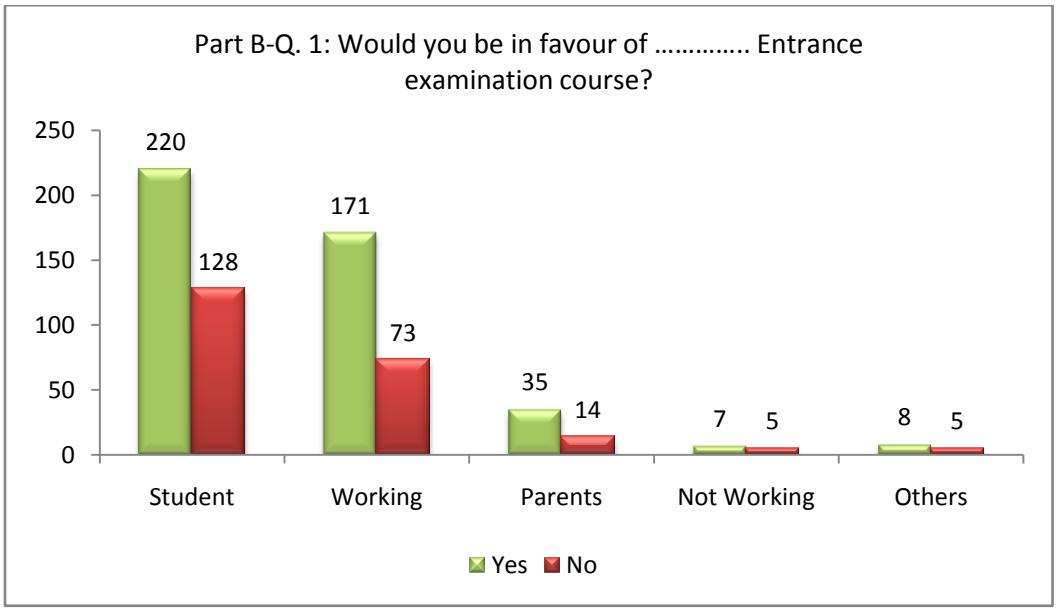


Figure 30

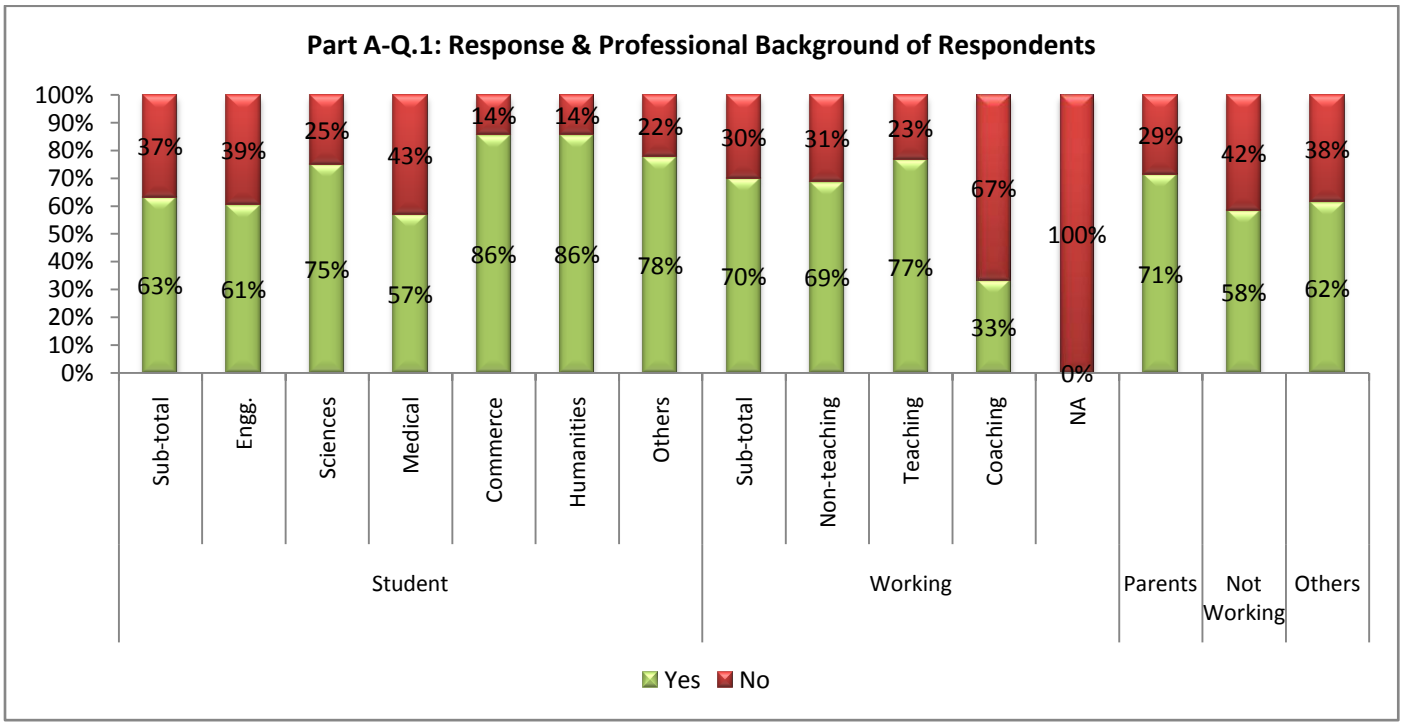


Figure 31

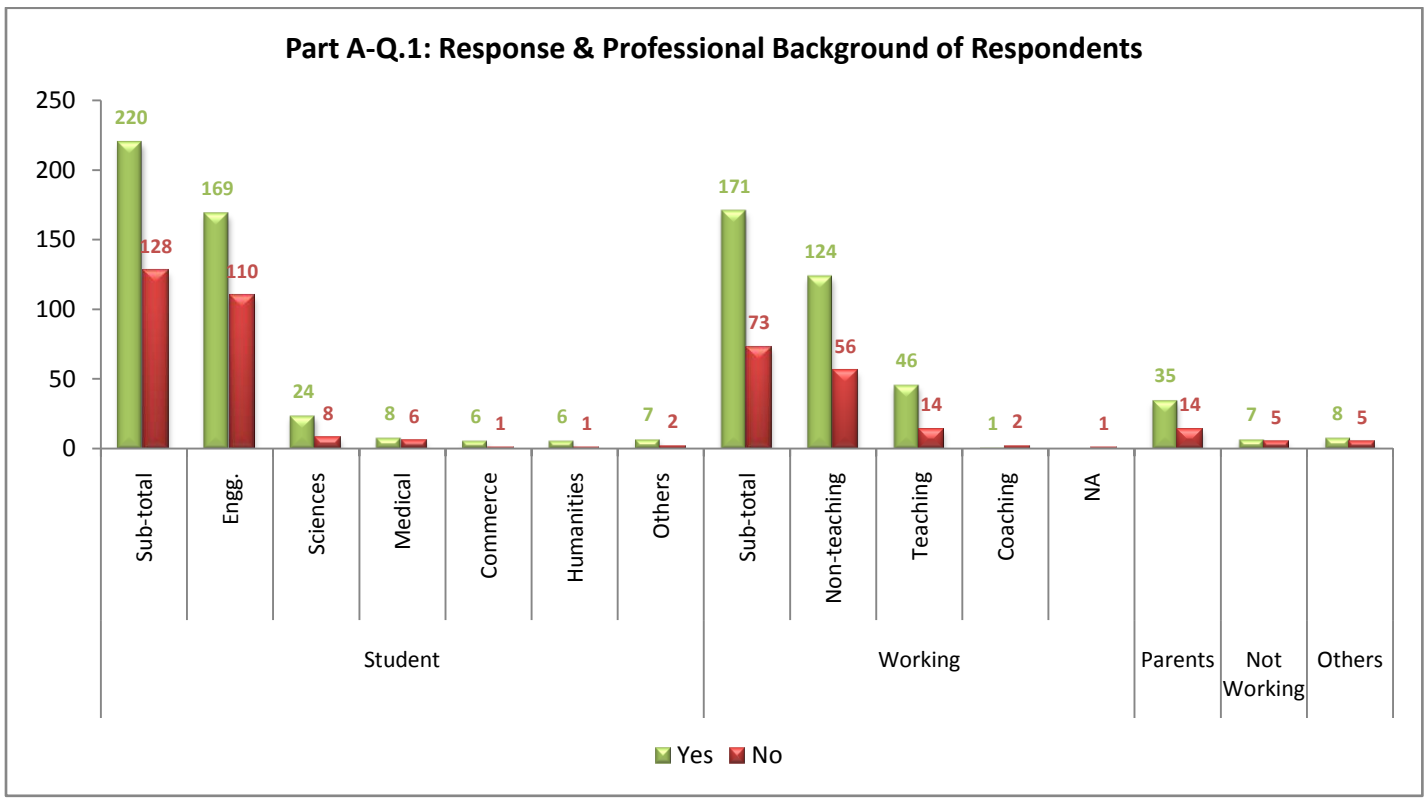
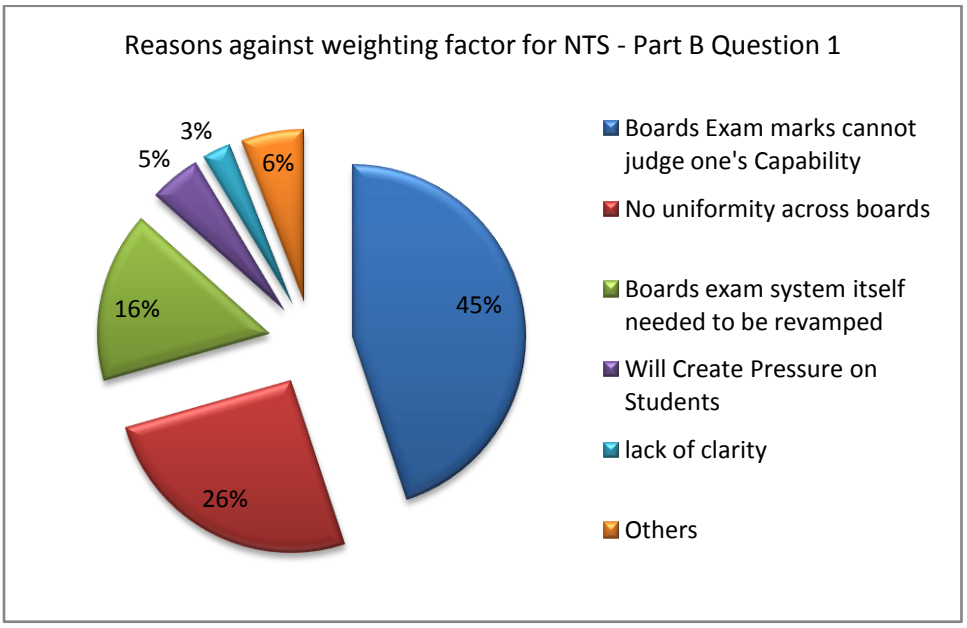


Figure 32


Reasons against weighting factor for NTS - Part B Question 1
3%
5%
6%
16%
45%
26%
Boards Exam marks cannot judge one's Capability
No uniformity across boards
Boards exam system itself needed to be revamped
Will Create Pressure on Students
lack of clarity
Others

2. If not in favour of a multi-parametric and rationalized National Testing Scheme, what are the over-riding reasons for objection?

Key Observations:

- 8% of the total (160 out of 2063) responded to the above question.
- **28% of the respondents lacked clarity in understanding the NTS, 15% of the respondents favoured NTS while 9% were satisfied with the current examination system.**
- The main reasons cited for objecting NTS were 'restricting the scope and options to only one examination', 'balancing the heterogeneity across institutions', 'suitability of weighting factor', 'pressure on students' etc.
- Under the 'others' category some of the reasons mentioned were 'intellectual ability cannot be tested by NTS', 'Illogical & complicated process', 'partiality in board exams' etc.

Note: for details see (Table 16 & 16 A, Figure 33)

Table 16

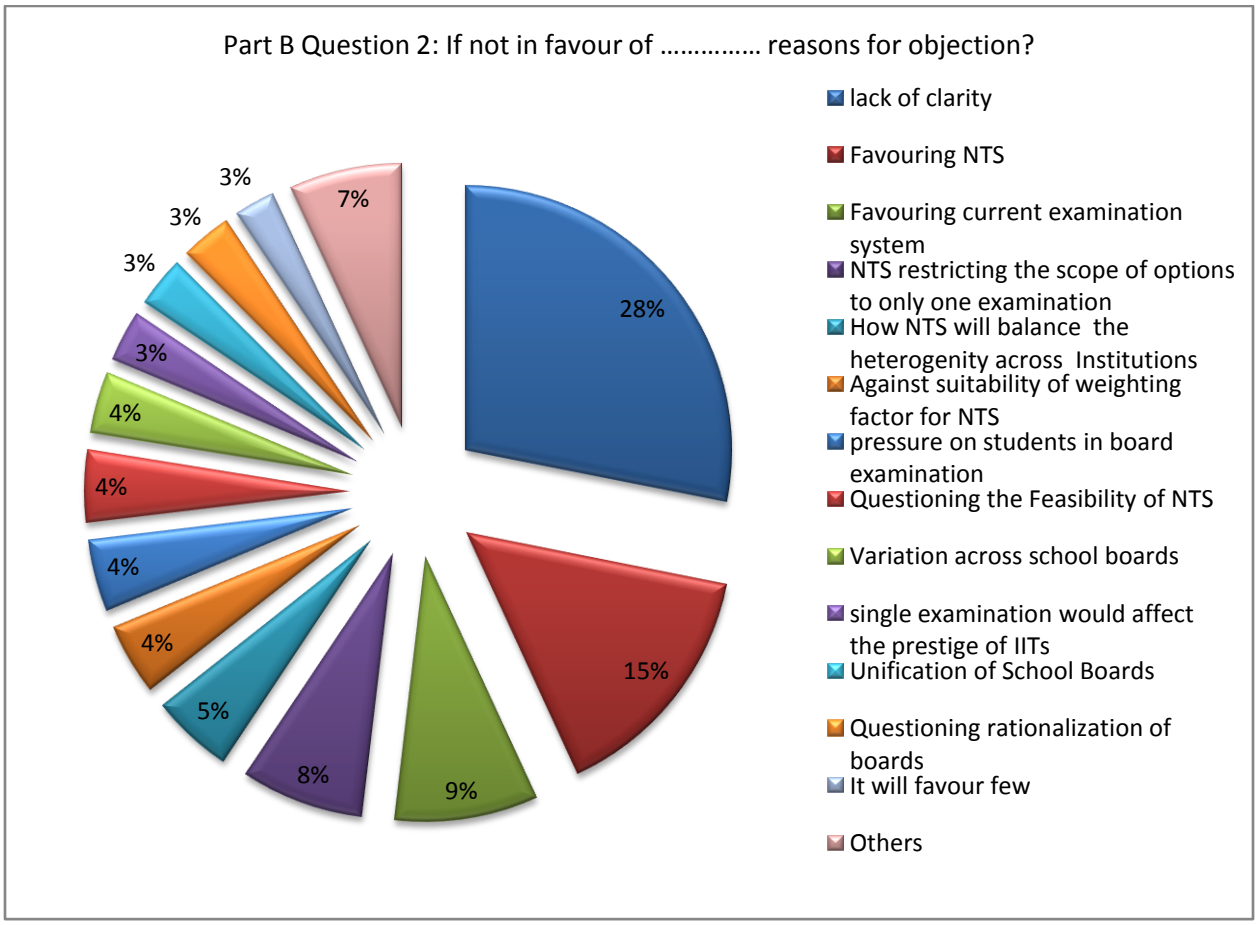
Part B 2 **Response Rate – 8%** **(160 out of 2063)**

S. No.	Answer Categorization	Freq	% Distribution
1	Lack of clarity	45	28.13%
2	Favouring NTS	24	15.00%
3	Favouring current examination system	14	8.75%
4	NTS restricting the scope of options to only one examination	12	7.50%
5	How NTS will balance the heterogeneity across institutions?	8	5.00%
6	Against suitability of weighting factor for NTS	7	4.38%
7	Pressure on students in board examination	7	4.38%
8	Questioning the Feasibility of NTS	7	4.38%
9	Variation across school boards	6	3.75%
10	Single examination would affect the prestige of IITs	5	3.13%
11	Unification of School Boards	5	3.13%
12	Questioning rationalization of boards	5	3.13%
13	It will favour few	4	2.50%
14	Others	11	6.88%
	Total	**160**	**100%**

Table 16 A

S. No.	Others	Freq	% Distribution
1	intellectual ability cannot be tested by NTS	2	1.25%
2	Unification of examination may lead to corruption	2	1.25%
3	Illogical & complicated process	2	1.25%
4	Not in favour of NTS (Fear of regional divide/ disparity)	1	0.63%
5	partiality in board exams	1	0.63%
6	Wastage of Time and Money	1	0.63%
7	Transparency in the conduct of NTS	1	0.63%
8	NTS should exclude IITs	1	0.63%
	Total	**11**	6.88%

Figure 33



3. Would you like to consider an Indian equivalent of SAT as the National Test Scheme?

Key Observations:

- 32% of the total (660 out of 2063) responded to the above question.
- **Majority of the respondents (73%) were in favour of Indian equivalent of SAT as NTS.**

Note: for details see (Table 17, Figure 34 – 36)

Table 17

Part B 3 **Response Rate - 32%** **(660 out of 2063)**

Professional Background	Sub-category	Yes	% Yes	No	% No	Total
A	B	C	D=C/G	E	F=E/G	G
Student	**Sub-total**	**240**	**69%**	**106**	**31%**	**346**
	Engg.	188	68%	90	32%	278
	Sciences	23	72%	9	28%	32
	Medical	10	71%	4	29%	14
	Commerce	4	57%	3	43%	7
	Humanities	7	100%		0%	7
	Others	8	100%		0%	8
Working	**Sub-total**	**190**	**78%**	**55**	**22%**	**245**
	Non-teaching	135	75%	46	25%	181
	Teaching	52	87%	8	13%	60
	Coaching	2	67%	1	33%	3
	NA	1	100%		0%	1
Parents		**39**	**85%**	**7**	**15%**	**46**
Not Working		**8**	**73%**	**3**	**27%**	**11**
Others		**8**	**67%**	**4**	**33%**	**12**
Total		**485**	**73%**	**175**	**27%**	**660**

Figure 34

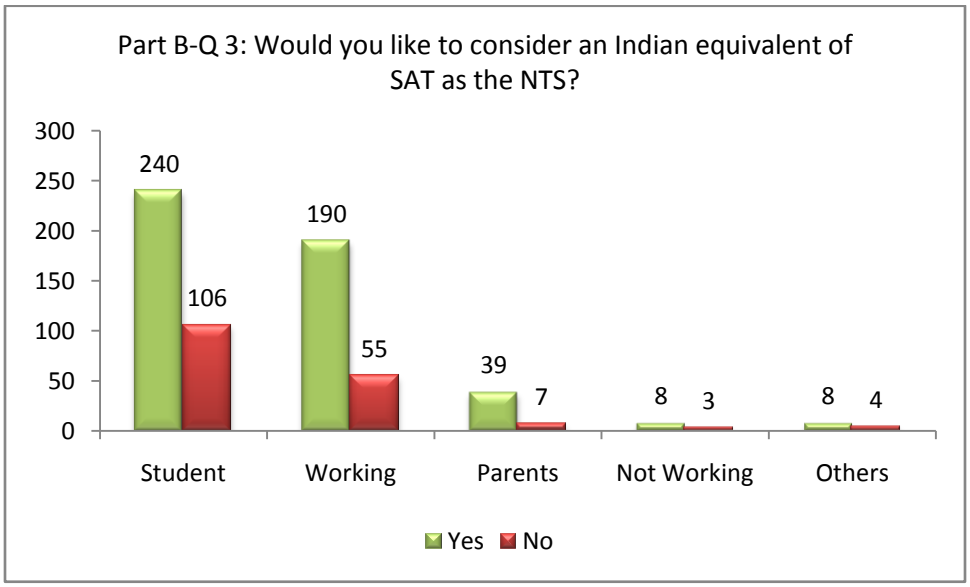


Figure 35

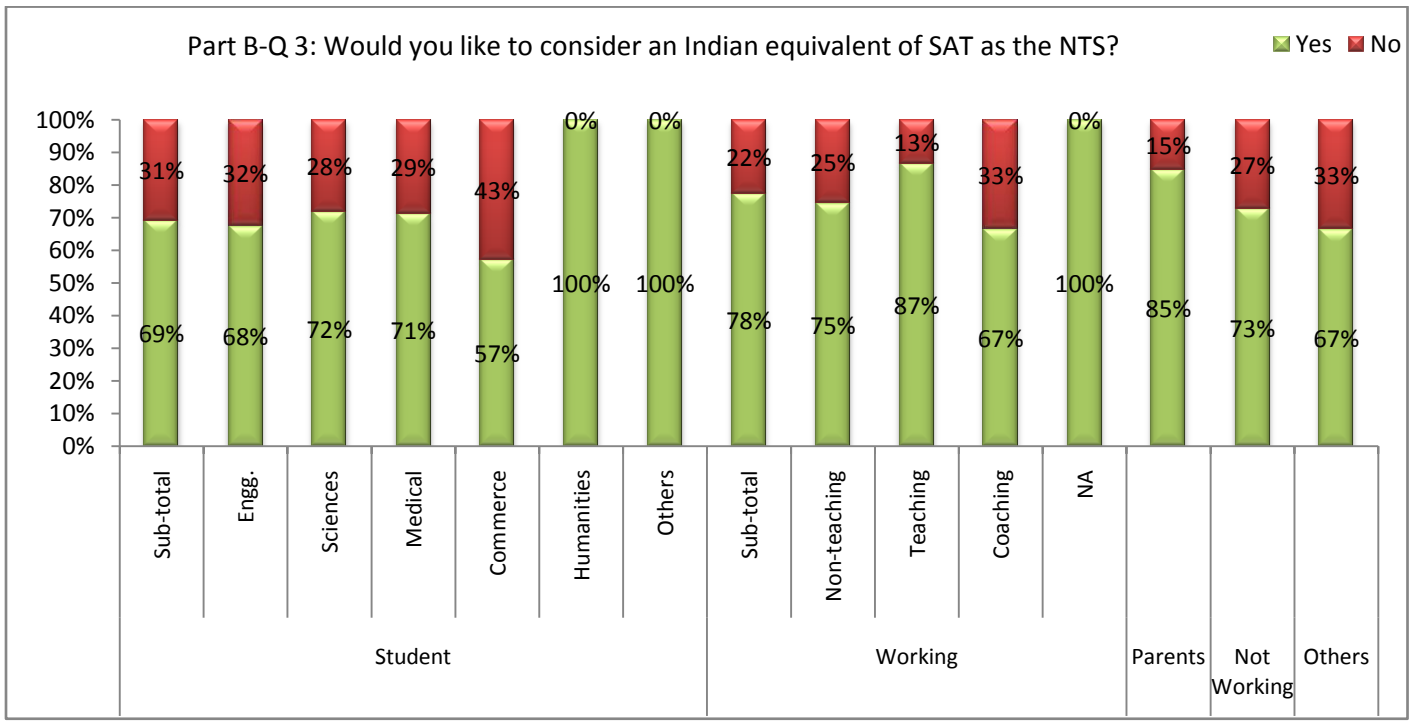
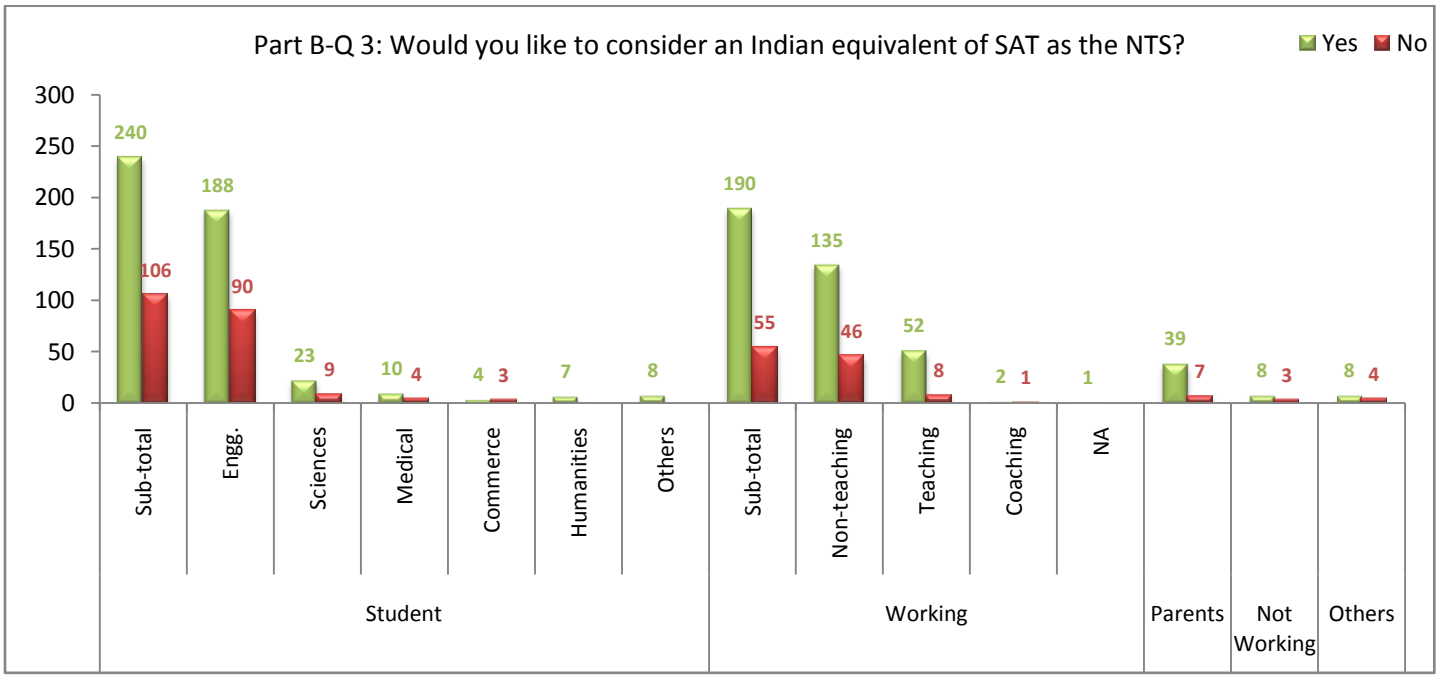


Figure 36


Part B-Q 3: Would you like to consider an Indian equivalent of SAT as the NTS?
Yes
No
300
250
200
150
100
50
0
240
106
188
90
23
9
10
4
4
3
7
8
190
55
135
46
52
8
2
1
1
39
7
8
3
8
4
Sub-total
Engg.
Sciences
Medical
Commerce
Humanities
Others
Sub-total
Non-teaching
Teaching
Coaching
NA
Parents
Not Working
Others
Student
Working

4. **If in favour of current JEE or AIEEE type competitive examination models, what is your view on test having an aptitude part (similar to SAT or current AIEEE) as well as an advanced test part (similar to current JEE)? Test should give more weightage to…**

A. Aptitude only b. A mix of aptitude and advanced c. Advanced test

Key Observations:

- 31% of the total (646 out of 2063) responded to the above question.
- **Majority of the respondents (70%) were in favour of 'a mix of aptitude and advanced test', whereas 18% favoured 'advanced test' only.** Major support for 'a mix of aptitude and advanced test' came from parents (81%) followed by working category (73%) and students (67%).

Note: for details see (Table 18, Figure 37 – 39)

Table 18

Part B 4 **Response Rate - 31%** **(646 out of 2063)**

Professional Background	Sub-category	Aptitude only	% Aptitude only	Advanced Test	% Advanced test	A mix of aptitude and advanced	% A mix of aptitude and advanced	Total
A	B	C	D=C/J	F	G=F/J	H	I=H/J	J
Student	**Sub-total**	**40**	**12%**	**70**	**21%**	**227**	**67%**	**337**
	Engg.	24	9%	65	24%	184	67%	273
	Sciences	4	13%	2	6%	25	81%	31
	Medical	6	50%		0%	6	50%	12
	Others	2	25%	1	13%	5	63%	8
	Commerce	4	57%	1	14%	2	29%	7
	Humanities		0%	1	17%	5	83%	6
Working	**Sub-total**	**31**	**13%**	**34**	**14%**	**174**	**73%**	**239**
	Non-teaching	22	12%	29	16%	127	71%	178
	Teaching	9	16%	4	7%	44	77%	57
	Coaching		0%	1	33%	2	67%	3
	NA		0%		0%	1	100%	1
Parents		**3**	**6%**	**6**	**13%**	**38**	**81%**	**47**
Not Working		**4**	**36%**	**4**	**36%**	**3**	**27%**	**11**
Others		**2**	**17%**	**2**	**17%**	**8**	**67%**	**12**
Total		**80**	**12%**	**116**	**18%**	**450**	**70%**	**646**

Figure 37

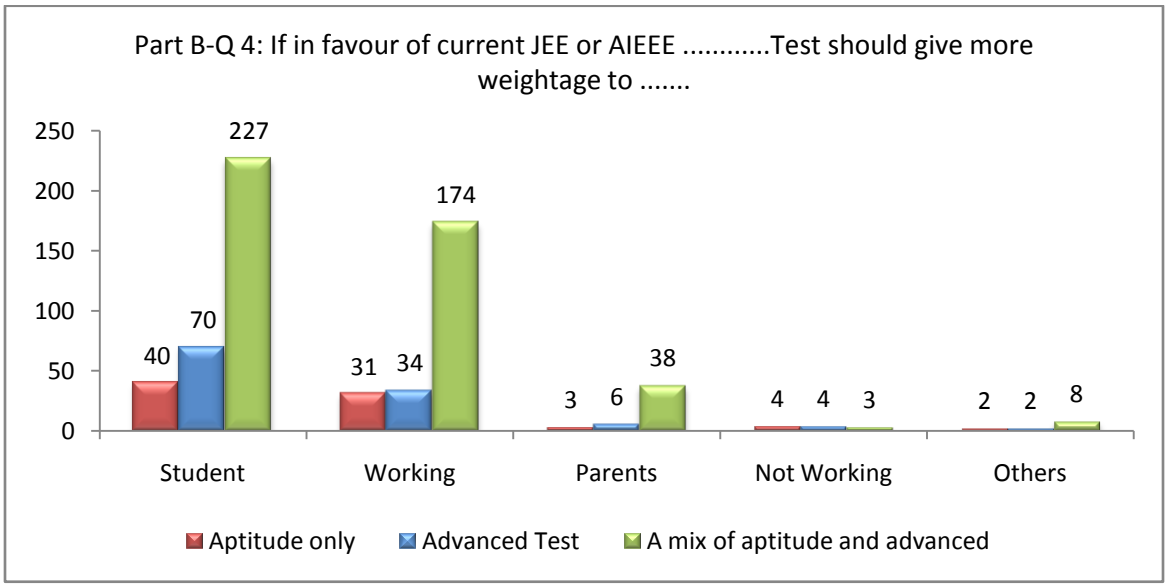


Figure 38

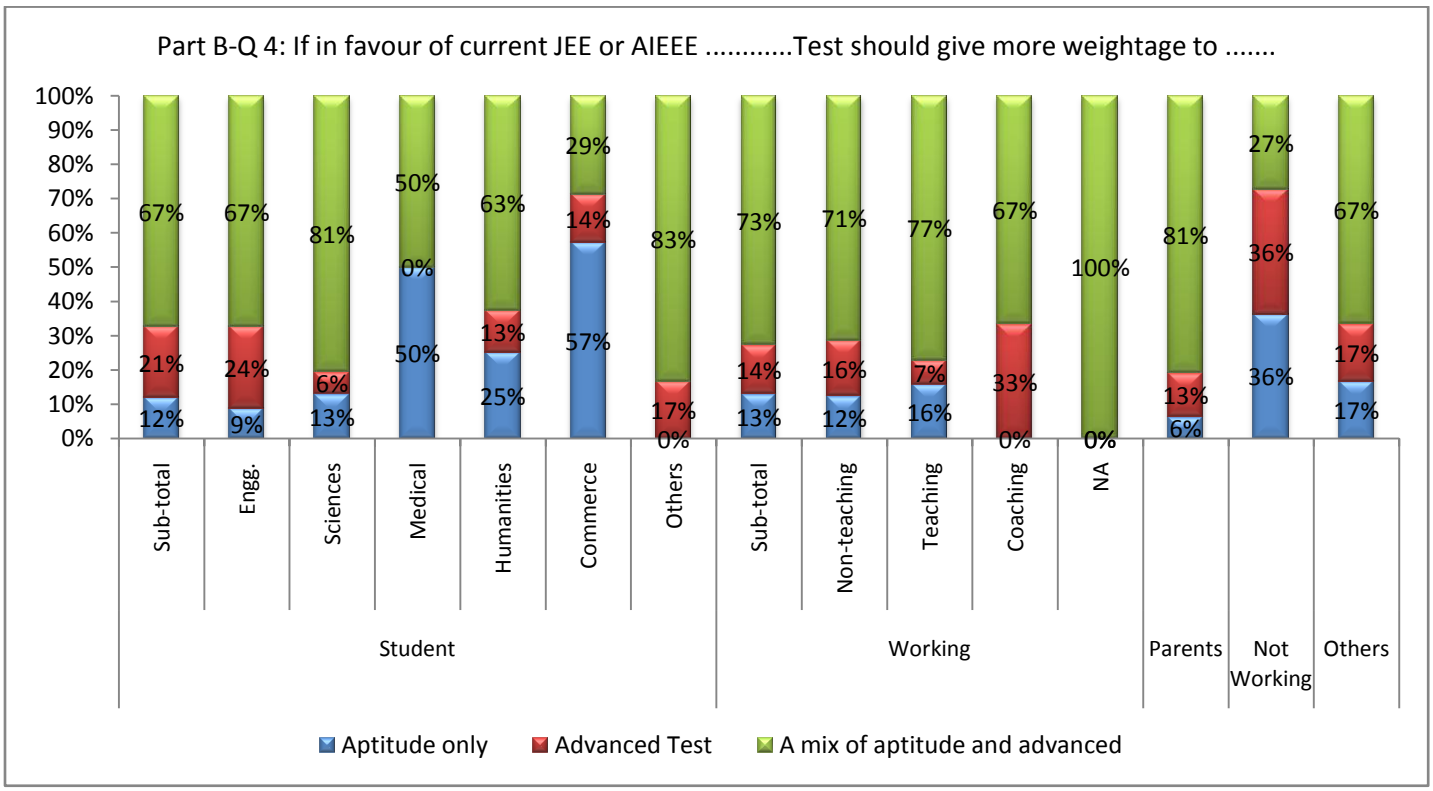
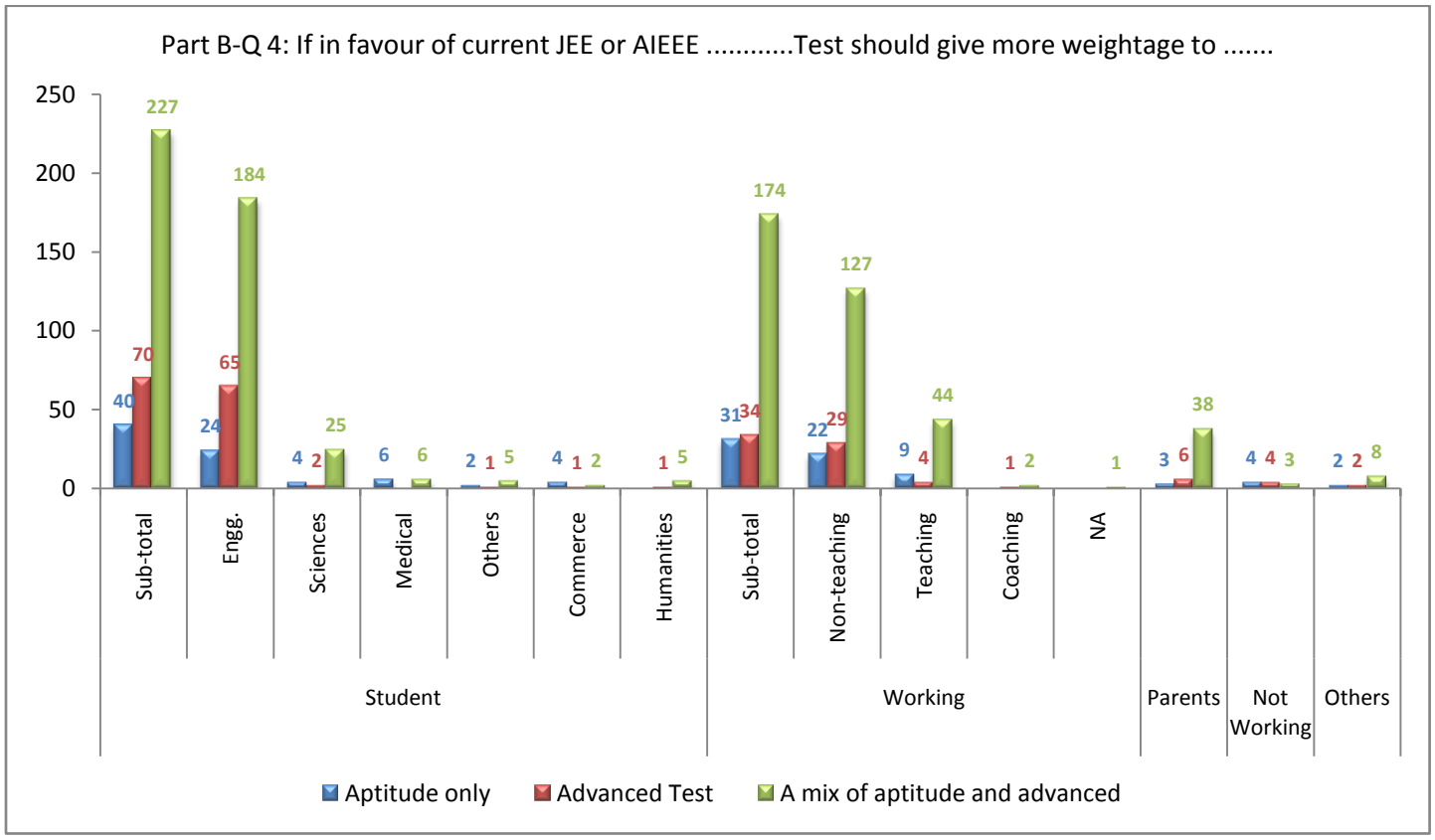


Figure 39


Part B-Q 4: If in favour of current JEE or AIEEE .....Test should give more weightage to .....
250
200
150
100
50
0
40 70 227
24 65 184
4 2 25
6 6
2 1 5
4 1 2
1 5
31 34 174
22 29 127
9 4 44
1 2
1
3 6 38
4 4 3
2 2 8
Sub-total
Engg.
Sciences
Medical
Others
Commerce
Humanities
Sub-total
Non-teaching
Teaching
Coaching
NA
Parents
Not Working
Others
Student
Working
Aptitude only
Advanced Test
A mix of aptitude and advanced

5. If in support of an alternative model, what are the essential features you would like to build into the system?

A. High filter type like IIT JEE B. Placement Type selection examination

C. Competitive ranking model D. SAT type E. Others. (Specify)

Key Observations:

- 31% of the total (629 out of 2063) responded to the above question.
- **Respondents preferred the following essential features for the NTS: High Filter Type Like IIT JEE 17%, SAT Type 15%, Competitive Ranking Model 13% followed by Placement Type Selection Examination 12% etc.** However, under 'others' category (5%) no feature was specified by the respondents.
- Each of the 'Other Combinations'(total 23 varied combinations) such as H + C, H + P, H + S, H + P + S etc were preferred by not more than 6 % of the respondents respectively.

Note: for details see (Table 19, Figure 40)

Table 19

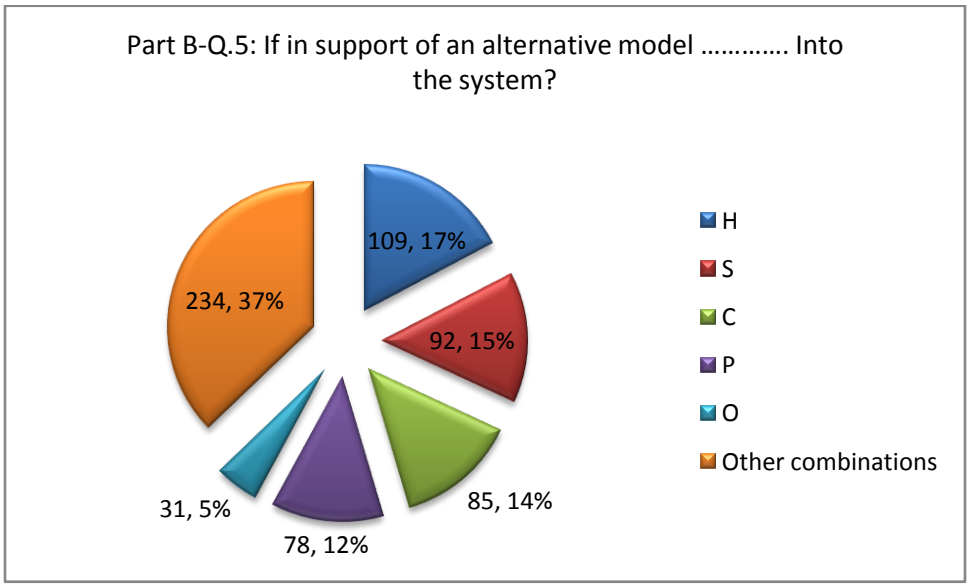
Part B 5 **Response Rate - 31%** **(629 out of 2063)**

Professional Background	Sub-categories	Total	H	S	C	P	O	Other combinations
Student		**331**	**71**	**39**	**31**	**41**	**16**	**133**
	Engg	266	66	30	23	28	14	105
	Sciences	26	3	4	3	3		13
	Other	15	1	3	2	2	1	6
	Medical	12		1	2	3	1	5
	Commerce	7	1	1	1	3		1
	Humanities	5				2		3
Working		**230**	**30**	**41**	**34**	**25**	**12**	**88**
	Employed	172	20	27	25	19	8	73
	Teaching	54	9	13	9	5	4	14
	Coaching	3	1			1		1
	NA	1		1				0
Parent		**45**	**3**	**11**	**13**	**5**	**1**	**12**
Not Working		**11**	**2**		**4**	**5**		**0**
Other		**12**	**3**	**1**	**3**	**2**	**2**	**1**
Total		**629**	**109**	**92**	**85**	**78**	**31**	**234**
% dist			**17.33%**	**14.63%**	**13.51%**	**12.40%**	**4.93%**	**37.20%**

Note:

H	**High Filter Type Like IIT JEE**
P	**Placement Type Selection Examination**
C	**Competitive Ranking Model**
S	**SAT Type**
O	**Others**

Figure 40


Part B-Q.5: If in support of an alternative model ……. Into the system?
109, 17%
92, 15%
85, 14%
78, 12%
31, 5%
234, 37%
H
S
C
P
O
Other combinations

MISCELLANEOUS SECTION

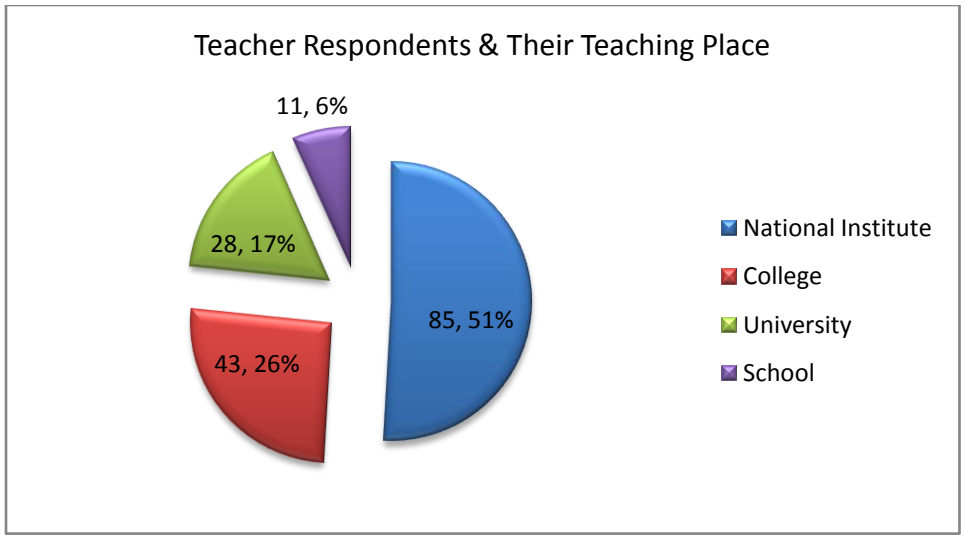
(Tables & Figures on Public Opinion Poll)

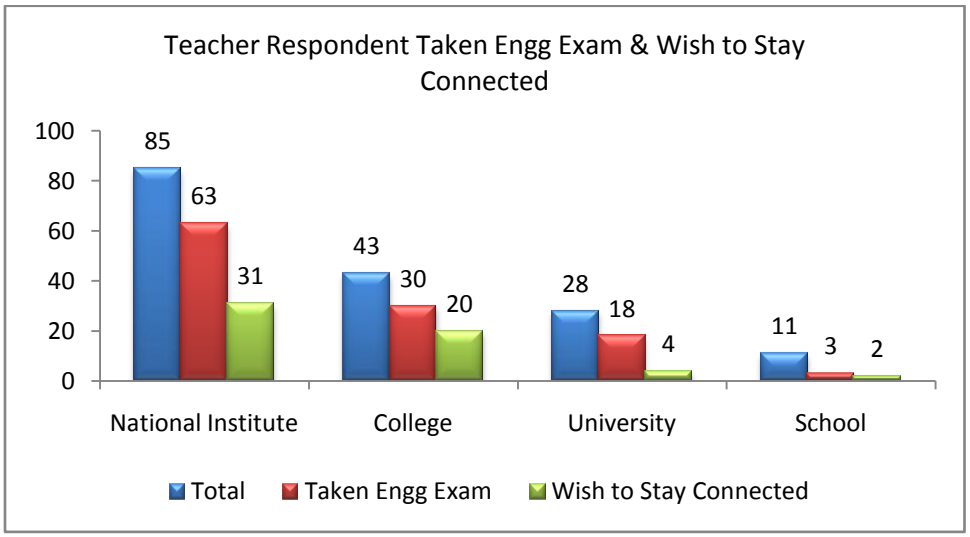
RESPONDER PROFILE

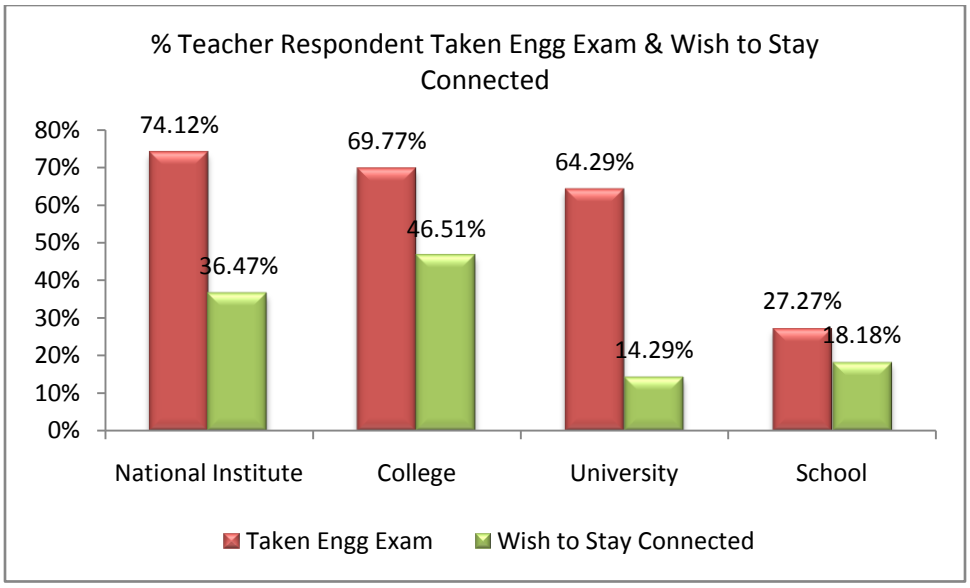
Working Respondent's Profile - Teachers

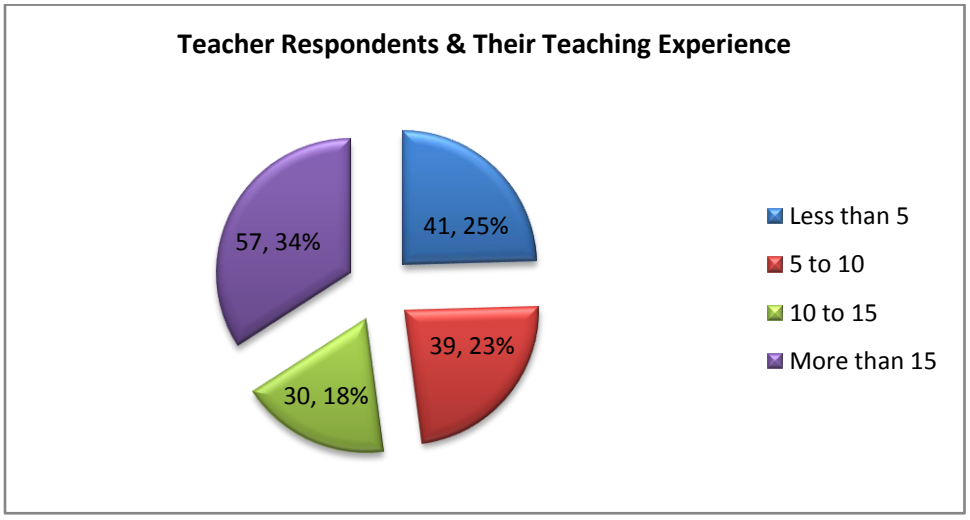
TEACHER RESPONDENTS' PROFILE TEACHING PLACE WISE													
			Teaching Experience				Teaching Level						
Teaching Place	Total	% Distribution	Less Than 5	5 To 10	10 To 15	More Than 15	Primary	Middle & Sec	Tertiary	Taken Engg Exam	% Taken Engg Exam	Wish To Stay Connected	% Wish To Stay Connected
National Institute	**85**	**50.90%**	19	13	13	40	0	0	85	63	**74.12%**	31	**36.47%**
College	**43**	**25.75%**	15	10	9	9	0	4	39	30	69.77%	20	**46.51%**
University	**28**	**16.77%**	4	12	6	6	0	1	27	18	64.29%	4	14.29%
School	**11**	**6.59%**	3	4	2	2	2	9	0	3	27.27%	2	18.18%
Total	**167**	**100%**	**41**	**39**	**30**	**57**	**2**	**14**	**151**	**114**	**68.26%**	**57**	34.13%

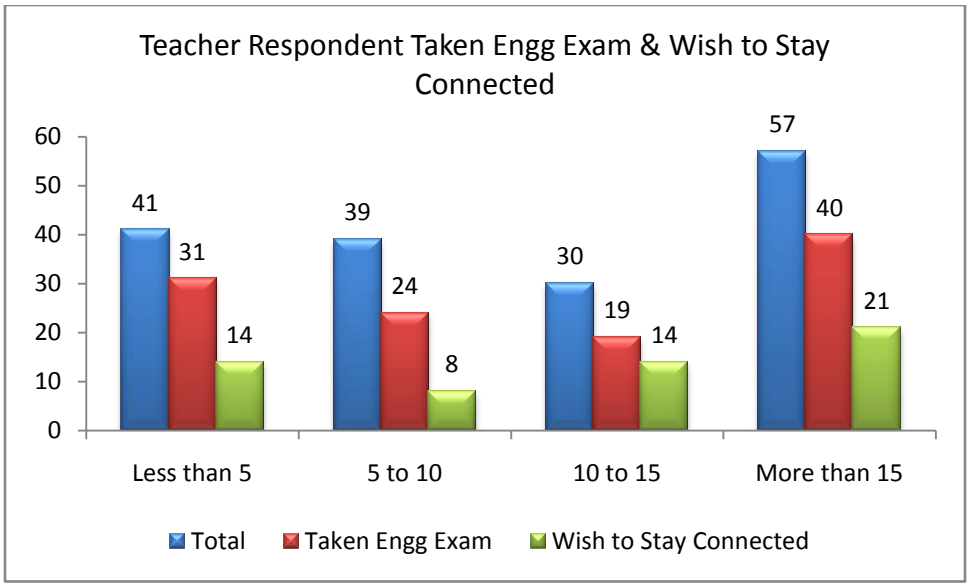
TEACHER RESPONDENTS' PROFILE TEACHING EXPERIENCE WISE													
			Teaching Level			Teaching Place							
Teaching Experience	Total	% Distribution	Primary	Middle & Sec	Tertiary	School	College	University	National Institute	Taken Engg Exam	% Taken Engg Exam	Wish To Stay Connected	% Wish To Stay Connected
Less Than 5	**41**	**24.55%**	1	5	35	3	15	4	19	31	75.61%	14	34.15%
5 To 10	**39**	**23.35%**	1	5	33	4	10	12	13	24	61.54%	8	20.51%
10 To 15	**30**	**17.96%**	0	2	28	2	9	6	13	19	63.33%	14	46.67%
More Than 15	**57**	**34.13%**	0	2	55	2	9	6	40	40	70.18%	21	36.84%
Total	**167**	**100%**	**2**	**14**	**151**	**11**	**43**	**28**	**85**	**114**	**68.26%**	**57**	**34.13%**

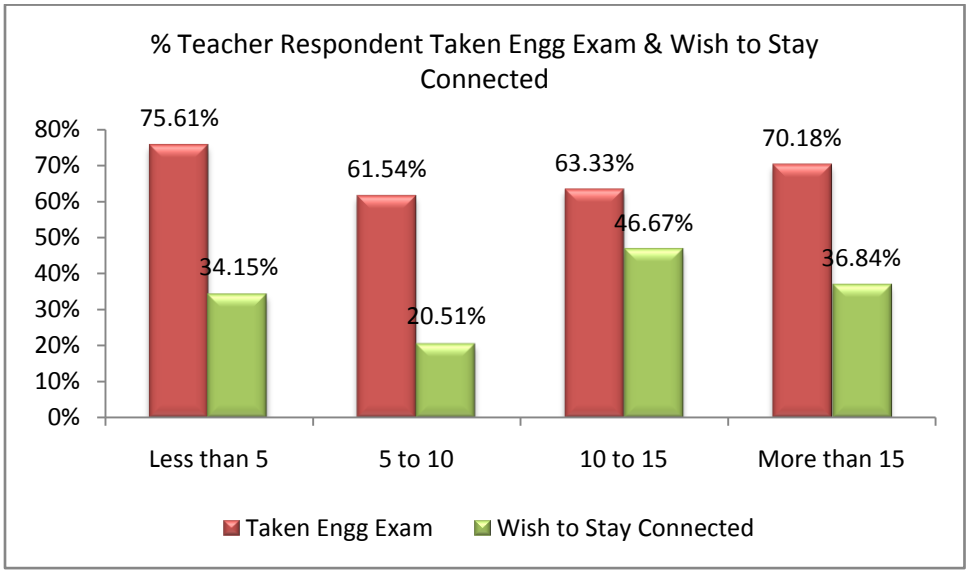

Teacher Respondents & Their Teaching Place
11, 6%
28, 17%
85, 51%
43, 26%
National Institute
College
University
School


Teacher Respondent Taken Engg Exam & Wish to Stay Connected
100
80
60
40
20
0
85
63
31
43
30
20
28
18
4
11
3
2
National Institute
College
University
School
Total
Taken Engg Exam
Wish to Stay Connected


% Teacher Respondent Taken Engg Exam & Wish to Stay Connected
80%
70%
60%
50%
40%
30%
20%
10%
0%
74.12%
36.47%
69.77%
46.51%
64.29%
14.29%
27.27%
18.18%
National Institute
College
University
School
Taken Engg Exam
Wish to Stay Connected

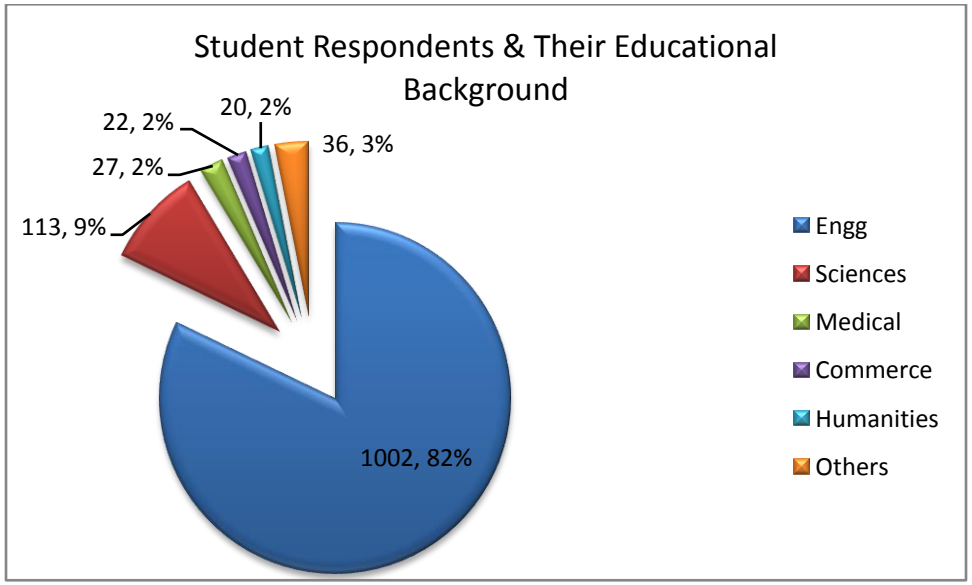

Teacher Respondents & Their Teaching Experience
57, 34%
41, 25%
39, 23%
30, 18%
Less than 5
5 to 10
10 to 15
More than 15

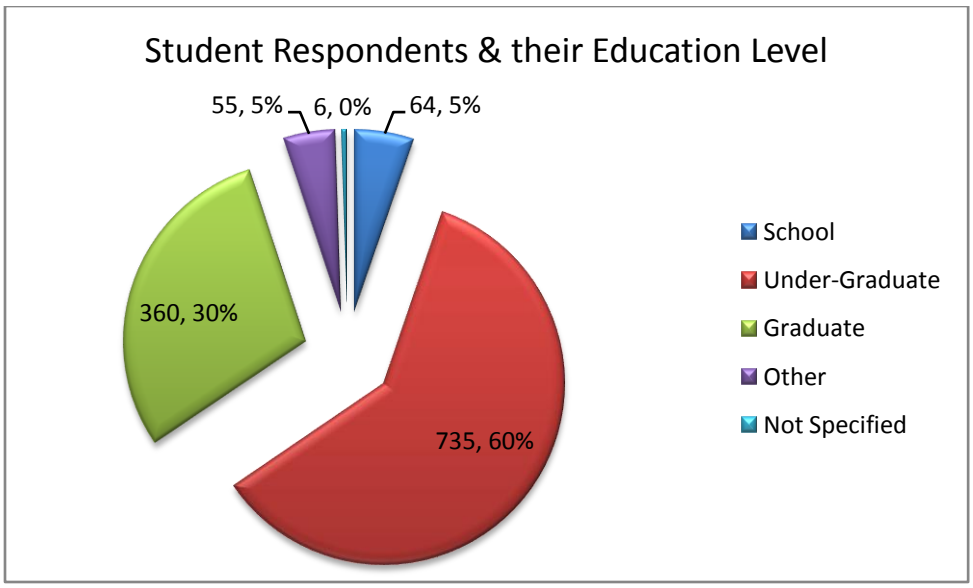

Teacher Respondent Taken Engg Exam & Wish to Stay Connected
60
50
40
30
20
10
0
41
31
14
39
24
8
30
19
14
57
40
21
Less than 5
5 to 10
10 to 15
More than 15
Total
Taken Engg Exam
Wish to Stay Connected

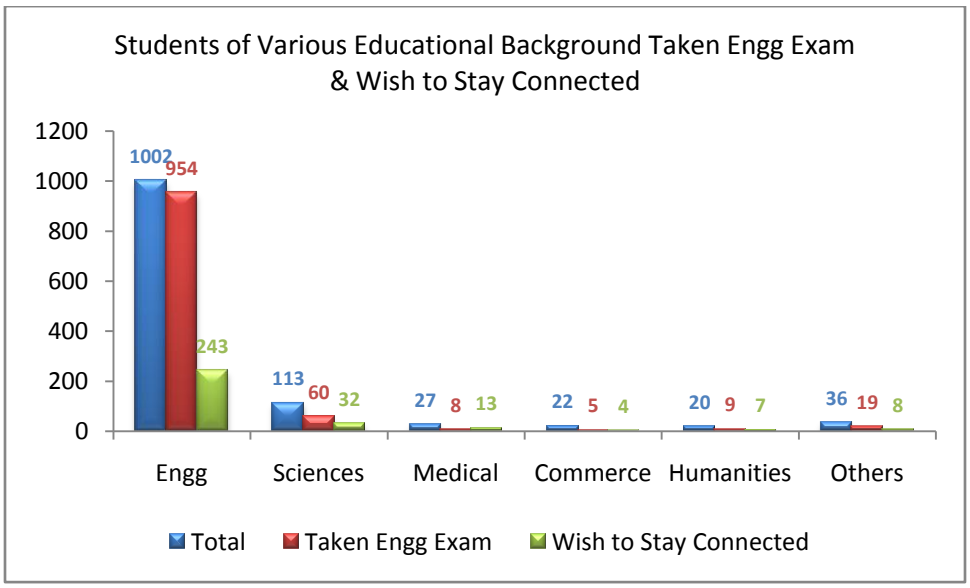

% Teacher Respondent Taken Engg Exam & Wish to Stay Connected
80%
70%
60%
50%
40%
30%
20%
10%
0%
75.61%
34.15%
61.54%
20.51%
63.33%
46.67%
70.18%
36.84%
Less than 5
5 to 10
10 to 15
More than 15
Taken Engg Exam
Wish to Stay Connected

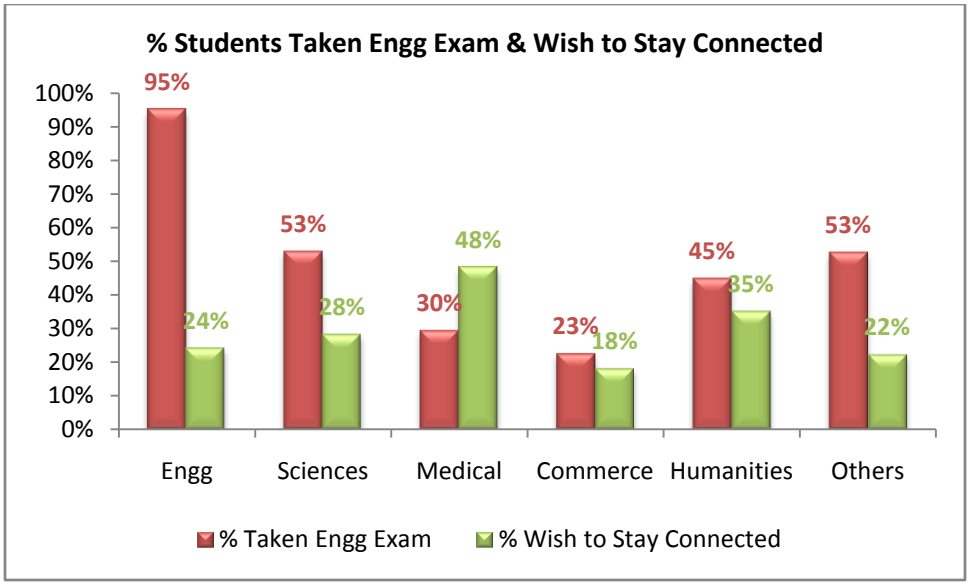
STUDENT RESPONDENTS' PROFILE

Educational Background	Total	% Distribution	Level Of Education					Taken Engg Exam	% Taken Engg Exam	Wish to Stay Connected	% Wish to Stay Connected
			School	Under-Graduate	Graduate	Other	Not Specified				
Engg	1002	82.10%		672	302	22	6	954	95.21%	243	24.25%
Sciences	113	9.30%	39	31	28	15	0	60	53.10%	32	28.32%
Medical	27	2.20%		15	12	0	0	8	29.63%	13	48.15%
Commerce	22	1.80%	3	7	7	3	0	5	22.73%	4	18.18%
Humanities	20	1.60%	2	6	7	7	0	9	45.00%	7	35.00%
Other	36	3.00%	20	4	4	8	0	19	52.78%	8	22.22%
Total	**1220**	**100%**	**64**	**735**	**360**	**55**	**6**	**1055**	**86.48%**	**307**	**25.16%**
% Distribution			**5.25%**	**60.25%**	**29.51%**	**4.51%**	**0.49%**				

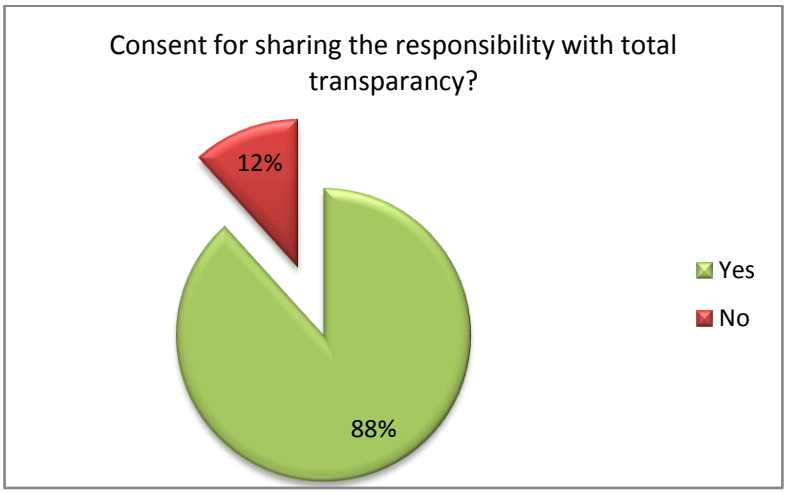



Student Respondents & their Education Level
55, 5%
6, 0%
64, 5%
360, 30%
735, 60%
School
Under-Graduate
Graduate
Other
Not Specified

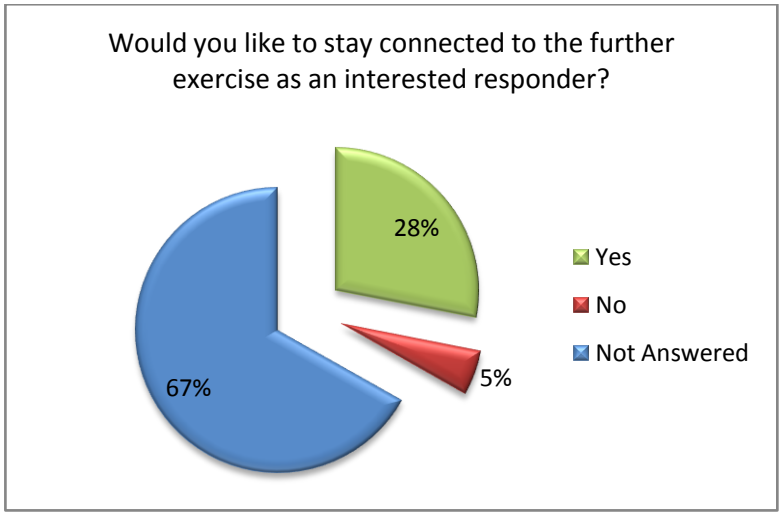

Students of Various Educational Background Taken Engg Exam & Wish to Stay Connected
1200
1000
800
600
400
200
0
1002
954
243
113
60
32
27
8
13
22
5
4
20
9
7
36
19
8
Engg
Sciences
Medical
Commerce
Humanities
Others
Total
Taken Engg Exam
Wish to Stay Connected

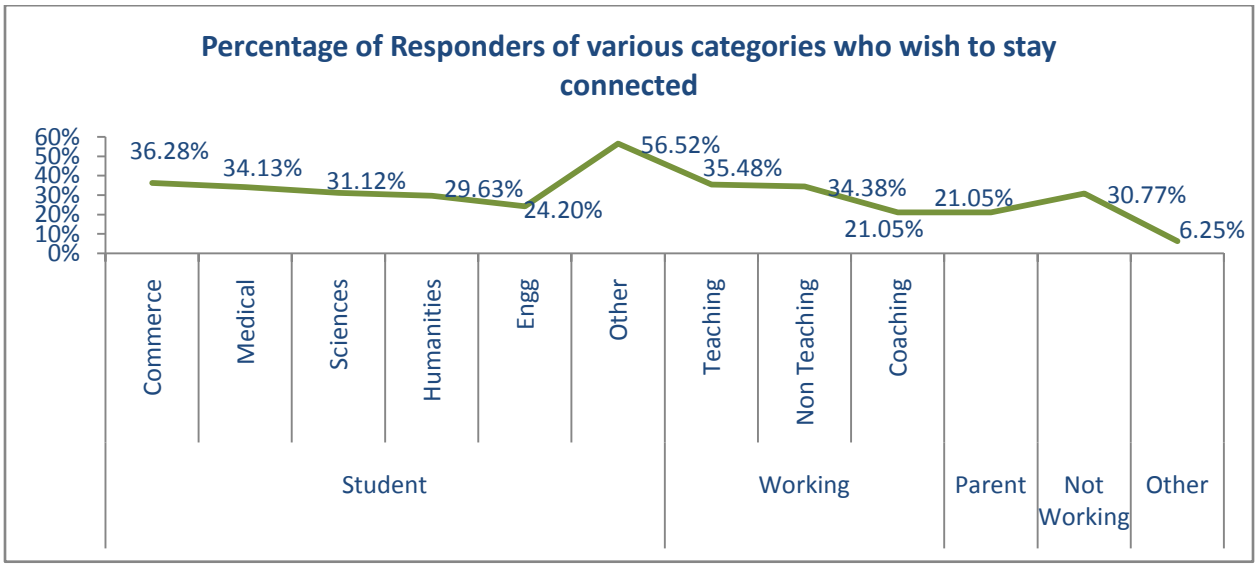


Consent for sharing the responsibility with total transparency	
Yes	**No**
1822	241



Would you like to stay connected to the further exercise as an interested responder?		
Yes	**No**	**Not Answered**
579	105	1379




Percentage of Responders of various categories who wish to stay connected
60%
50%
40%
30%
20%
10%
0%
36.28%
34.13%
31.12%
29.63%
24.20%
56.52%
35.48%
34.38%
21.05%
21.05%
30.77%
6.25%
Commerce
Medical
Sciences
Humanities
Engg
Other
Teaching
Non Teaching
Coaching
Student
Working
Parent
Not Working
Other

Detailed Response

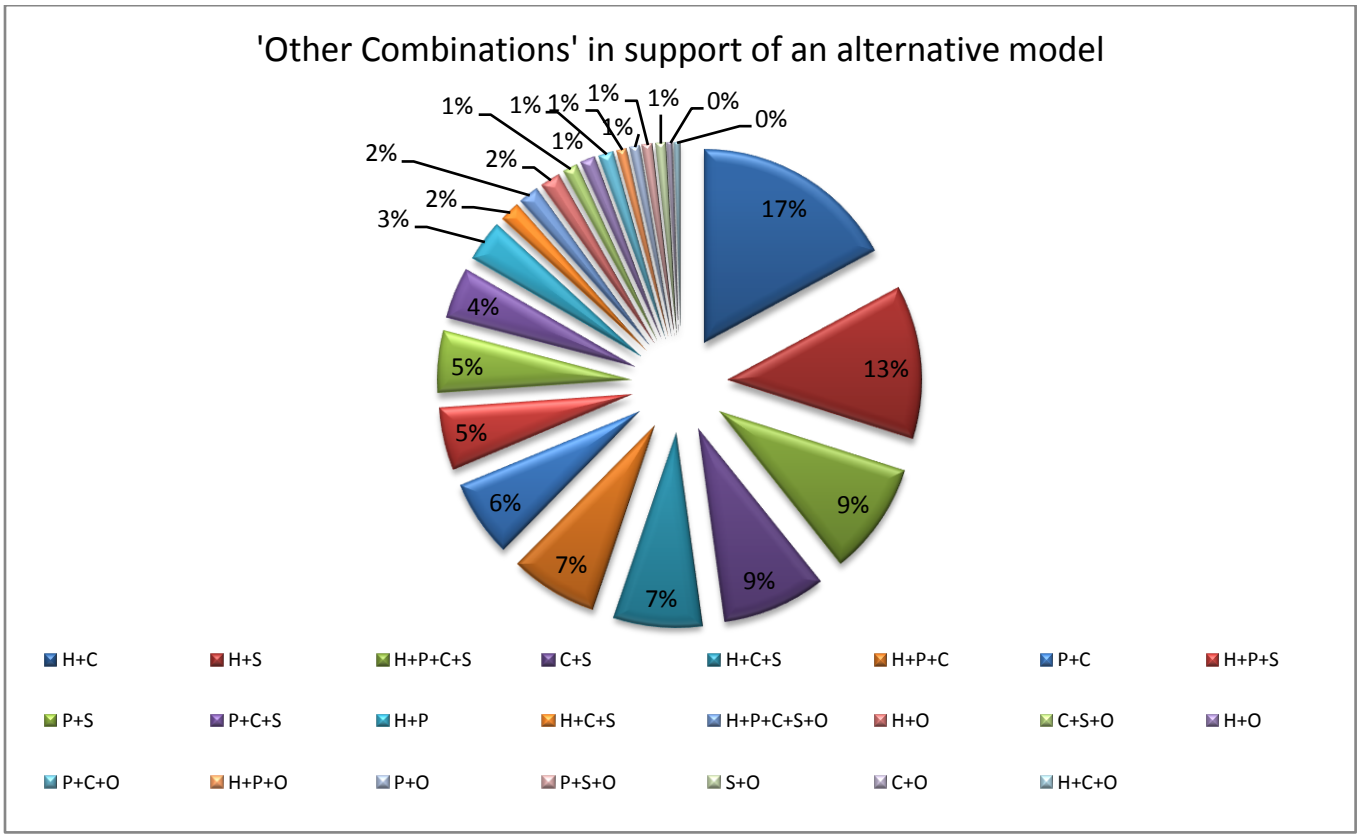
Part B

Question 5

'Other Combinations' in support of an alternative model for NTS

Professional Background	Sub-categories	Total	H+C	H+S	H+P+C+S	C+S	H+C+S	H+P+C	P+C	H+P+S	P+S	P+C+S	H+P	H+C+S	H+P+C+S+O	H+O	C+S+O	H+O	P+C+O	H+P+O	P+O	P+S+O	S+O	C+O
Student		**133**	**27**	**17**	**13**	**7**	**9**	**10**	**5**	**8**	**8**	**5**	**5**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**1**
	Engg	**105**	25	15	10	2	8	9	2	8	4	5	4	1	1	1	1	2	1	2		2		1
	Sciences	**13**	2	1	1			1	3						1	1	1				1		1	
	Other	**6**				4					1		1											
	Medical	**5**			2	1	1				1													
	Commerce	**1**																	1					
	Humanities	**3**		1							2													
Working		**88**	**12**	**13**	**7**	**10**	**7**	**5**	**8**	**2**	**4**	**5**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**0**	**1**	**0**	**1**	**0**
	Employed	**73**	12	9	5	9	4	4	7	2	4	3	3	3	2	2	1	1	1				1	
	Teaching	**14**		3	2	1	3	1	1			2									1			
	Coaching	**1**		1																				
	NA	**0**																						
Parent		**12**	**1**		**1**	**3**	**1**	**2**	**2**	**2**														
Not Working		**0**																						
Other		**1**			**1**																			
Total		**234**	**40**	**30**	**22**	**20**	**17**	**17**	**15**	**12**	**12**	**10**	**8**	**4**	**4**	**4**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**1**
% Distribution		**37%**	6.0%	4.0%	3.0%	3.0%	2.7%	2.7%	2.4%	1.9%	1.9%	1.6%	1.3%	0.6%	0.6%	0.6%	0.5%	0.5%	0.5%	0.3%	0.3%	0.3%	0.3%	0.2%

Question 5


'Other Combinations' in support of an alternative model
17%
13%
9%
9%
7%
7%
6%
5%
5%
4%
3%
2%
2%
2%
1%
1%
1%
1%
1%
1%
0%
0%
H+C
H+S
H+P+C+S
C+S
H+C+S
H+P+C
P+C
H+P+S
P+S
P+C+S
H+P
H+C+S
H+P+C+S+O
H+O
C+S+O
H+O
P+C+O
H+P+O
P+O
P+S+O
S+O
C+O
H+C+O

National Test Scheme (NTS)

Home page (specimen)

Appendix – A2

NTS – PUBLIC OPINION POLL QUESTIONNAIRE

Public opinion poll on the proposal to design and institute a rationalized National Testing Scheme for admission into Tertiary Education in Sciences and Engineering

1. Responder Profile

Name :
City :
Contact Numbers phone :
e-mail address :
Academic Background :
Professional Background (circle appropriate box):

A. Student B. Parent C. None
A. Working B. Not working
If Working
A. Teaching B. Educational coaching C. Employed else where

Education background
a. Engineering b. Medical c. Commerce d. Humanities e. Sciences f. Others (please specify)

If studied Engineering, the course was completed from
a. IITs b. NITs c. Other Govt. d. Other Private e. International f. Others (please specify)

Level of education
a. School level b. Under graduate c. Graduate d. others (please specify)

If teaching, level of teaching
a. primary b. middle and secondary c. tertiary

Length of teaching experience
a. Less than 5 years b. 5-10 years c. 10-15 years d. More than 15 years

Where do you teach?
a. School b. college c. university d. national institutions

If involved in coaching
Type of examination: JEE type AIEEE type Others (specify)

If employed else where, nature of employer.
a.Self b. Corporate c. Government

Length of professional service
Less than 5 years 5-10 years 10-15 years More than 15 years

Have you taken competitive examinations in this country? If so specify.

Have these exams been engineering exams?
Yes No

Consent for sharing this response with total transparency
Yes No

Part A – Understanding your view on the current examination system

The following questions are related to the current entrance examination system for engineering. As we understand the current system, there are several exams that a candidate has to appear for to get into different engineering colleges – IITs hold JEE, several other engineering colleges are affiliated to AIEEE, in addition there are several other state level and private exams held.

1. Do you support the following argument

"Today it appears that most students seeking admission into tertiary professional education in the country are appearing in as many as five to ten different types of competitive examinations with different sociological implications"

a. Yes, I completely agree b. No, I disagree

If yes, why?

2. Do you think there is a need to bring about a reform in the current multiple entrance examination system

a. Essential, do not change b. Could change, but only partial support c. Needs major reforms

3. List at least strong features in defence of the current examination system in order of ranking (we wish to understand the good part of the current examination system)

……., b……., c…… , d……..

4. List features of the current examination system that are required to be reformed

a. ……., b……, c……., d…….

Part B – Understanding your views on the suggested National Test Scheme

The following questions are related to a National Test Scheme for engineering that will be a mother examination incorporating entrance for all engineering colleges.
We are proposing a test scheme that will be used by all engineering colleges, the candidate will potentially be judged on two aspects – performance in the exam (consisting of a aptitude test, similar to current AIEEE, and an optional advanced test, similar level as the current IIT-JEE) and performance in school boards. Important to understand that the scheme as mentioned above is not a formal proposal but only a current hypothesis and would change based on your opinion on this survey.
Through the questions below, we are trying to get an understanding of the elements that the National Test Scheme should have.

1. **Would you be in favour of including a weighting factor for overall and consistent performance in examinations of school boards in the entrance examination scores.**

   Yes No

   If no, what are the perceived constraints in weighting school board performance and other inputs?

2. **If not in favour of a multi-parametric and rationalized National Testing Scheme, what are the over-riding reasons for objection?**

3. **Would you like to consider an Indian equivalent of Scholastic Aptitude Test (SAT) as the National Test Scheme?**

4. **If in favour of current JEE or AIEEE type competitive examination models, what is your view on test having an aptitude part(similar to SAT or current AIEEE) as well as an advanced test part(similar to current JEE)? Test should give more weightage to…**

   A. Aptitude only b. A mix of aptitude and advanced c. Advanced test

5. **If in support of an alternative model, what are the essential features you would like to build into the system?**

   A High filter type like IIT JEE B. Placement Type selection examination

   C. Competitive ranking model D. SAT type E. Others. (specify)

Part C - Would you like to stay connected to the further exercise as an interested responder?

Please give more details –
Address:
Best of mode of communication
a. Phone b. email c. any

*****

A study on the suitability of class XII board examination scores as a basis for national level admission to tertiary education

A report submitted by the Indian Statistical Institute

November 11, 2011

In India, there are over 40 different boards at the 10+2 level, including the state boards as well as the central boards such as CBSE and ICSE. These examinations cover a number of subjects (a student usually registers for five to seven subjects), and are conducted over a number of days. This is in contrast with various national level admission tests such as the IIT-JEE and the AIEEE, which are generally of shorter duration, and rely mostly on objective type tests. The possibility of using the board scores as a basis for national level admission to various 'tertiary level' courses had been under consideration for the past few years. The Ministry of Human Resources Development had constituted a committee under the Chairmanship of Dr. T. Ramasamy, Secretary, Department of Science and Technology (DST), to develop a National Test Scheme that would possibly include some criterion based on board scores. The Secretary-DST, in turn, asked the Indian Statistical Institute (ISI) to look into the following questions.

(a) Do the aggregate scores from different boards exhibit sufficient stability over the years, so that these can be used as criteria for admissions with a reasonable degree of confidence?

(b) What is the best way of standardizing different board scores in order to make them comparable for the purpose of selection?

Recent data on scores obtained by students in a few boards were made available, in order to help ISI to arrive at answers to these question.

This report provides the answers from ISI, with reasons.

1 The data

The data consist of the list of aggregate scores obtained by the students of four boards in the years 2007 to 2010. The boards are: CBSE (5.0-6.3 lakh examinees), Tamil Nadu board (5.6-7.3 lakh examinees), West Bengal board (3.0-4.6 lakh examinees) and ICSE board (23-56 thousand examinees). Out of these, the CBSE scores in the year 2010 could not be used because the data were incomplete, and the West Bengal scores for the year 2010 were not used because a data formatting issue could not be resolved within the requisite time frame.

2 Assumptions needed for comparability of different board scores

The following assumptions would have to be made in order to make the aggregate scores of different boards comparable.

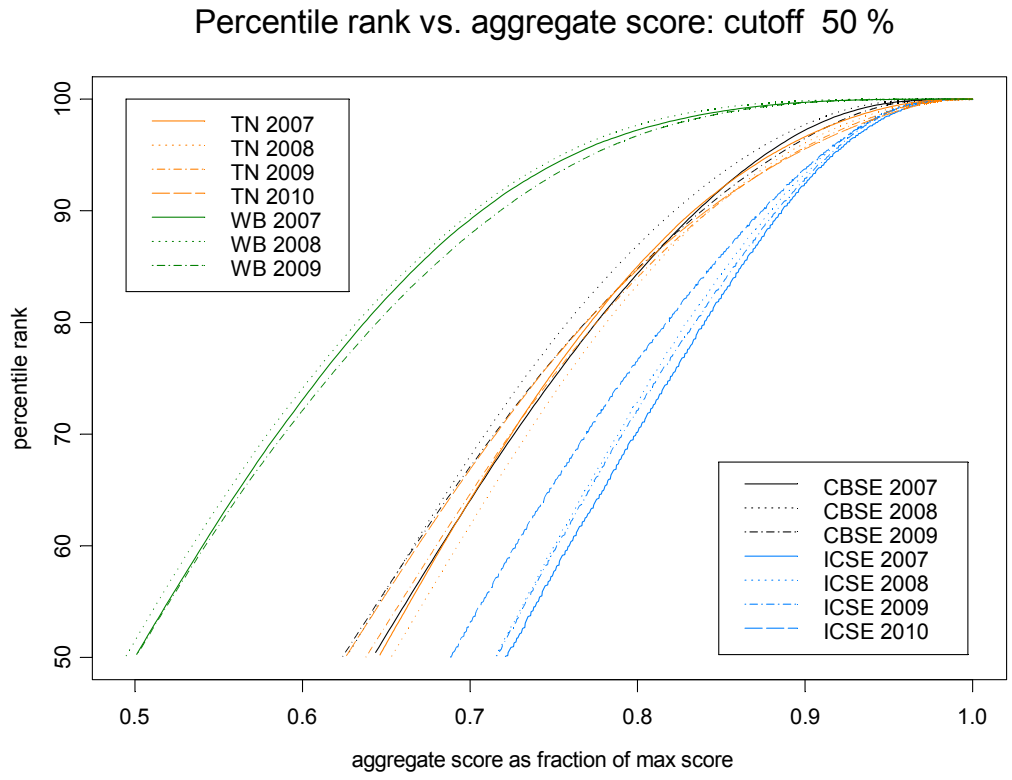
- Aggregate scores are expected to increase from less meritorious to more meritorious students in any particular subject
- Merit distribution is the same in all boards.

3 Stability of board scores

Under the above assumptions, the percentile ranks of students in different board examinations become directly comparable. It would be of interest to observe how the raw aggregate scores relate to the percentile ranks, and how these relationships vary from year to year as well as across different boards.

The number of subjects for aggregation varies from board to board, and sometimes even within a board. For the sake of standardization, the CBSE scores were aggregated over five subjects in all the cases, and the maximum score ranged from 492 (in 2008 and 2009) to 508 (in 2007). The Tamil Nadu board scores were aggregated over six subjects in all cases, and the maximum score ranged from 1188 (in 2010) to 1191 (in 2008). The West Bengal board scores were aggregated over the five compulsory subjects, and the total ranged from 459 (in 2007) to 475 (in 2008). The ICSE board permits students to take examinations in five, six or seven subjects, and the aggregate scores were turned into averages over the appropriate number of subjects. The maximum of this value ranged from 97.83 (in 2008) to 98 (in 2007 and 2009).

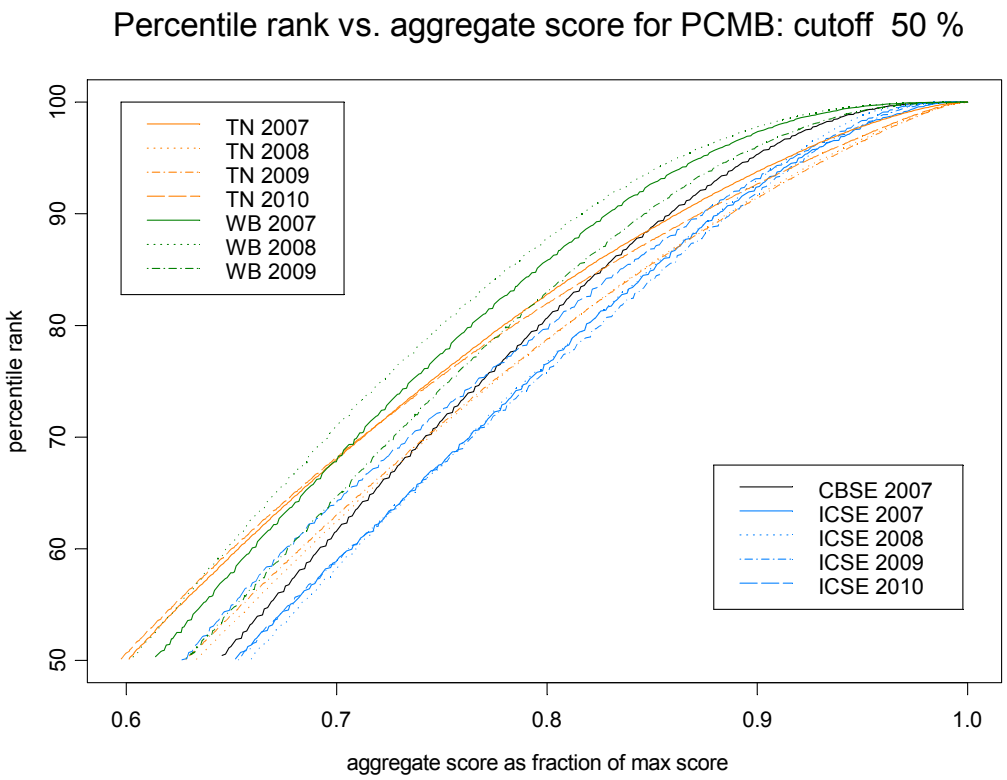
The following figure shows the plot of percentile rank against aggregate scores for all students on or above the 50th percentile mark. The aggregate score is expressed as a fraction of the maximum aggregate score obtained by a student in that examination. Each curve represents a particular board examination of a particular year. The curves corresponding to different boards are shown in different colours.



It is clear from the graph that the year-to-year variation in the aggregate scores is minimal, while there is substantial variation of aggregate scores from board to board. For example, a student at the 50th percentile of the ICSE board has an aggregate score

of about 70% of the maximum score, while the corresponding figure for the West Bengal board is around only 50%.

It would be interesting to find out whether the observed extent of board to board variation in aggregate score is primarily due to board to board variation in scores in non-science subjects. For this purpose, the curves were re-drawn by replacing the aggregate score with the average score in science subjects, namely, Physics, Chemistry, Mathematics and Biology (PCMB) in respect of those students who took the examination in at least three of these four subjects.



The graph shows relatively smaller variation from one board to another, suggesting that much of the board to board variation in aggregate scores can be attributed to scores in non-science subjects.

In any case, the stability of the aggregate scores of different boards over the years indicates stability of the examination processes that produce these scores.

4 Criterion for selection

Under the two assumptions mentioned in Section 2, the percentile ranks of the students computed from aggregate scores are comparable across different boards and years. Any monotone transformation of the percentile ranks is also appropriate for comparison, as long as the same transformation is used across different boards and years. Let us now consider a few such transformations.

Any of the curves in the first figure is a monotone function of the percentile rank. One can use any one of them, say CBSE 2007, as standard. If the same transformation of percentile ranks is used for other boards and years, then the resulting modified score

of any student of any board in any year can be regarded as the aggregate score, which could have been obtained by that student if he/she had appeared for the CBSE examinations in 2007. Thus, the transformed scores provide a common basis for comparison.

A feature of such a transformation is that, after this transformation, the scores are **not evenly distributed** throughout the available range of scores. In particular, when the scale of the CBSE 2007 aggregate score is used, less than 5% of the students have scores in the range of 90% to 100% of the maximum score. On the other hand, more than 10% of the students (spanning over the percentile range of 50 to 62) have scores squeezed in the narrow range of 65% to 70% of maximum score. This would lead to a loss of discriminating power in that percentile range, particularly if the board scores are used only as a component in a weighted selection criterion involving multiple components.

For maximal discrimination over the requisite range of percentile ranks, it is imperative that the scores have the uniform distribution over that range. This may be achieved if the percentile ranks themselves are used as scores. If there is a threshold percentile, say 75%, then the available range is maximally utilized by using the following linear transformation of the percentile rank:

$$\frac{\textit{Percentile rank of student} - 75}{100 - 75} \times 100 . \qquad (1)$$

According to this scale, a student with percentile rank 75 receives the score 0, a student with percentile rank 90 receives 60, and the topper receives 100. Similar computations can be done for other choices of the threshold percentile.

5 Recommendations

(a) The above analysis regarding stability of board scores should be carried out for all the boards over a longer period of time.

(b) If the reported stability of the board scores is found to hold generally, then a transformed percentile rank with a suitable cut-off, as described in (1), may be used as a score representing performance in the board examination, for the purpose of admission to tertiary education.

(c) The different boards should be asked to indicate the percentile rank of each student in the mark sheet.

(d) In order to prepare a formal and reliable basis for selection at the tertiary level, educational institutions at that level, including the IITs, should be asked to provide to the HRD ministry a statement of marks obtained by each graduating student, together with the student's score in the admission test of that institution (if any), the board score at the class XII level and the name of the board.

On multiple choice tests and negative marking

Rajeeva L. Karandikar

We critically examine the impact of marking schemes in multiple choice tests on the outcomes. We postulate reasonable models for the distribution of marks as well as of the guessing behaviour of the candidates when they do not know the correct answer. Through simulation, we show that the impact is significant. We suggest an alternative for improving the outcome.

Keywords: Gatecrasher, multiple choice test, negative marks, random guess.

Multiple choice tests have been used for screening candidates for a specific objective. Increasingly they are being used as a single test for final selection for admission to a course, award of fellowship, or for a job.

By a multiple choice test we mean a traditional test where each question has exactly one correct answer (among several choices, typically four or five) and to get credit the candidate needs to tick the correct answer (under the assumption that there is exactly one correct answer).

In a multiple choice test, when an answer is incorrect we can be sure that the candidate does not know the answer and in case the answer is correct, we are not sure if the candidate actually knows the answer or the outcome is due to a random guess. That is why whenever we talk of multiple choice tests, the issue of negative marks for an incorrect answer always crops up. Are there negative marks? If so what is the negative marking scheme? The discussion on negative marks often throws up differing views among experts. While some feel that there should be no negative marks as one should not take away credit that has been earned, some others argue that there should be nominal negative marks. Yet others argue that it does not matter: it is the same rule for everyone.

Even among those who feel that there should be negative marks, there is confusion as to the quantum of negative marks for an incorrect answer. Some argue that if every question has n alternatives, the correct negative mark for an incorrect answer should be $1/n$. The common interpretation of correct seems to be that a candidate choosing an answer randomly should not get any advantage on the average. In other words, if a candidate ticks all answers in a test randomly, the expected score of such a candidate should be 0. Simple calculation[1] shows that for this to happen the correct negative mark for an incorrect answer should be $1/(n-1)$. It is easy to show that if the negative score for an incorrect answer is $1/(n-1)$, the expected score of a candidate remains the same as the score based on his knowledge. The expected advantage from random guessing being zero does not guarantee that it has no impact on selection.

An important question that needs to be answered is: how many candidates who should not have been selected get selected because of random guessing. In other words, we need to examine how many candidates gatecrashed into the list of selected candidates. We will discuss this in the next section.

Another factor that has a big impact on the outcome is the difficulties that arise when there are incorrect or ambiguous questions. Often the solution of such a problem is to award marks to all candidates. This has an impact on the final selection. However, we have not factored this here. After all, this can be avoided if the administrators of the test are careful.

Is the impact of random guessing marginal?

Let us analyse the impact of random guessing on the ranks of the candidates and the subsequent selection of the candidates. Let us consider a situation where there are 200,000 candidates and the test is to select up to 1000 candidates (for admission to a course or selection for a job). It is common in India to have selections of such magnitudes, such as in the admission in engineering colleges or in the recruitment of large technology companies. The test consists of 200 questions. The candidate with serial number i knows answers to X_i questions. We will call X_i as the true score of the ith candidate, as it is the score based on his/her knowledge (X_i lies between 0 and 200).

The candidate may guess the answers to the questions for which he/she does not know the answers, getting credit for the ones he/she got right by chance, and possibly getting negative marks for the ones where he/she got the wrong answer. Let Z_i denote the observed score of the ith candidate.

Ideally we should have selected the top 1000 students based on their true scores, i.e. X_is; but true scores are not observable, only Z_is are observable and hence we would select the top 1000 students based on their observed scores.

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Let L denote the number of (lucky) candidates that have been selected, but would not be selected if we had been able to observe $\{X_i: 1 \le i \le 200{,}000\}$. In other words, L is the number of candidates who ideally should not have been selected, but got selected because they were lucky and got ahead of others whose true score was higher than their own. Is L large or small? A large (as a percentage of 1000) value of L would suggest that random guessing has significant impact on the final selection.

In order to get an idea about the order of magnitude of L, we undertook a simulation exercise with reasonable assumptions about the distributions of underlying random variables (explained below). We considered different schemes of negative marking: $N = 0$, $N = 0.25$ and $N = 1/3$. In order to analyse the impact, we also need to model the behaviour of the candidates with regard to random guessing. We assume that $P\%$ candidates resort to random guessing on questions where they do not know the (correct) answer.

Table 1 gives the average number of candidates that have been selected on the basis of observed ranks, who would not have made it if we could observe the true ranks or true scores. The results are based on 10,000 simulations of the underlying random variables. All results have been rounded to the nearest integer for better comprehension.

We see that random guessing has a significant impact. If there is no penalty for an incorrect answer ($N = 0$) and over 20% candidates resort to guessing, on the average over 200 of the 1000 candidates selected are gatecrashers. When the negative score for incorrect answers is 0.25 and more than 40% candidates are resorting to guessing, we would be selecting over 100 candidates on the average out of 1000 who should not have been selected. Even when $N = 1/3$ (when a candidate cannot change his/her expected score by random guessing), on the average over 100 candidates are gatecrashing if over 80% candidates resort to guessing.

Only when the negative score is 1/3 (something that is in the control of the examination organizers) and when only 10% candidates guess (examination organizers cannot control this proportion), the average number of those who gatecrashed reduces to about 17 and if 20% guess, the number is around 33.

We have seen that a large percentage of candidates can gatecrash the selected list via random guessing (except perhaps when $N = 0.5$ and $P \le 30$). Let us explore as to what the gap is between the cut-off based on true scores and the true score of the weakest candidate making it to the list. Let G denote the difference between the true cut-off and the true score of the candidate selected with the smallest true score. If G is small, we may ignore the effect of random guessing, but a higher value of G should raise an alarm because it means candidates much weaker than other better available candidates have been selected.

For the simulation model described here, Table 2 gives the results of the average gap. Once again all results are rounded to the nearest integer.

The gap is largest – 16, when there are no negative marks and when only 10% candidates guess. Even under most scenarios the gap is 10 or more on the average.

Having seen that the average gap is large, let us examine as to how weak could the weakest candidates be among those selected. Let T denote the true rank of the weakest candidate who has been selected. Once again high value of T (relative to 1000) suggests weakness of the multiple choice test-based selection.

Table 3 shows the average of T for different combinations of N and P based on 10,000 simulations rounded to the nearest integer.

Except for $N = 1/3$ and $P = 10$, we see that when we select 1000 candidates, on the average candidates with rank above 3000 are making it to the list. For several scenarios, the average T is 3500 and more.

This means the test fails to select better candidates even though there are on the average 2000 or more candidates who are better than those that the test is selecting. And the number is much higher under several scenarios.

Model for simulation

Suppose there are 200,000 candidates and the test is to select up to 1000 candidates. The test consists of 200

Table 1. Average L: number of candidates who should not have been selected, but have been selected

Percentage candidates guessing	Negative marks for an incorrect answer		
	0	0.25	1/3
10	136	27	17
20	198	51	33
30	225	75	47
40	256	98	59
50	216	113	72
60	232	117	84
70	181	115	97
80	197	116	109
90	152	124	122

Table 2. Average G: gap between true cut-off and true score of weakest candidate selected

Percentage candidates guessing	Negative marks for an incorrect answer		
	0	0.25	1/3
10	16	9	8
20	15	10	9
30	15	11	9
40	14	11	9
50	13	11	10
60	13	11	10
70	12	11	10
80	12	10	10
90	11	10	10

questions. Recall our notation: the candidate with serial number i knows answers to X_i questions.

Out of the $200 - X_i$ questions, if the candidate decides to guess, he/she guesses the answer by randomly choosing one out of the four options in the remaining $W_i = 200 - X_i$ questions.

We model X_i, W_i as follows: Let X_i be the integer approximation to Y_i, where Y_i has normal distribution with mean 125 and standard deviation 20. We would like to remark that the distribution of true scores around the true cut-off is all that counts (for the quantities we are monitoring in this article) and thus if we select, say 0.5% as in this study, then the distribution of scores of the top 3–5% candidates alone matters and the rest does not. So Gaussian assumption is not critical to this study.

We assume that a candidate resorts to guessing with probability P: writing $H_i = 1$, if the ith candidate guesses and $H_i = 0$ otherwise, with distribution of H_i being Bernoulli with success probability P. We also assume that H_i and X_i are independent.

Let A_i denote the number of questions a candidate got correct out of W_i by random guessing. Then (conditional on W_i) A_i is binomial with $n = W_i$ and $p = 0.25$.

If N represents the negative marks for an incorrect answer, the (observed) score of the ith candidate Z_i is given by

$$Z_i = X_i + A_i + N * H_i * (W_i - A_i).$$

Table 3. Average T: true rank of the weakest candidate selected

Percentage candidates guessing	Negative marks for an incorrect answer		
	0	0.25	1/3
10	7392	3277	2750
20	6902	3647	3099
30	6363	3911	3283
40	6163	4076	3415
50	5348	4123	3516
60	5285	4050	3609
70	4607	3929	3684
80	4635	3843	3762
90	4129	3854	3837

Table 4. Fifth percentile of L: number of candidates who should not have been selected, but have been selected

Percentage candidates guessing	Negative marks for an incorrect answer		
	0	0.25	1/3
10	114	17	10
20	167	35	20
30	178	54	29
40	198	69	38
50	172	75	47
60	168	79	57
70	137	74	67
80	147	79	77
90	97	87	87

We can verify that for $N = 1/3$, conditional expectation of Z_i given X_i equals X_i, i.e.

$$E(Z_i \mid X_i) = X_i.$$

Also, the random vectors (X_i, W_i, H_i, A_i), $1 \le i \le 200{,}000$, are independent.

We simulate the random variables described above and compute the score Z_i for $1 \le i \le 200{,}000$.

We only observe the scores of candidates Z_i and we can only rank and select candidates based on their score Z_i. Let $\mathcal{F}$ be the set consisting of the serial number of students selected based on the scores Z_i. Since there can be ties (several candidates having the same score), we may have to choose a few more or a few less. To be precise, let us assume that we select not more than 1000 candidates, so that if the number of candidates with score greater than or equal to 177 is 983 while there are 32 candidates with score 176, we select only 983.

Since X_i denotes the number of questions the ith candidate knows, ideally we would have liked to rank the candidates on $\{X_i\}$ and select up to 1000 ranks. Let $\mathcal{G}$ be the set consisting of the serial number of students who should have been selected. Let S denote the cut-off (unobserved) based on true scores, i.e.

$$S = \min\{X_i : i \in \mathcal{G}\},$$

and let R_i denote the (true) rank of the ith candidate based on true scores.

Each of the quantities L, G, T described above measures the extent of mismatch between $\mathcal{F}$ and $\mathcal{G}$. These quantities can be described as follows:

$$L = \#(\mathcal{F} \cap \mathcal{G}^c)$$

$$G = S - \min_{i \in \mathcal{F}} X_i$$

$$T = \max\{R_i : i \in \mathcal{G}\}.$$

For the model described above, we have given average values of L, G, T in the previous section for various choices of N and P.

It is well known that average alone does not describe a distribution. For example, the average can be high because the random variable in question takes a large value with a small probability, while with overwhelming probability it takes small values. So we give below the 5th percentile of L, G, T in each of the scenarios below.

Table 4 shows that if $N = 1/3$ and $P = 90$ so that 90% candidates resort to guessing, then with 95% probability we will end up selecting 87 or more candidates (about 9%) who should not have been selected.

Table 5 shows that under several scenarios considered, the gap G is 8 or more with 95% probability.

Table 6 shows that we are selecting candidates with (true) rank over 2000 with 95% probability under most of the scenarios. Selecting a candidate with (true) rank of

2000 means that we are leaving out 1000 candidates who are better than the selected candidate. This shows the weakness of the selection scheme.

Even with $N = 1/3$ and $P = 60$ or $P = 70$, we would be selecting candidates with rank about 2500 or more with 95% probability.

A better alternative

One possibility is to increase the number of alternatives in each question from which the candidate can choose the correct answer. Increasing the number of alternatives to five from four changes the situation marginally. And anyone who has set questions in a multiple choice test knows that setting credible alternatives in a question is not easy. So going beyond five seems rather difficult.

One simple way to expand the possible set of solutions is to have questions that may have one or more correct answer(s) and to get credit the candidate should select all the correct answers and not select any incorrect answer. Then a question with four alternatives is turned into a question with 15 alternatives. Here is an example of such a question:

Which of the following are prime numbers?

(A) 63
(B) 37
(C) 91
(D) 83

Table 5. Fifth percentile of G: gap between true cut-off and true score of weakest candidate selected

Percentage candidates guessing	Negative marks for an incorrect answer		
	0	0.25	1/3
10	13	6	5
20	13	7	6
30	12	8	6
40	12	8	7
50	10	8	7
60	10	8	7
70	9	8	7
80	9	8	8
90	8	8	8

Table 6. Fifth percentile of T: true rank of the weakest candidate selected

Percentage candidates guessing	Negative marks for an incorrect answer		
	0	0.25	1/3
10	5286	2049	1748
20	4820	2542	2008
30	4315	2626	2253
40	4299	2890	2293
50	3784	2827	2363
60	3722	2646	2563
70	3317	2624	2584
80	3321	2622	2607
90	2916	2651	2644

Since 37 and 83 are prime numbers and 63 and 91 are not, (B) and (D) are correct options, whereas (A) and (C) are incorrect. Thus to get credit, a candidate must tick the two alternatives (B) and (D), and not tick (A) or (C).

Such tests have been discussed in the literature[1] and have been in use. In the proposed scheme, there is no partial credit or negative marks. So the candidate gets one mark if he/she ticks all the correct options and does not tick any incorrect answer; otherwise he/she gets zero marks for that question.

It is easy to see in the above example that there are 15 possible choices ($4C1 + 4C2 + 4C3 + 4C4 = 4 + 6 + 4 + 1 = 15$). With 15 alternatives, the impact of random guessing is negligible.

It is important to give the instruction correctly so as to avoid the problem that occurred in a major examination recently (http://education.gaeatimes.com/2010/05/26/iit-kharagpur-professor-underlines-mistake-3897/). Such questions have been tried in various tests where there is a subsequent round of interview and the scores in the test seem to have much better correlation with the performance than a traditional multiple choice test.

Since such questions are likely to be more substantive and would require analysis, more time should be given to candidates. That is, a reasonably good candidate should have enough time to answer all the questions within the time limit. Also, the pattern, instructions and some examples should be made available to the candidates before the test. It will also eliminate the possibility that a subsection of candidates might get unfair advantage by having prior knowledge about the type of test.

Conclusion

We have considered a situation where we are to select the top 1000 out of 200,000 students based on a multiple choice test with four alternatives to each question and with exactly one correct answer. If the negative score for an incorrect answer is $N = 1/3$, then the expected score of a candidate does not change by random guessing.

However, simulation reveals that the impact on the set of selected candidates is significant. With 95% probability, we would be selecting candidates whose true rank could be as high as 2500.

Of course, if we stick to traditional question–answer tests where the candidate has to write down the solution, then that would be the best. However, if for practical reasons one has to resort to a multiple choice test that can be evaluated via a computer, then a better alternative is to have questions that have one or more correct answers and then to postulate that to get credit a candidate must select all correct answers and not select any incorrect answer.

1. Bush, M., Alternative marking schemes for on-line multiple choice tests. In 7th Annual Conference on the Teaching of Computing, Belfast; available at http://www.caacentre.ac.uk/dldocs/bushmark.pdf

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