ALTERNATIVE TO TRADITIONAL EXAMINATIONS- ADAPTIVE TESTING

Aishwarya Jaiswal (20BBT0086), Nimisha Gulia (20BBT0296), Aryan Sharma (20BCE0952), Kushagra Palod (20BCE0698), Soham Bhattacharjee (20BCE0656), Rashi Maheshwari (19BDS0006)

1. ABSTRACT

As the computer has come to affect many aspects of society during the last decade, it has had an impact on testing too. Adaptive testing is a process of test administration in which test items are selected for administration on the basis of the examinee's responses to previously administered items.

From the classroom to the professional world, we all have different learning styles, skills, and strengths. We all learn at different speeds. The traditional way of conducting examinations is a very unfair means to judge a student and also hinders the students' learning and developing capabilities, since they aren't given an exact report on the areas they need to focus and improve upon and adds on to the mental pressure.

In our country, examinations have become one of the most important parts of a student's life. Apart from the academic examinations, there are several entrance examinations that the students give in order to gain a good percentage or gain admission to top colleges and universities. Given the importance of examination in a student's life it is necessary that we bring in innovative ways to conduct it more effectively.

A Computer Adaptive Test is a test which adapts to the candidate's ability in real-time by selecting different questions from the bank in order to provide a more accurate measure of their ability level on a common scale.

CAT successively selects questions for the purpose of maximizing the precision of the exam based on what is known about the examinee from previous questions. For example, if an examinee performs well on an item of intermediate difficulty, they will then be presented with a more difficult question. Or, if they performed poorly, they would be presented with a simpler question. Compared to static multiple-choice tests that nearly everyone has experienced, with a fixed set of items administered to all examinees, computer-adaptive tests require fewer test items to arrive at equally accurate scores.

2. INTRODUCTION

Examination is a type of healthy competition or challenge to prove a person's knowledge and skill. Exams help any teacher in understanding the mental capacity of their students to rectify their shortcomings. It also helps the students to perform and think at a much greater level. It not only opens the doors for better personality, improving skills of mathematical reasoning, communication, logistics, science and expressive nature of the subject which will provide the platform to add the 'ability' , subtract the 'failure' and multiply their 'success'. These abilities learnt help the student in becoming an asset to the society rather than a liability.

There are many ways of conducting an examination taking into account the vast growth in technology. We have developed many methods for conducting exams, but the traditional pen and paper system of testing is not to be forgotten and still prevalent in our country of more than 1.3 billion people. However, There are many factors that need to be considered while conducting exams in the traditional pen and paper format. It requires a campus, adequate faculty, furniture like tables and chairs, registration processes etc. The traditional pen and paper examination system is lengthy, and evaluating answer scripts is a time-consuming process. From the students' point of view, pen and paper tests are seen

as time consuming and stressful, as it requires a lot of preparation and mugging up. Students have to remember all the concepts elaborately to clearly write answers to the questions being asked. Also, teachers have to set many sets of question papers with different questions for each and every examination. Moreover, they have to monitor every student present in the exam hall to avoid any malpractice which becomes a tough task. The manual evaluation process is also very time consuming. Other factors like malpractices in examination centers, paper leakages and providing an appropriate environment for students with physical disabilities becomes a problem while conducting exams in the traditional system.

Therefore, there is a common request from students as well as teachers to incorporate changes in the traditional examination system so that the above stated problems can be overcome. Many different testing models have been developed and implemented across the world which overcome many of the difficulties faced in the traditional testing mechanism. One of the most prominent methods is Computer Adaptive Testing (CAT).

Computer adaptive testing (CAT) is a kind of tailored testing which means it is tailor made for each and every test taker. It is a form of computer-based testing that is adaptive to each test-taker's ability level. It is sometimes referred to as personalized assessment. Our objectives include to emphasize the importance of Computer Adaptive Testing in the modern-day world, to overcome the disadvantages of traditional pen and paper tests by using Computerized Adaptive Testing mechanism, Highlighting the need to implement Computerized Adaptive Testing mechanism on a large scale in our country

3. METHOD(S)

1. We began by identifying the overall approach to the research - finding out the problem we need to solve and the kind of data we need to solve it.
2. Clearly defining the objectives and materials required
3. Identifying the stakeholders and people involved.
4. Organizing the team and assigning each team member appropriate work. Defining their roles and responsibilities.
5. Estimating the time required to deliver the perfectly designed project.
6. Spending time in deep research on the chosen topic.
7. Holding frequent meetings in order to promote interaction among team members and to exchange ideas.
8. Quantitative methods like surveys measure, rank, and identify patterns for making generalizations.
9. Consolidating the obtained information and describing it in the best possible manner.
10. Proving that the methods are chosen to suit the objectives and provide the best possible approach to answering the problem statement.
11. Assigning credits to individuals and sources from which we drew inspiration to do the project.
12. Acknowledging those who provided scope, support, and guidance in completing the project.

4. ALGORITHM AND MODEL

4.1. Item Response Theory

Item response theory (IRT) is a standard for the design, analysis, and scoring of tests, questionnaires or other variables.

• It is a theory of testing based on the relationship between individuals' performances on a test item and the test takers' levels of performance on the overall test.
• Computer adaptive testing (CAT) is a kind of tailored testing and is mostly based on this item response theory.

4.2. Components of CAT

A pool of questions calibrated with pre-testing data, or a calibrated item bank
• A starting point, which is a rule for determining the test-specific taker's starting point.
• A scoring algorithm is a method for estimating a test taker's skill as well as measurement inaccuracy.

A termination criterion is a set of rules for ending a test.

4.3. Working Principle

1. Begin with a question from the pool of medium difficulty
2. Estimate latent score based on the response
3. Select another question based on the current latent score
4. Again, calculate the latent score
5. Repeat the process until the stopping rule is satisfied(test taker or the examiner)
6. If terminated, calculate the final latent score and present it to the test taker.

5. RESULT/OUTCOME

For the purpose of understanding the needs of the student population, we asked several questions in a survey with 120+ responses.
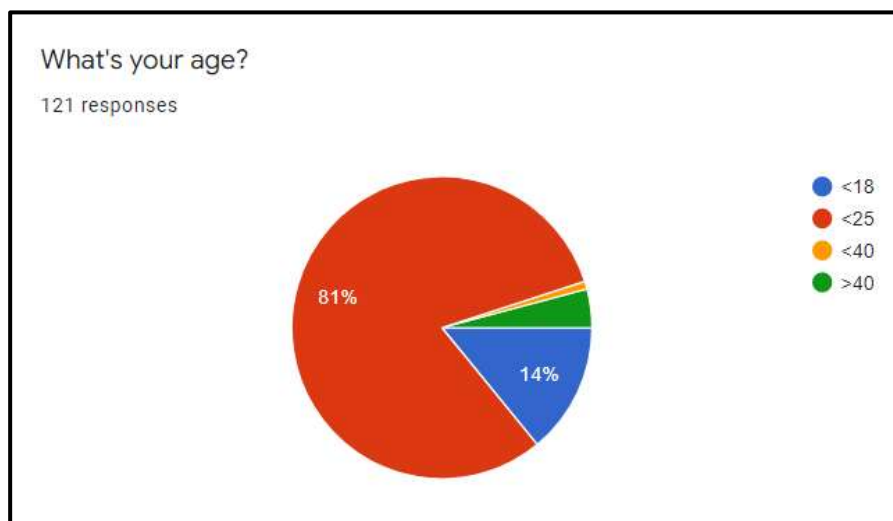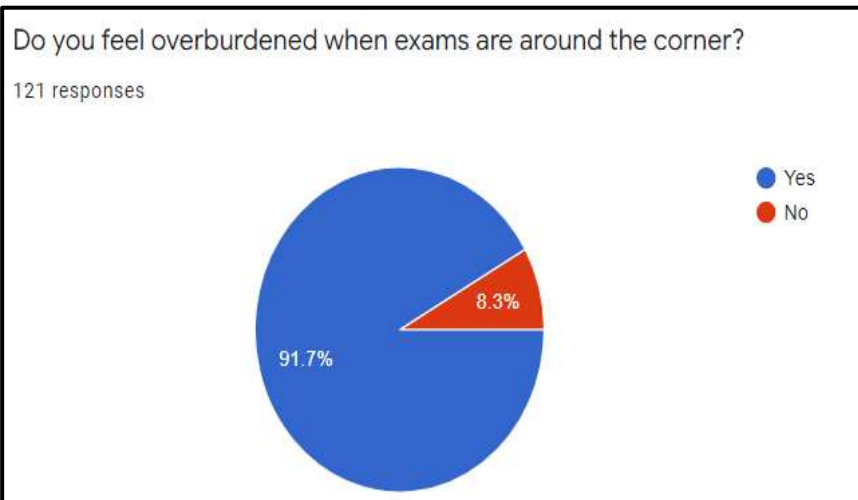

We asked age to better understand the demography and subsequent experiences of our target audience.

Are you satisfied with the current Education System in India?

121 responses

- ● Yes
- ● No

85.1%

14.9%
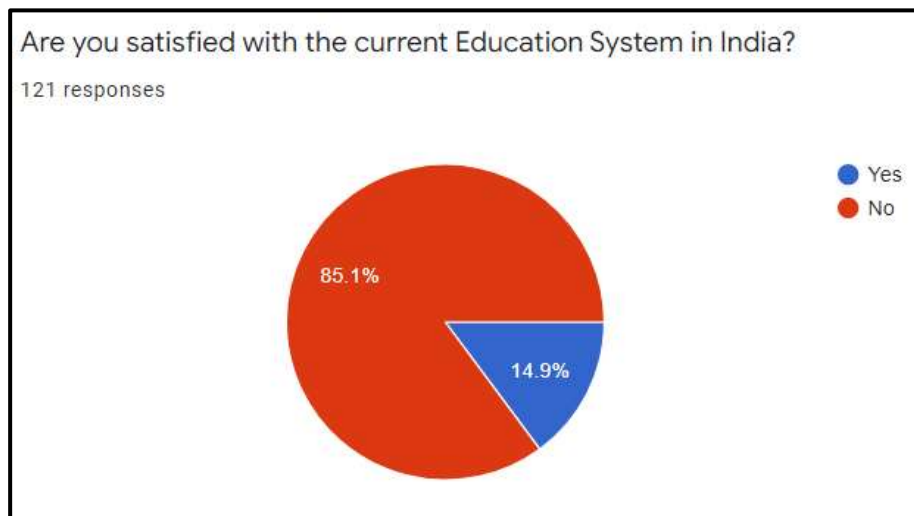
An overwhelming majority agreed that they were not satisfied with the current educational framework followed in the country.
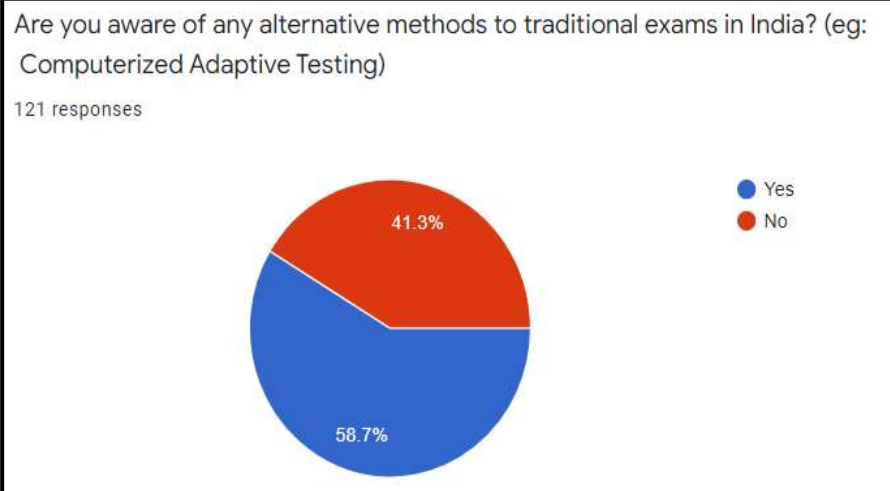
Do you consider yourself a slow learner?

121 responses

- ● Yes
- ● No
- ● Maybe

34.7%

47.9%

17.4%
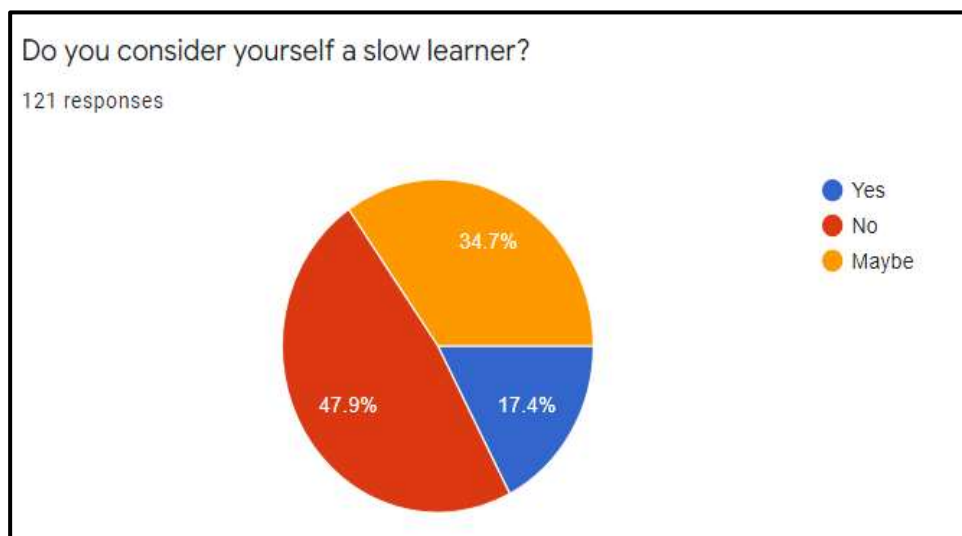
Around 52% of surveyed individuals do not consider themselves fast learners.

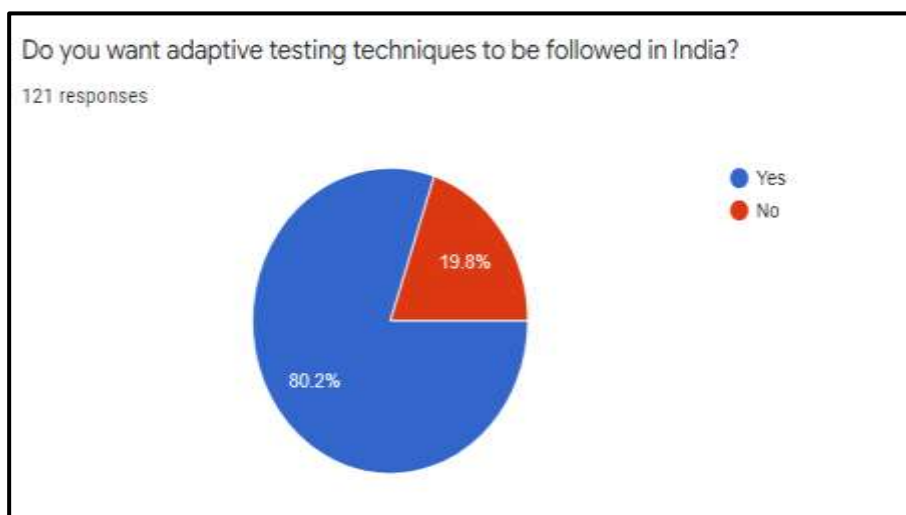Do you feel overburdened when exams are around the corner?

121 responses

- Yes
- No

8.3%
91.7%

A staggering majority of our audience agreed to feel overburdened when exams are around the corner.

Do you feel examinations in India are outdated?

121 responses

- Yes
- No

10.7%
89.3%
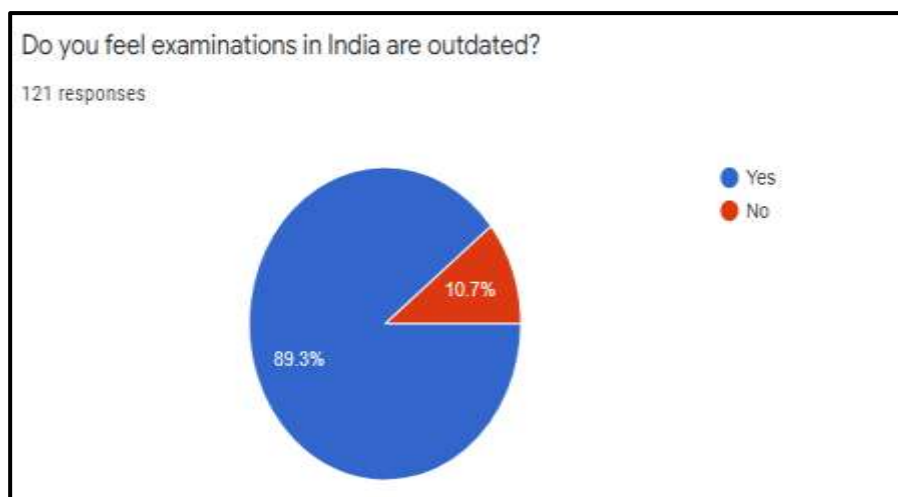
Almost 90% of students believe examinations in India are outdated.

Are you aware of any alternative methods to traditional exams in India? (eg: Computerized Adaptive Testing)

121 responses

- Yes
- No

41.3%

58.7%

Around half of our surveyed students were aware of alternative testing methods.

Do you want adaptive testing techniques to be followed in India?

121 responses

- Yes
- No

19.8%

80.2%

An overwhelming majority wanted newer testing methods like adaptive testing techniques or CAT.

7. DISCUSSION

6.1. Advantages of CAT

Advantages of computerized adaptive testing (CAT) are:

1. Shorter Tests and Immediate Results:

Significantly less time is needed to administer CATs than fixed-item tests since fewer items are needed to achieve acceptable accuracy. CATs can reduce testing time by more than 50% while maintaining the same level of reliability. As the test-takers do not have to waste their time attempting items that are too easy or hard, it reduces fatigue, a factor that can significantly affect an examinee's test results. Shorter tests also benefit the testing agency as the cost of the examinee seat time is reduced. Like most computer-based tests, CATs may show results immediately after testing.

2. Precise and Fair scoring:

CATs can be designed so that examinees are all measured with the same level of precision, even though they all potentially see different items. This makes the test extremely fair from a psychometric perspective. Because CATs are more efficient, the organization has the option to design the CAT to actually be more precise than a conventional test while still using fewer items. As mentioned previously, a CAT will provide an appropriate challenge for each examinee. Low examinees are not discouraged or intimidated. High examinees enjoy receiving difficult items. CATs can provide accurate scores over a wide range of abilities while traditional tests are usually most accurate for average examinees.

3. Test security:

Because the CAT algorithm is very flexible and can adapt with potentially millions of permutations, there is much greater security than if everyone was administered the same set of items. Test security may be increased because hard copy test booklets are never compromised. Furthermore, no two people take the same test, so parroting answers or copying from someone else is pointless, making them far more secure than a typical exam with a set number of questions given to a group of people.

4. Frequent Retesting:

The high number of permutations also enables more frequent retesting. If a student takes a CAT, then receives a few weeks of instruction, by the time they take a CAT again their ability would have increased somewhat, and they will receive a completely different test, making frequent retesting more feasible.

1. CAT gives more information about students' strengths and weaknesses.
2. The score of each examinee is determined based on both the percentage of questions that were answered correctly and the difficulty level of these questions.

6.2. Why we feel CAT should be implemented in India

In our country, examinations have become one of the most important part of a student's life. The future of a student depends on how well he/she has performed in the examinations. Apart from the academic examinations, there are several entrance examinations that the students give in order to gain a good percentage or gain admission to top colleges and universities. Given the importance of examination in a student's life it is necessary that we bring in innovative ways to conduct it more effectively and efficiently.

According to some reports and sources, the present examination system in India requires some changes. Some students feel that these examinations do not test their abilities completely. The present examination methods compel the students to learn and understand those topics which they are not interested in or is beyond their understanding. Hence the examination system is said to be defective as it does not provide a proper method to analyse the true strengths and weaknesses of a student.

As the evaluation is done in real-time, at the end of the test the candidate can receive immediate feedback in the form of ability statements as opposed to a raw score or grade, which provides factual information on their strengths and weaknesses based on the questions they answered.

6.3 Case Study:

USING CAT FOR A LARGE-SCALE NATIONAL TESTING PROGRAMME IN THE UK: A CASE STUDY

A teacher questionnaire revealed that:
• 78% thought that learners were engaged,
• 83% thought the assessments were the right length,
• over 60% found the learner and feedback reports to be useful.

It was observed that there are still some barriers to overcome as the mindset shifts from paperbased testing.

• In this personalised assessment method, the algorithm stops once it can confidently give an ability estimate of the student, so it was observed that some students had to attempt more questions than others, which wouldn't happen on a paper test.

• Since CAT is designed to challenge the high-ability learners, students might face questions from older age groups tha they haven't been formally taught. This can be taken in a positive way also, since the objective of CAT is to show learners what they can move on to, or even demonstrate capabilities beyond their age group.

One interesting observation was:

Learners at the lower end of the ability spectrum, typically, when they were doing the paper test, they would get somewhere between 90-95% of the questions incorrect. Which considerably reduces their morale. But with CAT, they come out of this saying "I could do it!". And the high flyers who would whiz through a paper test in ten minutes suddenly now say, 'that was a difficult test, I had to think'…at least it's making them realise there's something else to move on to."

CONTRIBUTION:

Respected Sir, all the members contributed significantly and no one was left behind. We can safely say that this was a successful team effort.

Aishwarya: Helped with the total Documentation, the final editing, writing the Abstract, and various other subtopics of the presentation. Lead the group review and ensure completion of work within the time frame.

Nimisha: Helped with the overall presentation ,utmost focus being the methodology of CAT and all-inclusive design part. Contribution in content and proofreading.

Aryan: Helped with the Documentation, editing, writing the introduction, Lead the team on stage including the introduction of the team and the onstage presentation.

Soham: Helped design the survey, wrote the result and inference, made it possible for the survey to reach a wider audience, and presented the algorithm behind CAT along with survey results.

Kushagra: Helped to formulate the survey questions, wrote the algorithms and working model of CAT and explained the problem statement, and pointed out the difference in traditional ways.

Rashi: Helped with the writing and editing of the report and presented advantages of CAT over traditional pen and paper tests.

ACKNOWLEDGEMENT:

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REFERENCES

- https://en.wikipedia.org/wiki/Computerized_adaptive_testing
- https://www.sciencedirect.com/topics/social-sciences/computerizedadaptive-testing
- https://www.researchgate.net/profile/David-Weiss-20/publication/229790641_Application_of_Computerized_Adaptive_Testing_to_Educational_Problems/links/5d548190458515304 0756905/ApplicationofComputerized-Adaptive-Testing-to-Educational-Problems.pdf
- https://adaptivex.io/benefits-of-adaptive-testing/
- https://surpass.com/news/2019/computer-adaptive-testing-background-benefits-and-case-study-of-a-large-scale-national-testing-programme/
- https://www.edglossary.org/computer-adaptive-test/
- https://assess.com/media/Advantages-of-Computerized-Adaptive-Testing.pdf
- https://files.eric.ed.gov/fulltext/ED497385.pdf

- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5549015/
- https://www.researchgate.net/publication/328546785_Computerized_Adaptive_and_Multistage_Testing_with_R_Using_Packages_catR_and_mstR
- https://www.act.org/content/dam/act/unsecured/documents/ACT_RR2012-6.pdf
- https://www.researchgate.net/publication/311853698_Computer_Adaptive_Multistage_Testing_Practical_Issues_Challenges_and_Principles