

Quality Education Study

STUDENT MISCONCEPTION AND COMMON ERROR REPORT





School education is a very important part of progress in society. We need to provide our children quality education in an equitable manner. This is one important path towards a just, equitable and humane society.

Wipro is committed to this cause and has been working for more than a decade on various projects to help improve school education in India through Wipro Applying Thought in Schools program. Wipro has also been working with engineering colleges to help improve quality of education. This is through our Mission 10X program. In my personal capacity, through the Azim Premji Foundation (and the University founded by it), we have been working in collaboration with various state governments to help improve quality and equity in the government schooling system.

There are many dimensions on which we need to work in a sustained manner to bring about quality & equity in education. One of these dimensions is the understanding of what is happening in different kinds of schools.

Wipro and Educational Initiatives have partnered in the Quality Education Study to understand popular schools in India better. Five years ago we had undertaken the “Student Learning in Metros” study. From that study, we had learnt that there were serious gaps in the way children learn even in popular schools. Our education system seemed to mainly encourage rote learning and memorization.

We undertook the current study to re-assess the situation and also to throw light on other aspects that contribute to quality in education e.g. organizational issues of the school, student attitude and values.

The study has taken a year of hard work by the team that has worked on it. However we should treat this study as a beginning. Many of these findings require deeper research before we generalize. We hope that this study will trigger more debate and further research and help in expanding our understanding of quality education.

- Azim H. Premji

Chairman,
Wipro Limited



From the Authors:

The Quality Education Study would not have been possible without the help and support of a large number of people.

We would like to specifically thank the School Principals for giving permissions to freely conduct the study in the schools for classes 4, 6 and 8.

We would also like to acknowledge the support and guidance of experts who helped in finalisation of the instruments and various aspects of the study.

We would like to express our gratitude to the Wipro team for their continued support throughout the study.

Lastly, we are also thankful to the students, teachers of the schools who participated in the assessments.

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CONTENTS

Quality Education Study



1. About the Study
2. What are Misconceptions and Common Errors
3. How to Read the Graph
4. Misconceptions and Common Errors in Maths
5. Misconceptions and Common Errors in Science
6. Misconceptions and Common Errors in Social Science
7. Misconceptions and Common Errors in Language

I. About the Study

Quality Education Study (QES) has been conceptualized jointly by the Wipro and Educational Initiatives (EI) and was executed in a partnership mode, with EI carrying out the actual execution. This was planned as a 3 year long study to expand the meaning of 'quality' in education to include educational outcomes beyond cognitive learning and study the attributes of quality learning environments. The study expands a project executed jointly by Wipro and EI in 2005-06 which looked at the quality of student achievement in leading schools in 5 metro cities of India and was published as a cover story in the India Today magazine.

The Quality Education Study (QES) covered 83 English medium schools selected from the list of 'top'¹ schools identified through a public opinion survey carried out in Bangalore, Chennai, Delhi, Kolkata and Mumbai. In addition, 6 more schools were included in the study based on recommendations from experts as learning environments that are different from most schools. These schools were not restricted to the 5 metro cities. Overall, about 23,000 students, 790 teachers and 54 Principals from 89 schools participated in the study.

Students of classes 4, 6 and 8 were assessed through a test. The test consisted of objective, multiple-choice questions in English, Mathematics, Environmental Science and Social Studies. The questions were carefully selected from a pool of ASSET² items which have already been extensively tested with thousands of students. Few questions were also selected from international studies such as Trends in Mathematics and Science Study (TIMSS), Progress in Reading Literacy Study (PIRLS) and national studies by EI such as Student Learning in Metros (SLIM) Study.

The main objective of the study was to expand the understanding of quality in school education and the attributes of good learning environments. These could be further specified as follows:

- To identify, study and where possible measure some of the factors or parameters that are seen to occur in different learning environments.
- Provide information on different approaches and practices and their contexts
- Provide information on student learning levels
- Comparisons on student achievement as seen in schools of different types, boards and regions
- Provide information on some values and attitudes students seem to hold
- Provide information on participation of students in the areas of learning not considered part of the core curriculum like sports, music, arts etc. and the supportive environments for the same provided by schools

The results of the study reveal that students seem to harbour number of misconceptions in the different subjects. As students move to higher classes, although the overall performance improves, the number of students holding on to same misconception continues, which indicates that if a student develops a misconception in a lower class, then it is more likely to continue in higher classes too without getting corrected from lower classes which continue to higher classes.

The misconception and common errors report covers misconceptions and common errors among students of classes 4, 6 and in Maths, Science, Social Studies and English. The examples are provided in the report.

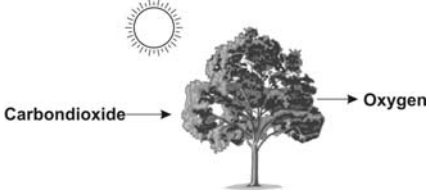
¹ 'Top' schools are schools identified on a public opinion survey carried out as a part of the previous 'Student learning in Metros' study by EI and Wipro in 2006. Full details of this study are available at <http://www.ei-india.com/whats-wrong-with-our-teaching/>

² ASSET is a national benchmarking diagnostic test conducted twice a year by Educational Initiatives Pvt. Ltd. For more information visit <http://www.ei-india.com>

2. What are Misconceptions and Common Errors?

Students develop cognitive understanding of the world around them through interactions based on their daily experiences. Teachers and schools help build this understanding. 'Misconceptions' are concepts the students acquire when they get incomplete answers to their questions or when exposed to incorrect facts. These result in cognitive gaps in their understanding.

Students try to fill these gaps by formulating their own notions, attributing meanings, and by drawing conclusions that might seem to them as logical. The resulting misunderstandings or alternative concepts formulated by the students, if not challenged, interfere with subsequent learning. As a consequence, students experience difficulty in understanding and internalising any new concept. This could be explained through following instances.

Question was asked to teachers	Question was asked to students of Class 4, 6 and 8
<p>Which of the following statements is TRUE?</p> <p>A. Plants get CO₂ from the air and O₂ from the water in the soil during the day.</p> <p>B. Plants get CO₂ and O₂ from the air during the day and night respectively.</p> <p>C. Plants get CO₂ from the air and do not require O₂ during the day.</p> <p>D. Plants get both CO₂ and O₂ from the air during the day.</p>	<p>Which process that happens in a tree is shown in this picture?</p> <div style="text-align: center;">  </div> <p>A. making of food B. breathing C. resting D. losing water</p>
<p>This question checks if teachers understand the gaseous exchange that takes place in plants. Plants require carbon dioxide for making of food and oxygen for respiration simultaneously. A large no of teachers who chose option C seem to think that plants do not require oxygen during the day, while who chose option A think that carbon dioxide is got from air while oxygen is got through water during the day. These indicate that teachers are themselves not clear about the process of acquisition of the different gases by plants. They probably also think that only one gas could be acquired through the stomata at a time and hence if carbon dioxide is taken in, then oxygen cannot be taken in at the same time. They probably also fail to consider that it is air that enters the stomata while the different gases from the air are absorbed. These shows fundamental confusion in process related to breathing and making of food in plants.</p>	<p>A large no of children of class 4 answered this question correctly while % of students answering this question in class 8 didn't increase much. Probably more interesting, compared to class 4, a high % of students say that the above is the process of breathing in a tree.</p> <p>In the curriculum, making of food is often introduced first at lower class level and hence there is only one process students learn about and that too as a given fact, most probably learn it as a fact. Around class 4 and 5, students are also introduced to concepts of breathing. As the first concept on making food itself in probably acquired conceptually, this creates confusion in the acquisition of the new concept of breathing in students. It also leads to all sorts of confusions such as - Do plants breathe? Do plants breathe at all times? Do plants breathe but takes in Carbon dioxide and gives out Oxygen? Do plants breathe when photosynthesis is taking place simultaneously? If the two processes are simultaneous from where and how are these gases got by plants, etc. In these cases the teachers if having misconceptions on their own are unable to help the students acquire correct concepts.</p>

Identifying the exact nature of student misconceptions is difficult through regular classroom interactions. Generally, student misconceptions persist until students recognise that their understanding is flawed. Any question in an assessment test that attempts to identify the misconceptions of the students must force the students to actively use their conceptual understanding. A detailed understanding of these misconceptions through large scale diagnostic assessments provide the teacher with a starting point to explore these in the classroom and eventually help to build correct notions or conceptual understanding.

Common Errors:

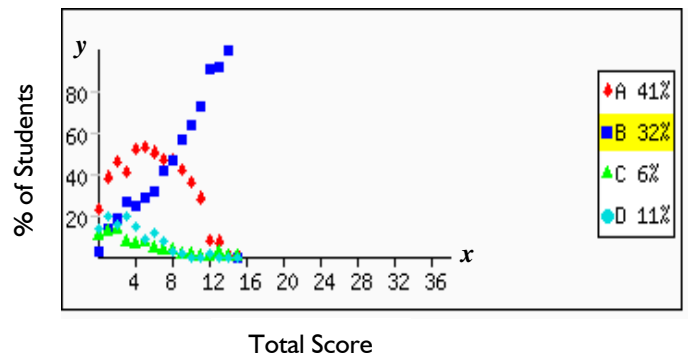
Detailed analysis of the answers given by students in each question in Maths, Language, Science and Social Science reveal that students' understandings of the concepts are often faulty as they seem to harbour many mistaken notions. They also seem to commonly make errors in answering some questions. For example, students harbour wrong notions such as:

- A square can be recognised as a square only in an upright orientation (with one side horizontal) and not when it is tilted.
- Measure of an angle is related to the length of its arms. Greater the arm length, greater is the measure of an angle.
- If area of a shape decreases, its perimeter also decreases.
- Students' knowledge of spelling conventions in commonly used words.
- Upward direction points to the north and downward direction points to the south.
- Students tend to classify organisms based on their external characteristics that are easily perceivable.

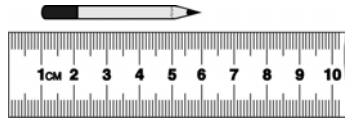
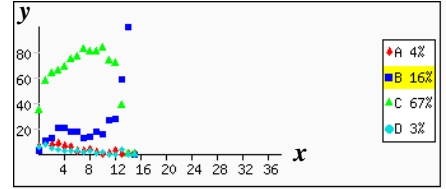
and much more....

3. How to Read the Graph

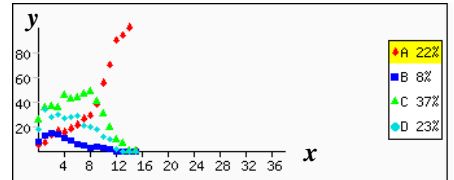
These are the item response curves for the question. The graphs show what percentage of students scoring different total scores in each class, chose which answer options for the question. The X axis is the total score in the paper and the Y axis is the percentage of students. The legend box shows the total percentage of students who chose each option. In this graph, the percentage of students choosing option B increases as one moves from a low total score to a high total score, while percentage of students choosing option A increases upto a certain total score and then starts reducing.



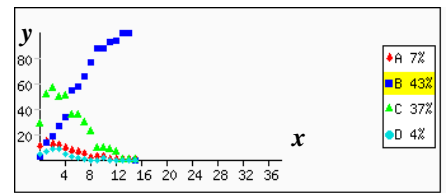
4. Misconceptions and Common Errors in Maths

S. No.	Class	Paper Code	Q. No.	Question	Graphs
1	4	411	32	<p>The length of this pencil is about _____.</p>  <p>A. 4 cm B. 5 cm C. 6 cm D. 7 cm</p>	


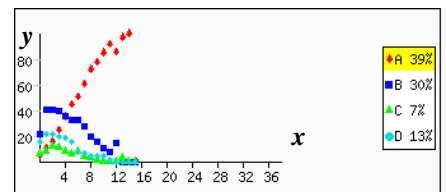
Explanation: It is important to note that a very high percentage of students across all the different ability levels have answered incorrectly as C. Only about 16% of the students have answered the question correctly. On interviewing a few students, it was found that couple of students noticed that one of the end points of the pencil lies near the 1 cm mark of the scale. They counted the number of division marks from 1 cm mark up to 6 cm to count them as 6 and answered as 6 cm. Some of the students had missed seeing the starting point of the pencil is at '1 cm' mark and not at '0 cm' mark.

2	4	412	24	<p>$220 + 380 = \underline{\quad} + 400$</p> <p>What should come in the blank above to make the number sentence true?</p> <p>A. 200 B. 380 C. 600 D. 1000</p>	
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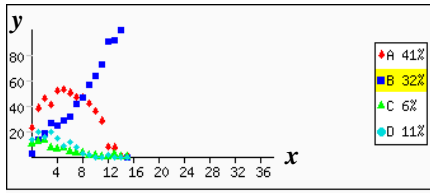
Explanation: About 37% of students answered wrongly as C, 600. These students lack proper understanding of equal-to sign. They interpret "=" sign as the result of the expression on its left side than as equality of expressions on the either side of it. 600 is the result of $220 + 380$ and so the answer is what these students have conceptualized. Not clearing this misconception can hamper proper understanding of algebra concepts later on.

3	4	411	25	<p>Which number equals 3 ones + 2 tens + 4 hundreds?</p> <p>A. 432 B. 423 C. 324 D. 234</p>	
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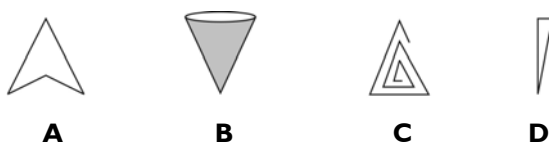
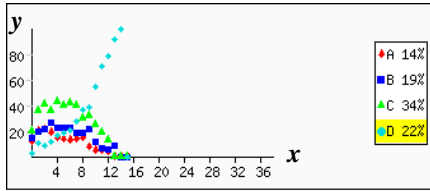
Explanation: About 37% of the students have chosen C. These students don't seem to understand the concept of place value of a number and the representation of a number. Possibly they don't understand the meaning of the notation 3 ones + 2 tens + 4 hundreds.

4	4	411	28	<p>What time is the clock alongside showing?</p>  <p>A. 4:45 B. 5:45 C. 9:23 D. 9:25</p>	
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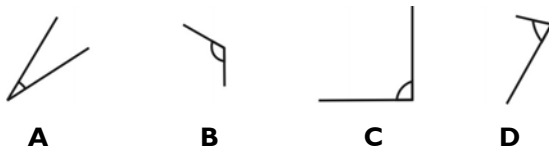
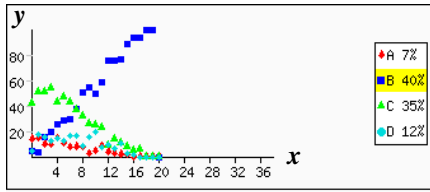
Explanation: About 30% of the students have answered as B. These students are not aware of the movement of the hour hand. As the hour hand is closer to 5, they have read the time as 5:45. The students are not able to differentiate between the position of the hour hand at the beginning of an hour and towards the end of that hour.

5	4	412	31	 <p>One table can seat 4 people.</p> <p>How would you find out how many tables are needed to seat 28 people?</p> <p>A. Multiply 28 by 4. B. Divide 28 by 4. C. Subtract 4 from 28. D. Add 4 to 28.</p>	
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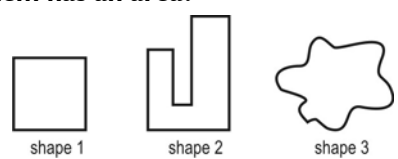
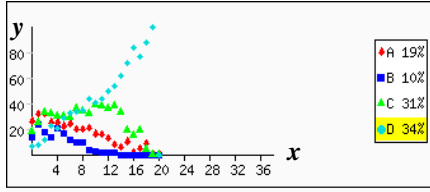
Explanation: This question tests word problem solving skill. It tests if a student can choose appropriate arithmetic operation to be performed to solve a word problem involving a real life situation. About 41% of the students have answered wrongly as A. These students think that multiplying 28 and 4 will give the number of tables required to seat 28 people.

6	4	412	30	<p>Which of these is a triangle?</p>  <p>A B C D</p>	
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Explanation: The most common wrong answer chosen by students is option C (34%). The student response data and our interactions with students show that students are able to identify the basic geometrical shapes when found in the most common forms. The shape C resembles the triangle that they mostly see in their books. The triangle in D is not what these students will commonly find in their text books. Hence these students have answered wrongly as C.

7	6	611	39	<p>Which angle has the greatest degree measure?</p>  <p>A B C D</p>	
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Explanation: About 35% of the students have chosen C and only about 40% of the students have answered correctly as B. These students think the measure of an angle is related to the length of its arms. Greater the arm length, greater is the measure of an angle is what they think. The measure of an angle as amount of turn is not understood by these students.

8	6	611	40	<p>Shown here are 3 shapes drawn on a paper.</p> <p>Which of them has an area?</p>  <p>shape 1 shape 2 shape 3</p> <p>A. shape 1 only B. shape 2 only C. shapes 1 and 2 only D. All of them have an area.</p>	
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Explanation: The question tests the understanding of area- that any closed shape encloses an area. It is interesting to see that 31% of the students answered as C. These students have the misconception that only shapes whose boundary consists of only straight lines have an area. Possibly these a few of these students think that only shapes of which there are formula to calculate their area has an area. These students could see that the shape 2 can be split into 3 rectangles. Hence its area can be calculated. 19% of the students have answered as A and seem to think that only geometrical shapes like rectangles, squares etc. have area as there are formulae to calculate their area. Only 34% of the students are selecting the correct answer.

9	6	611	44	<p>In which of the following collections is $\frac{2}{3}$ of the circles black in colour?</p> <p>A B C D</p>	
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Explanation: The question tests if a student can identify a fraction of given symbols in a collection. The most wrong answer option chosen by the students is option B (42%). Possibly these students have not realised that $\frac{4}{6}$ is the same as $\frac{2}{3}$. They are merely matching the number in the numerator 2 with the number of circles shaded to answer as B.

10	6	612	29	<p>Which of these insects is the smallest? (Check the measurements given.)</p> <p>A B C D</p>	
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Explanation: This is one of the most common errors that students make when they go beyond whole numbers and start understanding and using decimal fractions, negative integers etc. They tend to extend the notion of ordering of whole numbers inappropriately to these numbers. Here, students selecting option A (47%) possibly think 1.3 is smaller than 1.08 as it has less number of digits (which applies to whole number but not decimals). Possibly they may comparing numbers after the decimal point in the given decimals as the whole number part (1) remains the same i.e. 3, 08, 4 etc. Since 3 is the least among these, they conclude 1.3 is the least among the given decimals.

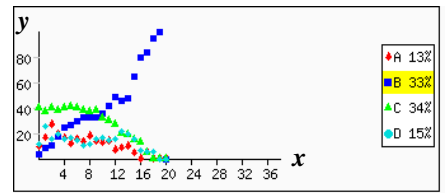
11	6	612	27	<p>Afzal has made a square on his computer screen. He now turns the shape as shown.</p> <p>What is the change in the shape?</p> <p>A. The square changes into some other shape and its side lengths also change.</p> <p>B. The square changes into some other shape but its side lengths don't change.</p> <p>C. The figure remains a square, but its side lengths change.</p> <p>D. The figure remains a square, and there is no change in its side lengths.</p>	
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Explanation: Students identify shapes by their visual appearance than by their properties. The square in this orientation is the less likely to be seen in textbooks commonly. So the students fail to identify basic shapes in non-standard orientations. Here, about 70% of the students have failed to realise that changing orientation of the shape does not change properties of the shape. A square has all its sides equal and all its angles are right angles. These properties are retained even if the orientation of a square is changed and the shape is still a square. A large percentage of students are selecting option B (47%) which means that these students feel that by changing the orientation the shape remains intact but it becomes some other shape.

12	8	811	32	<p>Which of these shapes is/are trapezium (s)?</p> <p>A. shape 3 only</p> <p>B. shapes 1 and 3 only</p> <p>C. shapes 1, 2 and 3 only</p> <p>D. shapes 1, 2, 3 and 4</p>	
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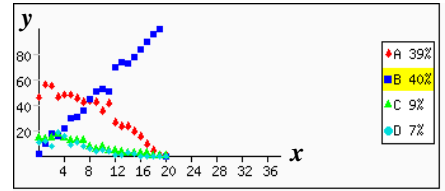
Explanation: Majority of the students selecting option C (47%) are not able to identify the shape 4 as a trapezium. Students are merely going by visual appeal of a shape than its properties to identify the shape. Students at this level are expected to identify shapes based on their properties. Here, a trapezium is a quadrilateral with one pair of parallel sides. The shape in 4 is a quadrilateral with a pair of parallel sides and hence a trapezium.

13	8	811	40	<p>Rashi measured two of the sides of a triangle and found them to be 4 cm and 9 cm.</p> <p>Which of the following could be the length of the third side?</p> <p>A. 3 cm</p> <p>B. 8 cm</p> <p>C. 13 cm</p> <p>D. 14 cm</p>
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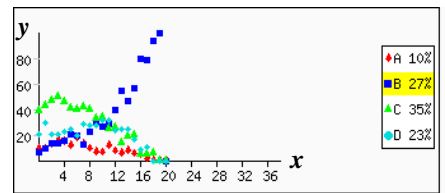
Explanation: about 33% students selected the correct option B, whereas 34% students are choosing option C. Students answering C seem to think that the length of a side of a triangle is the sum of the lengths of the other two sides in the question i.e. $4\text{ cm} + 9\text{ cm} = 13\text{ cm}$. They are possibly not able to visualize that a triangle is not possible to construct in such a case and the 3 points will lie on a straight line. These students lack the understanding of triangular inequality (the sum of the length of two sides exceeds the length of the 3rd side), a property of a triangle.

14	8	811	41	<p>Which of these is equal to $(-1)^{2009}$?</p> <p>A. -2009</p> <p>B. -1</p> <p>C. 1</p> <p>D. 2009</p>
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Explanation: As the ability of the students drop, more number of students are selecting the most common wrong answer A (39%). Students seem to have a difficulty in understanding the exponent notation properly. Possibly many of these students are interpreting $(-1)^{2009}$ as $-1 * 2009$. Students are expected to see that $(-1)^{2009}$ means (-1) multiplied to itself 2009 times. Hence the number is the same as -1 .

15	8	812	38	<p>Nandita cut off a square of side 1 cm from a rectangular sheet as shown:</p> <div style="text-align: center;"> <p>Rectangular sheet → Sheet after square piece is cut off</p> </div> <p>What would be the change in perimeter as compared to the original sheet?</p> <p>A. It would remain the same.</p> <p>B. It would increase by 2 cm.</p> <p>C. It would decrease by 2 cm.</p> <p>D. It would decrease by 3 cm.</p>
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Explanation: Students seem to have a wrong notion that if area of a shape decreases, its perimeter also decreases. Here, when a square is removed along the boundary of a square paper, its area decreases. So, students think that its perimeter has also decreased. This suggests inadequate understanding of perimeter which at class 8 grade should have developed as an enduring understanding among students.

16	8	812	49	<p>Study the graph shown below.</p> <p>The sale of which fruit increased the maximum from Day I to Day 2?</p> <p>A. Apples B. Oranges C. Melons D. Papayas</p>	
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Explanation: In this question students need to compare the length of the bars corresponding to a particular fruit shaded in light grey dark and in black. The one with the maximum difference in their lengths would be the fruit with the maximum increase in the sale. 39% of the students have answered as C, the longest bar among all the bars shown. Possibly students are not clear about the interpretation of a double bar graph.

4.1 Misconceptions and Common Errors Across Classes

A 'Secondary Study' was carried out to track progress in student learning. A common paper with questions of class 4 level was administered to class 4, 6 and 8 students to gather insight on how well students retain the concept learnt and if there is a change in misconceptions acquired in lower classes. This also tries to understand how learning increase from lower to higher classes. A few examples of misconceptions persist across classes are specified below:

Example - I

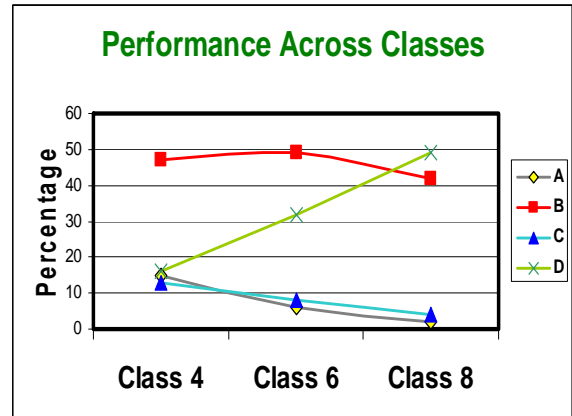
Afzal has made a square on his computer screen. He now turns the shape as shown.

What is the change in the shape?

A. The square changes into some other shape and its side lengths also change.
B. The square changes into some other shape but its side lengths don't change.
C. The figure remains a square, but its side lengths change.
D. The figure remains a square, and there is no change in its side lengths.

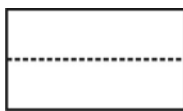
<p>Class-4</p>	<p>Class-6</p>	<p>Class-8</p>
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Explanation: Students seem to identify shapes based on their visual appeal only and not by their properties. Students seem to have a misconception that by changing the orientation (rotating) of a shape, its dimensions like length would also change. At class 8 level these students are expected to identify shape using its properties. It is observed that the percentage of students choosing the correct answer is increasing as we move to the higher classes, however it is important to note that the extent of the students choosing option B (most common wrong answer chosen) is not decreasing much.



Example - 2

Jill had a rectangular piece of paper.

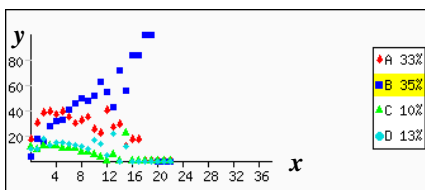


She cut her paper along the dotted line and made an L shape like this.

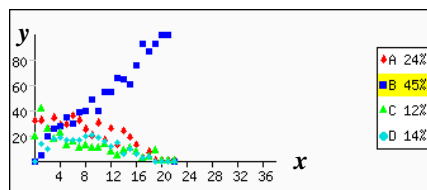


Which of these statements is true?

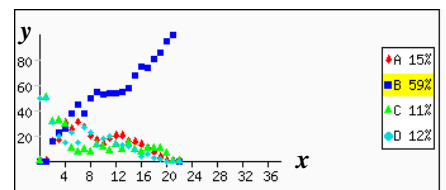
- A. The area of the L shape is greater than the area of the rectangle.
- B. The area of the L shape is equal to the area of the rectangle.
- C. The area of the L shape is less than the area of the rectangle.
- D. We cannot work out which area is greater without measuring.



Class-4

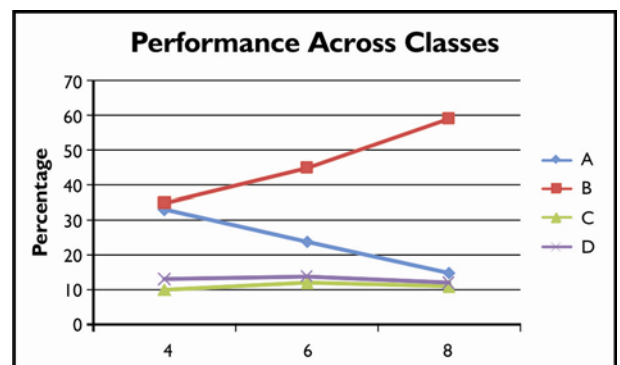


Class-6



Class-8

Explanation: The question is testing the idea of conservation of area. We see an increase in the percentage of students choosing the correct answer (B) as we move up in class, but it is important to note that even at class 8 level around 41% students have difficulty in understanding this concept. This is one of the basic understandings in concept of area.

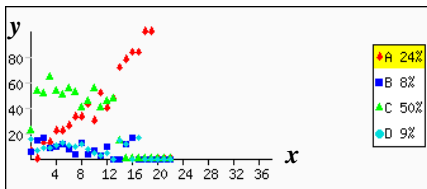


Example - 3

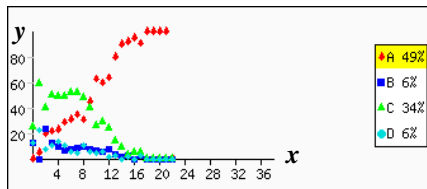
$$\frac{5}{5} \square \frac{4}{4}$$

What should come in the empty box to make the number sentence true?

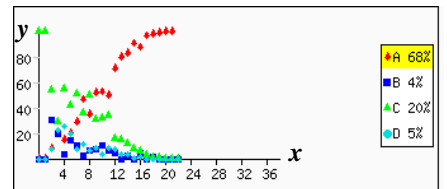
- A. =
- B. >
- C. <
- D. (We cannot say for sure.)



Class-4

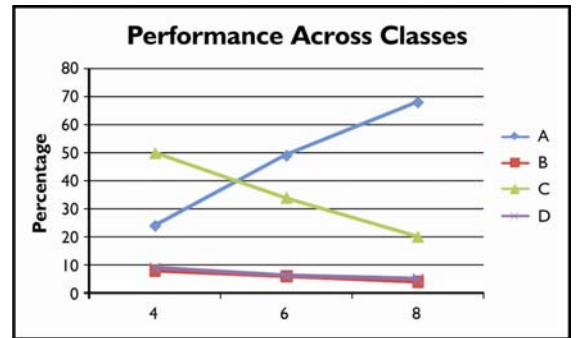


Class-6



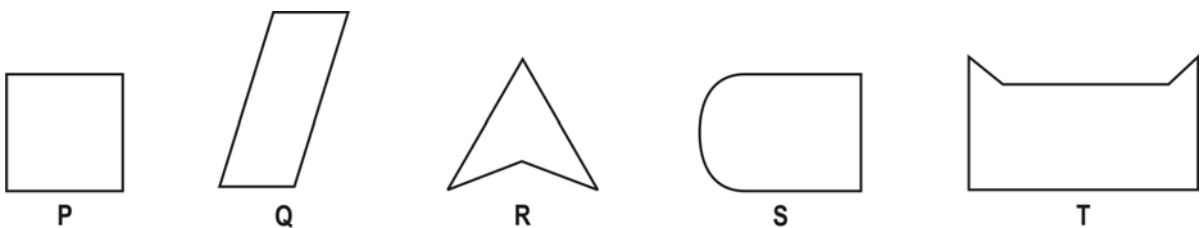
Class-8

Explanation: Equivalent fraction is one of the basic concepts learnt by class 4. However, the data shows that around 32% of the students are making a mistake in choosing the correct answer. By class 8, students work on higher concepts like ratio and proportion which has its base on fraction understanding, hence it is important to have the fundamental clear.

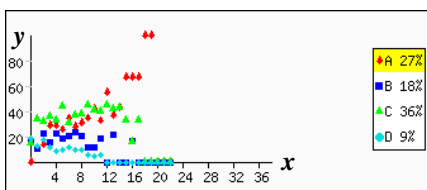


Example - 4

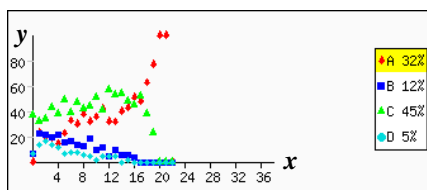
A 'quadrilateral' is a closed shape with exactly four sides. Each side is a straight line. Which of the following shapes are quadrilaterals?



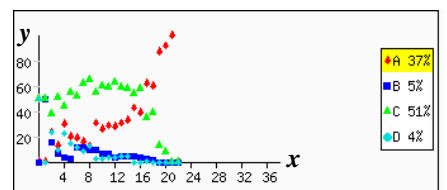
- A. only P, Q and R
- B. only P, Q and T
- C. only P and Q
- D. P, Q, R and S



Class-4



Class-6



Class-8

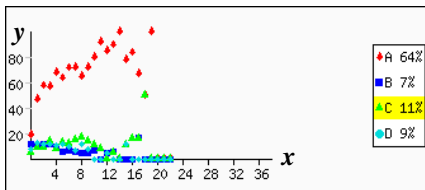
Explanation: From the response it seems that a lot of students choosing option C are not able identify figure R as a quadrilateral which is a concave quadrilateral (i.e. one of the angles is exceeding 180 degree). It is important to note that the number of students choosing this incorrect option is increasing as we move to class 8, whereas the students choosing the correct option is not showing much increment as we move to higher class.



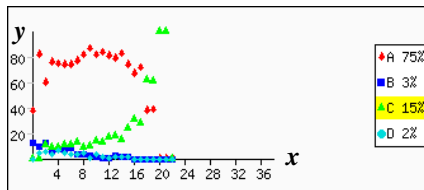
Example - 5

$10 + 30 \div 5 - 2$ is equal to

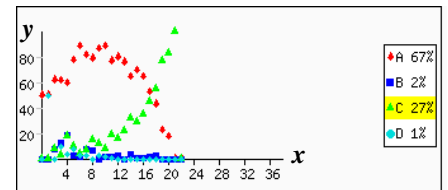
- A. 6
- B. 13
- C. 14
- D. 2



Class-4

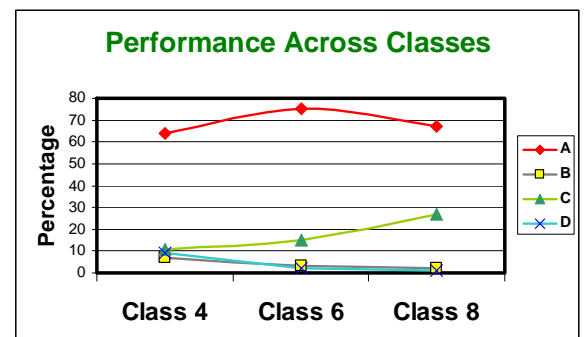


Class-6



Class-8

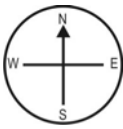

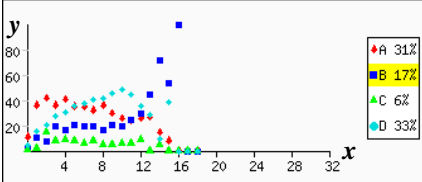
Explanation: It is important to note that a very high percentage of students across all the classes are not clear with the order of operations (BODMAS). A very small percentage of students are choosing the correct answer across all the classes. The most common incorrect option chosen by students is option A. These students are performing the operations in order from left to right and not using the BODMAS rule.



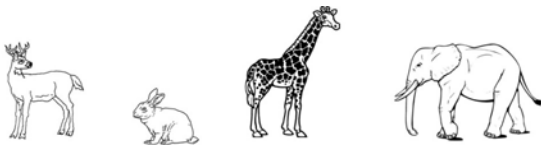
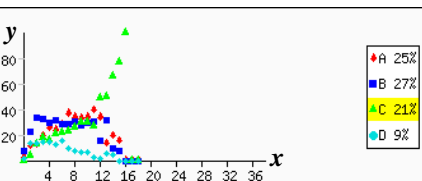
5. Misconceptions and Common Errors in Science

S. No.	Class	Paper Code	Q. No.	Question	Graphs										
I	4	411	39	<p>Early humans led a nomadic lifestyle, which meant that they travelled from place to place looking for edible plants and animals in the wild. In the Neolithic period (almost 10,000 years ago), they found out something that allowed them to settle down in one place instead of wandering.</p> <p>What was this discovery?</p> <p>A. fire B. wheel C. pottery D. agriculture</p>	<table border="1"> <caption>Science Question Performance</caption> <thead> <tr> <th>Option</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>24%</td> </tr> <tr> <td>B</td> <td>22%</td> </tr> <tr> <td>C</td> <td>11%</td> </tr> <tr> <td>D</td> <td>29%</td> </tr> </tbody> </table>	Option	Percentage	A	24%	B	22%	C	11%	D	29%
Option	Percentage														
A	24%														
B	22%														
C	11%														
D	29%														

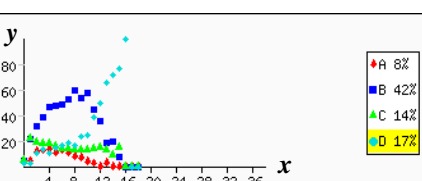
Explanation: Merely 29% of the students chose the correct option D 'agriculture'. 24% of the students selected option A 'fire'. They seem to be considering the fact that fire was discovered the earliest by humans and missing out the point that the discovery of fire would not have allowed humans to settle down in one place. 22% of the students chose option B 'wheel'. They probably just read the part about moving from one place to another and opted for wheel. 11% of the students chose option C 'pottery'. They seem to be making a random guess.

2	4	411	41	<p>The basic directions are North, South, East and West as shown here:</p>  <p>Prabhu faces the rising sun and spreads his hands out. In which direction will his left hand point?</p>  <p>A. east B. north C. south D. west</p>	
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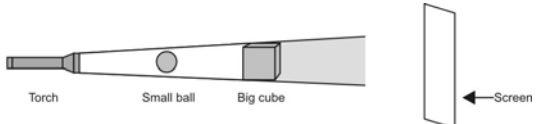

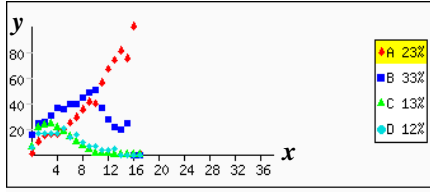
Explanation: Only 17% of the students chose the correct option B 'north'. 31% of the students chose option A 'east'. These students might have only seen the words 'the rising sun' and chosen this as their answer. Only 6% of the students chose option C 'south'. They are either making a random guess or the concept of 'left' and 'right' is not clear to them. 33% of the student chose option D 'west'. They might be only looking at the left hand and matching it with the directions given. They are probably not considering the fact that Prabhu is facing the rising sun, i.e. the east.

3	4	411	48	<p>One of the zoos in India brought an animal that was NOT found in the forests of India. Which of these could it be?</p>  <p>A B C D</p>	
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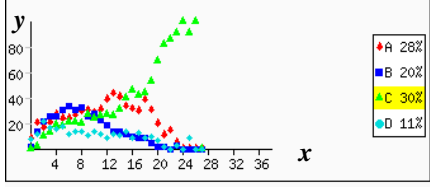
Explanation: Only 21% of the students chose the correct option C 'giraffe'. 25% of the students chose option A 'deer' and 27% of the students chose option B 'rabbit'. This is probably because students have seen the pictures of all these animals in their books and are either randomly guessing or choosing the animal that they have never seen.

4	4	411	52	<p>All living things can be grouped as PLANTS or ANIMALS. Which of these in the list below are ANIMALS?</p> <p>FISH FLY MAN LION GRASS CROCODILE</p> <p>A. All are animals. B. Lion and crocodile are animals. C. Lion, man and crocodile are animals. D. Lion, man, crocodile, fly and fish are animals.</p>	
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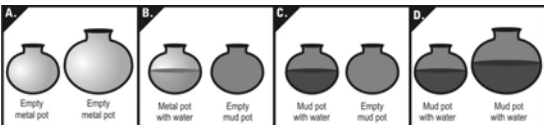
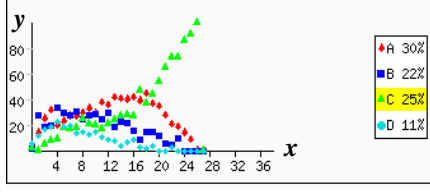
Explanation: Only 17% of the students chose the correct option D 'Lion, man, crocodile, fly and fish are animals'. 8% of the students chose option A 'All are animals' and they probably made a careless mistake by including 'grass' too in the list of animals. 42% of the students chose option B 'Lion and crocodile are animals'. Children probably go by common observation to identify a creature as an animal. They tend to classify organisms based on their external characteristics that are easily perceivable. The most common response in discussions with students was that an animal is a creature that has four legs and lives on land. However, "animals" is a far broader category according to scientific classification. 14% of the students chose option C 'Lion, man and crocodile are animals'. Some children are able to appreciate that man is also an animal. However they do not accept fly and fish as animals giving reasons like "an insect is too small and it can fly" and "a fish lives in water". It seems that the basic idea of scientific classification is not clear to students who have chosen this option.

5	4	412	50	<p>A torch, a small ball, a cube and a screen are arranged as shown below.</p>  <p>What will the shadow on the screen look like?</p> 	
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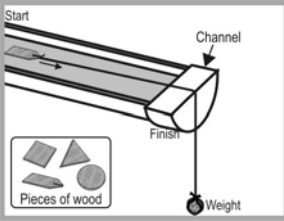
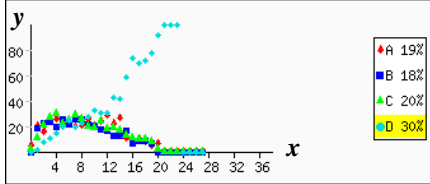
Explanation: Only 23% of the students chose the correct option A. Most (33%) of the students chose option B. Students selecting this option seem to have incorrect notions about shadows and so think that the shadow of both, the small ball and the big cube will appear together on the screen. Some of these probably think that the ball and the cube will make the pattern shown in option B. 13% of the students chose option C and 12% of the students chose option D. They are probably making a random guess. Some of the students choosing option D might even have visualized the small ball to be slightly towards the right and so think that the shadow would look like the one shown in option D..

6	6	611	62	<p>Study the table shown here. (For example, the first cell tells us that of the air we breathe in, about 21% or 21 parts out of 100 is oxygen).</p> <table border="1" data-bbox="475 896 965 1019"> <thead> <tr> <th>Gas</th> <th>Inhaled air</th> <th>Exhaled air</th> </tr> </thead> <tbody> <tr> <td>Oxygen</td> <td>21%</td> <td>15%</td> </tr> <tr> <td>Carbon dioxide</td> <td>0.04%</td> <td>4%</td> </tr> </tbody> </table> <p>What can we conclude from the table?</p> <p>A. We breathe in pure oxygen and breathe out pure carbon dioxide.</p> <p>B. The air we breathe in contains more carbon dioxide than oxygen.</p> <p>C. The air we breathe out has more carbon dioxide than the air we breathe in.</p> <p>D. The human body produces oxygen during the breathing process.</p>	Gas	Inhaled air	Exhaled air	Oxygen	21%	15%	Carbon dioxide	0.04%	4%	
Gas	Inhaled air	Exhaled air												
Oxygen	21%	15%												
Carbon dioxide	0.04%	4%												

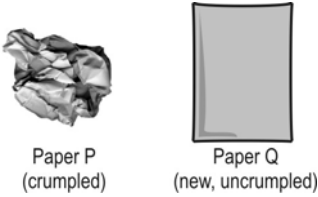
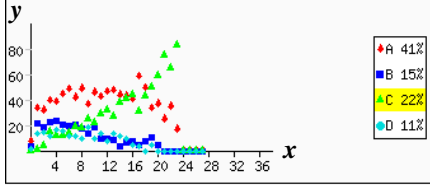
Explanation: Only 30% of the students chose the correct option C. 28% of the students chose option A 'We breathe in pure oxygen and breathe out pure carbon dioxide.' Students might have come across the phrase 'we take in oxygen and give out carbon dioxide' in textbooks, which seems to have caused a strong wrong notion that only oxygen from the air is breathed in and only carbon dioxide is breathed out. The notion seems to be so strong that in spite of the data clearly showing both the gases in the inhaled and the exhaled air, they are selecting A. The students are ignoring the word 'pure' and are probably not looking at the table provided. Around 20% of the students chose option B and 11% of the students chose option D. They are probably not able to interpret the information given in the table and are making random guesses. Some of the students choosing option D may be seeing that the exhaled air has 15% oxygen and think that this oxygen is produced during the breathing process.

7	6	611	72	<p>"Empty vessels make more noise".</p> <p>Vasudha wanted to test this proverb. Which of the following pairs of vessels should she strike with a stick to do this?</p> 	
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Explanation: This question was designed to check whether the students have the skill to design an experiment for a given hypothesis. Only 25% of the students chose the correct option C. 30% of the students chose option A. They are probably just looking at the word 'empty' in the proverb and choosing the option which has both the empty pots. 22% of the students chose option B. They are probably not clear about the fact that one pot should be empty and the other should be filled, all the other conditions should be the same to come to a conclusion. Only 11% of the students chose option D and are probably making a random guess.

8	6	612	60	<p>Govinda cuts out thin pieces of wood into different shapes of the same weight. Each piece of wood is tied by a string and placed at the 'start' of the water channel. The time taken to reach 'finish' is noted with the help of a stopwatch. The weight pulls the wood to the 'finish' of the water channel. The same procedure is repeated for the other pieces.</p>  <p>What question is Govinda most probably trying to answer?</p> <p>A. What is the reason for wood to float?</p> <p>B. Does the floating of wood depend on the angle of the channel?</p> <p>C. Do some shapes of wood sink in water?</p> <p>D. Does the speed of movement depend on the shape of wood?</p>	
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Explanation: This question intends to check the design of experiments skill in the students. Only 30% of the students chose the correct option D. Almost equal percentage of students chose the other three options. The students are not able to understand the aim of the experiment. The design of experiment skill is not well developed among the students.

9	6	612	71	<p>Anupam takes papers P and Q, which are exactly the same. He crumples P as shown in the figure.</p>  <p>Which of the following statements about P and Q is true?</p> <p>A. P has more weight than Q.</p> <p>B. Q has more weight than P.</p> <p>C. P and Q have equal weight.</p> <p>D. P and Q both have no weight.</p>	
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Explanation: Only 22% of the students chose the correct option C. 41% of the students chose option A 'P has more weight than Q'. This seems to be a misconception among the students. They probably chose this option because they must have observed it in their daily lives and not considered the fact that addition or removal of matter is required for the weight to increase or decrease. 15% of the students chose option B 'Q has more weight than P'. They are probably choosing this option just by seeing the size of the paper. Only 11% of the students chose option D and are probably making a random guess.

10	8	811	66	<p>All living organisms need to respire to stay alive. Questions 66 and 67 are about the process of respiration.</p> <p>Which of the following are examples of respiration?</p> <ol style="list-style-type: none"> Humans use oxygen and release carbon dioxide. Plants use carbon dioxide and release oxygen. Burning dry leaves uses oxygen and releases carbon dioxide. <p>A. only 1 B. only 2 C. only 1 and 2 D. 1, 2 and 3</p>	
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Explanation: Merely 20% of the students chose the correct option A. Only 12% of the students chose option B and are probably making a random guess. 41% of the students chose option C. These students are perhaps confused between respiration and photosynthesis and consider any gas exchange process taking place in plants as respiration. 19% of the students chose option D. They might be considering respiration as a process in which energy is released and so consider even combustion as an example of respiration.

11	8	811	67	<p>Which of the following statements about plants is true?</p> <ol style="list-style-type: none"> Plants take in only oxygen during the day. Plants take in oxygen only during the night. Plants take in only carbon dioxide during the day. Plants take in oxygen both during the day and night. 	
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Explanation: Only 20% of the students chose the correct option D. 12% of the students chose option A 'Plants take in only oxygen during the day.' 27% of the students chose option B 'Plants take in oxygen only during the night.' They probably believe that plants respire only during the night. 32% of the students chose option C 'Plants take in only carbon dioxide during the day.' This seems to be a misconception among the students as the students are taught in detail about photosynthesis in plants but not respiration. Students choosing this answer are focusing on the fact that plants carry out photosynthesis during the day and are probably unaware of, or are disregarding the fact that they also respire constantly.

12	8	811	69	<div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>When a solid is placed in a liquid having LOWER density, it sinks.</p> </div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>When a solid is placed in a liquid of HIGHER density, it floats.</p> </div> </div> <p>What will happen if a solid having the SAME density as the liquid is placed in it?</p> <ol style="list-style-type: none"> It will sink. It will float. It will stay in any position within the liquid. A solid cannot have the same density as a liquid. 	
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Explanation: 30% of the students answered this question correctly. 12% of the students chose option A 'It will sink.' They probably think that it will sink because it is a solid. 21% of the students chose option B 'It will float.' They are probably taking into account the example of water and ice. However, ice floats in water because it has more volume and hence lesser density. 29% of the students think that 'A solid cannot have the same density as a liquid.'

13	8	812	57	<p>When we see with only one eye (by covering the other eye with our hands), what is the difference in what we see?</p> <ol style="list-style-type: none"> There is no difference. We cannot distinguish colours. We cannot distinguish depths. We cannot distinguish heights. 	
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Explanation: Merely 21% of the students chose the correct option C. 45% of the students chose option A 'There is no difference'. This seems to be a misconception among the students. They probably do not understand the fact that binocular vision helps in estimating distances and depths, so if we see with only one eye we cannot distinguish depths. 10% of the students chose option B 'We cannot distinguish colours' and 16% of the students chose option D 'We cannot distinguish heights'. They are probably making a random guess.

14	8	812	70	<p>A circuit has five bulbs connected to a battery. Initially they all glow. After some time one of them fuses, but the other four continue to glow. Which of the following circuits could it be?</p> <p style="text-align: center;">A B C D</p>	
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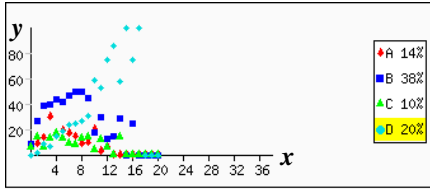
Explanation: Only 29% of the students answered this question correctly. Only 12% of the students chose option A. They are probably making a random guess. 33% of the students chose option C. Students seem to be swayed by seeing 4 bulbs in a line in this circuit, and may be blindly matching it to the phrase 'other four continue to glow' in the question stem. They seem to be unaware that current must flow through all bulbs also in this circuit in order to be a closed loop. 18% of the students chose option D. These students may be vaguely aware that some parts of circuits connected in parallel can function even if one part is not working.

14	4	613	24	<p>Which of these need energy to work?</p> <p>1. Mobile phones 2. Cars 3. Watches</p> <p>A. only 2 B. only 1 and 2 C. only 1 and 3 D. 1, 2 and 3</p>	
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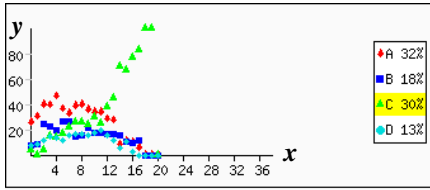
Explanation: Merely 27% of the students chose the correct option D. 28% of the students chose option A. These students are linking the requirement of energy to movement, and since they see cars as moving objects, and the other objects as stationary, they believe only cars need energy to work. 21% of the students chose option B. These students might also have seen mobile phones being charged everyday and might be thinking that mobile phones have energy that is transferred to them. Alternatively, they may have seen many different things being done using mobile phones and linked that to needing 'energy'. Only 13% of the students chose option C and are probably making a random guess.

15	4	613	33	<p>Which of these is/are examples of EVAPORATION?</p> <p>1. water from oceans and rivers changing to water vapor 2. water from a glass kept in the open changing to water vapor 3. water vapor changing to water to produce rain</p> <p>A. only 1 B. only 1 and 2 C. only 2 D. 1, 2 and 3</p>	
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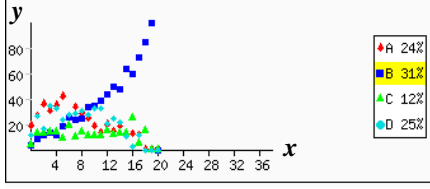
Explanation: Only 22% of the students answered this question correctly. 31% of the students chose option A. These students have probably heard of the term 'evaporation' only in the context of the water cycle and thus think that it can only occur in the water cycle. Some students in fact think the 'water cycle' itself is called evaporation. 16% of the students chose option C. These students probably believe that evaporation can take place only outdoors, in the presence of sunlight. 16% of the students chose option D. These students probably do not understand the meaning of evaporation.

16	4	613	35	<p>Samir looked out of the glass window of a train in the afternoon. He could see a man standing outside on a bridge. He could see everything else that was on the other side of the glass window too.</p>  <p>Which other object allows things on the other side to be seen through it, like the glass window?</p> <p>A. a bright torch B. a clean mirror C. a polished plate D. a pair of spectacles</p>	
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Explanation: Only 20% of the students chose the correct option D. 14% of the students chose option A. These students probably did not understand the question and have chosen the torch because it helps in seeing. 38% of the students chose option B. Students choosing this option may simply be associating light and 'seeing things' through objects with mirrors. They may also be confusing 'seeing through' something with 'seeing on/in' something. Only 10% of the students chose option C. Students choosing this option may be associating a mirror-like surface with the word 'polished' and may, thus, be associating it with light as in option A. They may also be making a random guess.

17	6	613	41	<p>Gopi is reading the newspaper on a Friday and sees the weather forecast for the next 3 days. What can he conclude by looking at this forecast?</p>  <p>A. It will definitely rain on Saturday, and it will definitely be sunny on Sunday and Monday. B. It will definitely rain on Saturday, but we can't be sure of the weather on the other 2 days. C. There is a chance of rain on Saturday, and the other 2 days are likely to be sunny. D. He can't say just by looking at these figures; he needs to see the temperatures also.</p>	
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Explanation: Only 30% of the students answered this question correctly. 32% of the students chose option A. These students are able to interpret the information given by the pictures but did not understand that the weather can only be predicted and it is not definite. 18% of the students chose option B. These students probably got confused by the sun and the clouds shown in the last two pictures and thought that the weather on the other two days is uncertain. 13% of the students chose option D. These students are not able to interpret the information given in the pictures or probably feel that the weather depends only on the temperature.

18	6	613	42	<p>The basic directions are North, South, East and West as shown here:</p> <p>Prabhu faces the rising sun and spreads his hands out. In which direction will his left hand point?</p>  <p>A. east B. north C. south D. west</p>	
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Explanation: Only 31% of the students chose the correct option B 'north'. 24% of the students chose option A 'east'. These students might have only seen the words 'the rising sun' and chosen this as their answer. Only 12% of the students chose option C 'south'. They are either making a random guess or the concept of 'left' and 'right' is not clear to them. 25% of the students chose option D 'west'. They might be only looking at the left hand and matching it with the directions known to them. They are probably not considering the fact that Prabhu is facing the rising sun, i.e. the east.

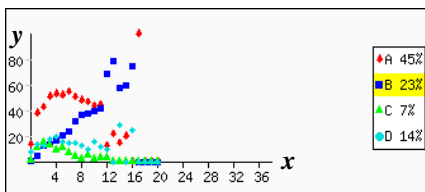
5.1 Misconceptions and Common Errors Across Classes

A 'Secondary Study' was carried out to track progress in student learning. A common paper with questions of class 4 level was administered to class 4, 6 and 8 students to gather insight on how well students retain the concept learnt and if there is a change in misconceptions acquired in lower classes. This also tries to understand how learning increase from lower to higher classes. A few examples of misconceptions persist across classes are specified below:

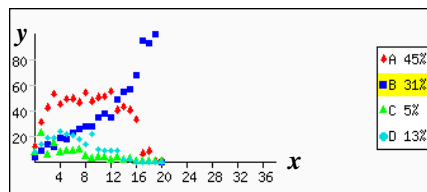
Example - 1

An animal has six legs. What is it most likely to be?

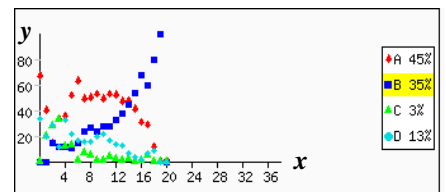
- A. a spider
- B. a fly
- C. a lizard
- D. a centipede



Class-4

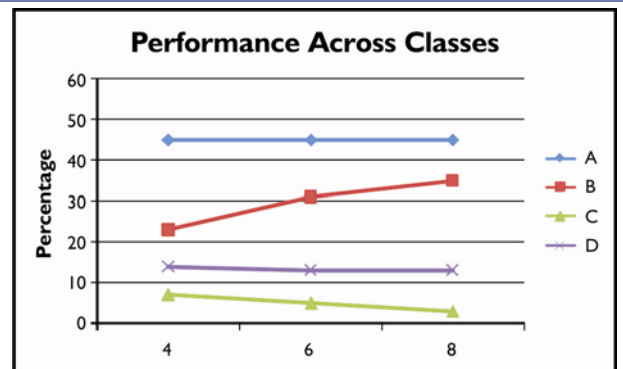


Class-6



Class-8

Explanation: Only 23.2% of the students in class 4, 31.1% of the students in class 6 and 35.6% of the students in class 8 answered this question correctly. Around 45% of the students in all three classes have chosen the wrong option A. These students seem to have a misconception that a spider has six legs. Students choosing option C probably making a random guess. Students choosing option D probably have never seen a centipede and are guessing it to have six legs, eliminating the other options. They are not aware that a fly has six legs.



Example - 2

Which of the following correctly arranges the below in the INCREASING order of temperature?



boiling water

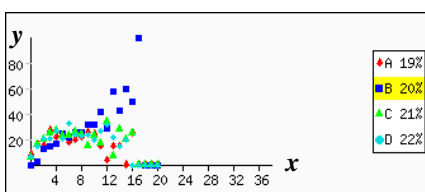


flame of a stove

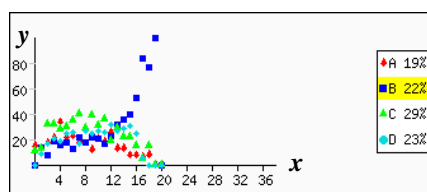


air on a hot summer day

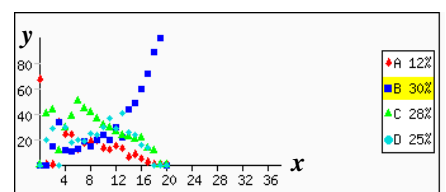
- A. the flame of a stove, air on a hot summer day, boiling water
- B. air on a hot summer day, boiling water, the flame of a stove
- C. air on a hot summer day, the flame of a stove, boiling water
- D. boiling water, the flame of a stove, air on a hot summer day



Class-4



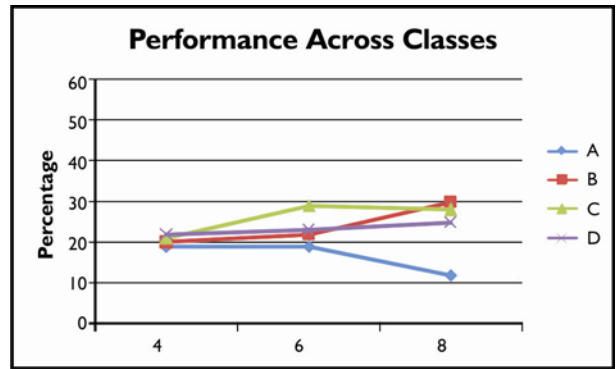
Class-6



Class-8

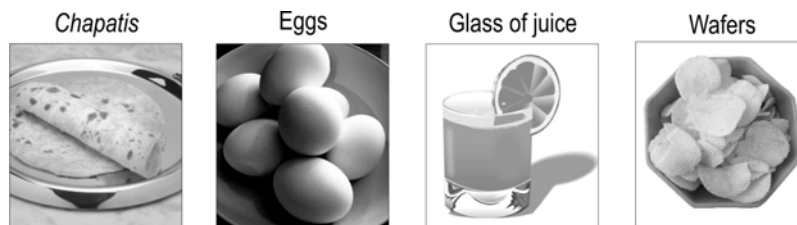
Explanation: Only 20% of the students in class 4, 22% of the students in class 6 and 30% of the students in class 8 have answered this question correctly.

Students selecting option A probably making a random guess. 21% to 29% of the students chose option C across three classes. It is possible that these students must have thought that it is possible to touch the flame of a stove for a second but if boiling water is touched even for a second, it hurts a lot and thus chose this option. Another probable reason is that the students might be aware of the temperature of boiling water at this level but not aware of the temperature of a flame. So they are choosing boiling water to be hotter than the flame. 22% to 25% of the students chose option D across classes. Students choosing this option might simply be looking at the third picture and interpreting the Sun as the hottest.

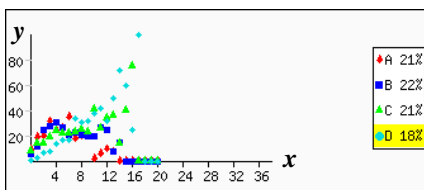


Example - 3

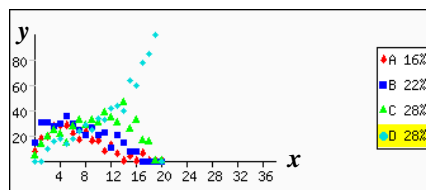
Which of these is a food item?



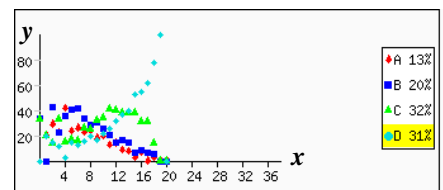
- A. only chapatis
- B. only chapatis and eggs
- C. only chapatis, eggs and wafers
- D. all - chapatis, eggs, glass of juice and wafers



Class-4

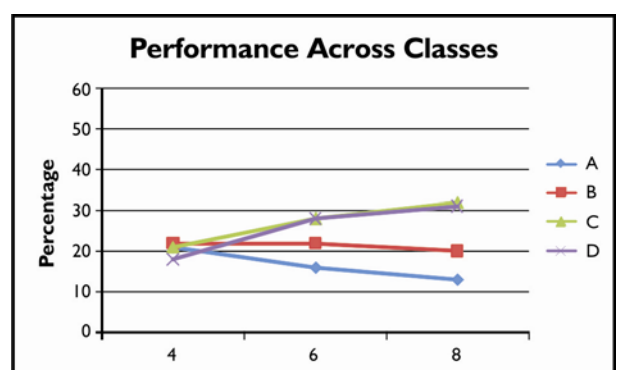


Class-6



Class-8

Explanation: Only 18.6% of the students in class 4, 28.8% of the students in class 6 and 31.6% of the students in class 8 have answered this question correctly. The number of students choosing option C increases as we go from class 4 to class 8. Students selecting option A probably only consider the item included in their meals as food and so think that only chapatis are food items. Students selecting option B might have heard that chapatis and eggs are healthy items and provide good nutrition. They might also have heard of wafers as junk food. This coupled with a wrong notion that liquids cannot be food items, may be the reason for them to choose this wrong option. Students selecting this option C do not consider liquids to be food items and so think that only the other 3 items are food.



6. Misconceptions and Common Errors in Social Science

S. No.	Class	Paper Code	Q. No.	Question	Graphs										
1	4	412	43	<p>Kavya goes shopping and buys many things. She wants to use a bag that she can reuse several times and is environment friendly. She should _____.</p> <p>A. use a cloth bag B. use a new brown paper bag C. use the plastic bag supplied by the shop D. bring many plastic bags from home and put one item in each bag</p>	<table border="1"> <caption>Graph Data for Question 1</caption> <thead> <tr> <th>Option</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>45%</td> </tr> <tr> <td>B</td> <td>15%</td> </tr> <tr> <td>C</td> <td>15%</td> </tr> <tr> <td>D</td> <td>9%</td> </tr> </tbody> </table>	Option	Percentage	A	45%	B	15%	C	15%	D	9%
Option	Percentage														
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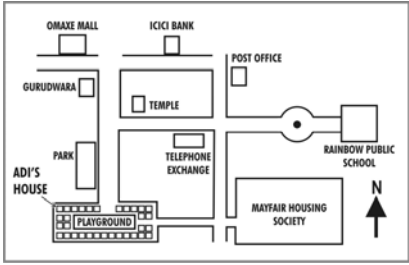
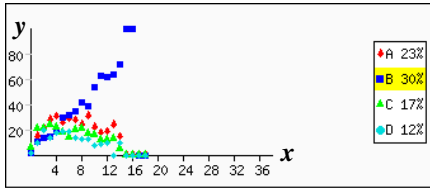
Explanation: 45% of students chose A as the correct answer. 15% of students have chosen option B. Students who chose either B may think that paper can be recycled easily. However, they have ignored the condition stated in the question that it can be reused several times. These students also seem to be unaware of the fact that paper is made by processing material obtained from trees, and thus is not an environment friendly option. 15% of students chose option C. Students selecting this option may not be aware that plastic is not biodegradable and hence and hence not environment friendly.

2	4	412	45	<p>Given here is a list of things done by this agency:</p> <ol style="list-style-type: none"> 1. Repairing bad roads 2. Supplying water to homes 3. Taking care of parks and gardens 4. Putting powder on roads to kill pests <p>Which of the following could be doing the things mentioned here?</p> <p>A. a college B. a police station C. a government hospital D. a municipal corporation</p>	<table border="1"> <caption>Graph Data for Question 2</caption> <thead> <tr> <th>Option</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>12%</td> </tr> <tr> <td>B</td> <td>15%</td> </tr> <tr> <td>C</td> <td>17%</td> </tr> <tr> <td>D</td> <td>37%</td> </tr> </tbody> </table>	Option	Percentage	A	12%	B	15%	C	17%	D	37%
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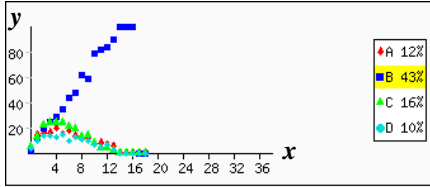
Explanation: The question checks whether students are aware of basic ideas and issues related to citizenship and governance. Students are expected to know that a government body like a municipal corporation provides basic amenities like roads, water etc. to citizens. Only 37% of students could answer this question correctly. Students who selected options A, B or C are not aware of this.

3	4	412	52	<p>Among these people, who is alive today?</p> <p>A. Mahatma Gandhi B. Indira Gandhi C. Rajiv Gandhi D. Sonia Gandhi</p>	<table border="1"> <caption>Graph Data for Question 3</caption> <thead> <tr> <th>Option</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>9%</td> </tr> <tr> <td>B</td> <td>17%</td> </tr> <tr> <td>C</td> <td>17%</td> </tr> <tr> <td>D</td> <td>38%</td> </tr> </tbody> </table>	Option	Percentage	A	9%	B	17%	C	17%	D	38%
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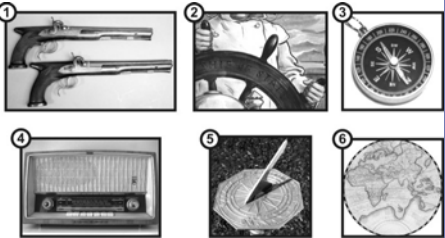
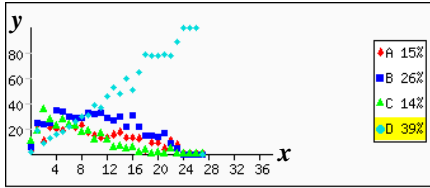
Explanation: Only 38% of students got this right (option D). From the pattern of wrong responses, it seems that students are not familiar with current affairs (Sonia Gandhi is featured prominently in the media). It may a distant possibility that the surname 'Gandhi' used in all options might have confused them. However, it is surprising that only 38% of students could answer a question that checks factual knowledge based on general awareness.

4	4	411	47	<p>Adi goes to Rainbow Public School, which is near his house. Given below is a map which shows both – his house and his school. Look at it carefully to answer the question.</p>  <p>While going to school, Adi passes by the temple every day. In which direction is the temple located, with reference to Adi's house?</p> <p>A. North B. North East C. North West D. West</p>	
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Explanation: Students see maps at various places. They also learn about the different directions and how to relate to them on a map. The question was designed to test if students understand geographical directions and the use of the compass rose on the map. Only 30% of students could answer this question correctly (option B). 23% of students selected the wrong option A. This could be because students associate upwards or forward direction with the cardinal direction north. 17% of students selected the wrong option C. These students might be confused between northwest and northeast. 12% of students chose the wrong option D. Most students probably do seem to understand cardinal and intermediate directions clearly.

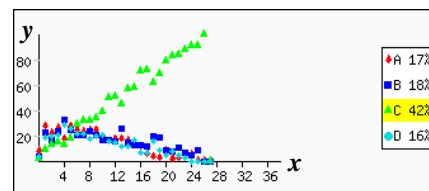
5	4	411	53	<p>In my summer holidays, I want to visit a place that has a beach. Which of these states can I visit?</p> <p>A. Bihar B. Tamil Nadu C. Madhya Pradesh D. Uttaranchal</p>	
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Explanation: This question checks whether students are familiar with the major geographical features of different states of India. Only 43% of students chose the correct answer Tamil Nadu (option B). 38% of students have answered this question incorrectly and are not aware of which the general location of states (in this instance, states located along the coastline).

6	6	611	48	<p>The period between the 15th and 17th centuries was called the Age of Discovery. During this time, Europeans explored the world by sea looking for new trade partners and goods. They used many new technologies to help them sail. Which of the following were the new developments they must have used to seek a trade route to India?</p>  <p>A. 3, 4, 6 B. 2, 3, 5 C. 1, 4, 5 D. 2, 3, 6</p>	
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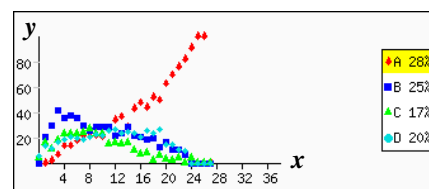
Explanation: 39% of students have selected the correct answer D. 26% of students selected the wrong answer B which is also the most common wrong answer. These students probably could not relate cartography in image 6 to technological development, hence chose the sundial in image 5 instead. Students who have chosen A or C might also be unaware that the radio is a fairly recent invention.

7	6	611	50	<p>An archaeologist digging at a prehistoric site in Madhya Pradesh is hoping to find remains that will give him clues about the people who lived there. He has found something that tells him that they may have been able to start and control fires. Which one of the following finds has given him that idea?</p> <p>A. the skull of a man B. bones of fish and animals C. a cave painting drawn with charcoal D. arrows that might have been used for hunting</p>
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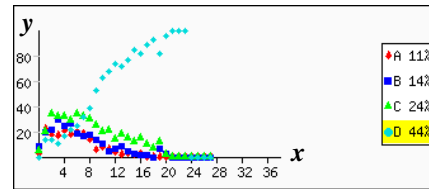
Explanation: Only 42% of students could answer this question correctly. Nearly 51% of students chose wrong options A, B or D. These students probably could not see the connection between charcoal and fire.

8	6	611	55	<p>Which of the following regarding the Indian government and Constitution is true?</p> <p>A. The Constitution defines what powers the government may have and may not have. B. The Constitution was made by the British parliament and has been used since 1947. C. Only members of the police force can directly make changes to the Constitution of India. D. The Constitution applies only to the general public in India and not officials of the government.</p>
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Explanation: Only 28% of students could answer this question correctly. It is surprising that a large number of students do not know the basic facts about Indian constitution. 25% of students chose wrong option B – indicating that they probably do not associate the Constitution with Republic Day. 20% of students chose wrong option D – these students do not understand that the Constitution applies to all Indian citizens. 17% of students chose wrong option C – these students might be making trivial associations between the police (which they might see as “government”) and the Constitution.

9	6	612	47	<p>The image shown here is of a terracotta sculpture from the archaeological site of Chandraketugarh in West Bengal. It is dated to the Sunga Period of Indian history (2nd - 1st century BC). Looking at the image closely we can get information about _____.</p>  <p>A. hunting and gathering life in ancient Bengal B. caste and occupation in ancient India C. religious beliefs of people in ancient Bengal D. costume and jewellery used in ancient India</p>
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Explanation: Only 44% of students have answered this question correctly (option D). 24% of students selected option C, the most common wrong answer. These students probably connect idols with religious activity. Students selecting options A and B may not have thought this question through or do not understand correctly the relation between different types of historical sources and the kinds of evidence they can produce.

10	8	812	71	<p>According to mythology, Kerala was once full of forests and poisonous snakes. To live in this land, without destroying nature, snake worship was initiated and <i>Sarpa Kavu</i> (snake forests) were created here in agricultural plots. None of the items offered to the snakes formed a part of the snake's food. But these food items attracted rats and in turn rat snakes – the snakes that ate rats mainly. These rat snakes, in turn, were food for the poisonous snakes. Besides snake forests, today many private houses have a corner of their garden reserved for snakes (<i>Kavu</i>). Humans are not allowed to enter this area, allowing snakes to develop their own ecosystem.</p> <p>The <i>Kavu</i> tradition in Kerala reflects _____.</p> <p>A. a way of preserving biodiversity B. the domestication of wild animals C. Kerala's fragile ecosystem D. attempts to control global warming</p>	
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Explanation: Only 39% of students could answer this question correctly (option A). 23% of students chose option C, the most common wrong answer. These students probably have not understood the idea expressed in the passage. 20% of students chose wrong option B. These students probably do not understand what domestication means.

11	8	812	72	<p>The Unity School of Christianity, known as the Unity Church, is a religious movement which was founded in 1889. These are some beliefs of the Unity Church:</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p><i>Worship can be pursued at any time and location when one feels devotion for God. It can be experienced continually through the day. God is within each one of us; he is directly accessible. We need only to quietly turn within ourselves to contact Him.</i></p> </div> <p>This is similar to the Bhakti movement's idea of _____.</p> <p>A. rejecting all religious traditions B. a personal relationship with a deity C. the world around us being an illusion D. all human beings being created equal</p>	
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Explanation: Only 31% of students have answered this question correctly. This shows that students are unable to analyse and interpret information. 31% of students chose option D, the most common wrong answer – this could be because they are answering based only on prior knowledge about the Bhakti movement (without connecting it to the information given here).

7. Misconceptions and Common Errors in Language

S. No.	Class	Paper Code	Q. No.	Question	Graphs										
1	4	411	3	<p>Passage Excerpt:</p> <p>.....That night when the mice came out of their holes and saw the mousetraps on the ceiling, they thought it was a tremendous joke. They walked around on the floor, nudging each other and pointing up with their front paws and roaring with laughter. After all, it was pretty silly, mousetraps on the ceiling.....</p> <p>Why were the mice nudging each other and pointing up with their paws when they came out of their holes on the first night?</p> <p>A. They could see a chair on the ceiling. B. They thought Labon had done something silly. C. They wanted the cheese in the mousetraps. D. They were afraid of what they saw.</p>	<table border="1"> <caption>Graph Data for Question 1</caption> <thead> <tr> <th>Option</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>24%</td> </tr> <tr> <td>B</td> <td>35%</td> </tr> <tr> <td>C</td> <td>21%</td> </tr> <tr> <td>D</td> <td>12%</td> </tr> </tbody> </table>	Option	Percentage	A	24%	B	35%	C	21%	D	12%
Option	Percentage														
A	24%														
B	35%														
C	21%														
D	12%														
<p>Explanation: This question checks whether students are able to make straightforward inferences and the results seem to show that students are either not going back to the passage to verify facts or are picking on wrong answers based on prior knowledge or incorrect interpretation of actions. Only 35.3% of the students have chosen the correct option B. Options A and C have a similar percentage of students choosing them (Option A – 24.5% and option C – 21.8%) probably because they recall random events in the story like, seeing mousetraps stuck on the ceiling and the cheese in them. Students' prior knowledge that mice always like to eat cheese may have made them think that the mice were pointing out to that. If the students had re-read the passage, they would have identified the sentences that mention the words, “silly” and “tremendous joke” immediately after the mice come out of their holes.</p>															
2	4	411	5	<p>Passage Excerpt:</p> <p>“Good gracious me!” cried one. “Look up there! There’s the floor!”</p> <p>“Heavens above!” shouted another. “We must be standing on the ceiling!”</p> <p>“I’m beginning to feel a little giddy,” said another.</p> <p>“All the blood’s going to my head,” said another.</p> <p>“This is terrible!” said a very senior mouse with long whiskers. “This is really terrible! We must do something about it at once!”</p> <p>“I shall faint if I have to stand on my head any longer!” shouted a young mouse.</p> <p>“Me too!”</p> <p>“I can’t stand it!”</p> <p>“Save us! Do something somebody, quick!”</p> <p>They were getting hysterical now. “I know what we’ll do,” said the very senior mouse. “We’ll all stand on our heads, then we’ll be the right way up.”</p> <p>How does the story show you what the mice thought was happening?</p> <p>A. by telling you what Labon thought of the mice B. by describing where the mice lived C. by telling you what the mice said to one another D. by describing what the mice were like</p>	<table border="1"> <caption>Graph Data for Question 2</caption> <thead> <tr> <th>Option</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>29%</td> </tr> <tr> <td>B</td> <td>15%</td> </tr> <tr> <td>C</td> <td>26%</td> </tr> <tr> <td>D</td> <td>22%</td> </tr> </tbody> </table>	Option	Percentage	A	29%	B	15%	C	26%	D	22%
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D	22%														

Explanation: Over 29% of the students have chosen A, an incorrect choice, whereas only 26.2% have chosen the correct answer C. The reason they have done this is because they assume that only a person can speak and i.e. Labon in this story. However, the question clearly instructs them to identify the information that would suggest what the mice were thinking. In the passage there are many lines that show the mice talking to each other. However, the students have ignored this completely.

3	4	411	12	<p style="text-align: center;">Stretchable Dog</p> <p>Things required:</p> <ul style="list-style-type: none"> ✓ the outer cover of an empty matchbox ✓ the inside box of an empty matchbox ✓ water colour ✓ glue ✓ paintbrush ✓ a pair of scissors ✓ pencil ✓ white sheet <p>How to make it:</p> <ol style="list-style-type: none"> 1. Take an empty matchbox. Using the glue, paste the white sheet on the upper lid of the outer box as shown in the picture. 2. Draw a half part of the dog as shown in the picture with the pencil. Using a brush, paint the outer cover and the dog with the water colours. 3. Paste the white sheet on the back part of the inside box. Then draw the remaining part of the dog and colour it. 5. Allow it to dry for a few minutes. 6. Now insert the inside box (as shown in the picture); we will get a normal picture of a dog. 7. If you pull out the inside box, you will get a stretchable dog. <p style="font-size: small; border: 1px solid black; padding: 2px; display: inline-block;">Hi friends! Don't think that with the matchbox you can make only a dog; you can also make me. Try once and enjoy.</p> <p>This passage is MOST LIKELY be found in a book of “_____”.</p> <p>A. Animals B. Colours C. Crafts D. Matchboxes</p>	
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Explanation: In this passage presenting a method to make a 'stretchable dog' out of matchboxes and other materials, this question checks if students are able to make the right connections and draw relevant conclusions. Only 36.5% of the students answered this correctly (option C). Similar percentages of students have chosen A & D (24.1% and 24.5% respectively). Since, the activity mentions a dog, students have been misled into choosing option A. The main component in the activity is a matchbox; therefore, students have chosen D. This again shows that most of the students may be looking for words from the passage in the options rather than thinking carefully about what the question is asking. If they had understood that the passage contains instructions to make a toy dog out of matchboxes etc, they would have known that it is a craft idea which could only be described in a book on Crafts.

4	4	411	19	<p style="text-align: center;">Manoj and his Mother</p> <p>Mother: How many sums did the teacher give in the test today? Manoj: Five. Mother: And did you get them all correct? Manoj: Leaving out the first two and the last three, I got all the sums correct. Manoj's answer to his mother's SECOND question was _____.</p> <p>A. truthful and clear B. correct but not clear C. completely wrong D. what the teacher had told him</p>	
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Explanation: Only 28.2% of the students chose the correct answer – option B. The wrong answer with the highest percentage of students choosing it is C (27.0%). In order to answer this question, students need to understand that Manoj is trying to confuse his mother without being untruthful. As soon as Manoj's purpose is understood, option B stands out clearly as the answer. The high percentage of wrong or invalid answers (67.8%) points to the fact that students find it difficult to understand character's intentions where it is not explicitly mentioned.

5	4	412	16	<p>In the question below, choose the word that is SPELT WRONGLY.</p> <p>A. neice B. friend C. seize D. cease</p>	
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Explanation: This is a question to check students' knowledge of spelling conventions in commonly used words. Only 22.8% of them have chosen option A, the correct answer and the wrong options C and D have been chosen by more number of students (over 26% each). It is likely that students have not assimilated the usage of the 'ei' or 'ie' vowel combinations in commonly used words. Students may be choosing 'seize' under the mistaken impression that it should be 'size' and may be choosing 'cease' because it is the only word which does not have an 'i' in it.

6	4	412	17	<p>Which of these is a CORRECT ANSWER to the question - "Do you like English?"</p> <p>A. "Yes, I like." B. "Yes, I'm liking it." C. "Yes, I do." D. "Yes, it I like."</p>	
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Explanation: This question tests students on verb-tenses and sentence structure. The question is in present tense and the only appropriate option that is complete and in present tense is C (chosen by a mere 23%). Majority of the students have chosen the same wrong answer – option A (53.9%). Option A captures a common error that many Indian speakers of English make. The verb “like” is a transitive verb and cannot occur without an object. The only way to shorten this sentence is as shown in option C. The evidence provided by the performance on this question indicates that the students tested are also prone to this error.

7	4	412	15	<p>He travelled _____ rough mountains and through sandy deserts in the hot sun to find the princess.</p> <p>A. on B. in C. over D. at</p>	
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Explanation: This question tests students on the usage of prepositions. The right answer, C was chosen by only 37.2% of the Class 4 students. The second highest response (32.2%) was option A. This has occurred again due to direct vernacular translation. Most Indian languages would translate a mountain journey as climbing up a mountain or walking on the mountain. However, in English, when you cross a mountain you go “over” it. The high percentage of students not answering this question correctly (62.8%) suggests that students do not have the requisite familiarity with prepositions.

8	4	412	18	<p>Passage excerpt:</p> <p>Flying lemurs are unusual animals. They glide rather than fly. They live in trees and are found in South East Asian forests....</p> <p>They have a flat body with a thin flowing sheet of skin that stretches from the neck out to the fingers, and then down along the sides of body to the toes and the tip of the tail. This sheet of skin allows the lemur to glide from tree to tree, making jumps of upto 50 metres, as if they are flying. They have both, a broad and flat head.....</p>	
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				<p>In this passage, we come to know about _____.</p> <p>A. How the lemur flies like a bird B. How the lemur moves between trees C. How the lemur hunts for its food D. How the lemur looks at things</p>
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Explanation: This question checks whether students read a passage carefully enough to be able to answer what is described in the passage and what is not. The pattern of response to this question suggests that students have NOT read the passage very carefully. A majority of them have gone by the title and chosen option A (44.5%) and only 32.8% have chosen the correct answer in option B.

9	6	611	6	<p>Singing sands _____ people for centuries and even scientists are not sure why or how it happens.</p> <p>A. had mystified B. will mystify C. have mystified D. is mystifying</p>	
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Explanation: This question is checking the appropriate use of verb tense. The passage is written in present tense. Therefore, options A and C are ruled out. However, 25.7% of the students have chosen A. This shows that students are not paying attention to preceding text in a passage before choosing the text. Option D has also been chosen by 25.7% of the students. When an event is described and the timeframe in which it occurred is provided ("for centuries" in this case) the present continuous cannot be used.

10	6	611, 612	11, 2	<p>Passage Excerpt:</p> <p>.....The two-and-a-half hour running length will almost certainly make you fidget a lot, as you wonder 'Who are all these people and where did they come from?' However, the set is impressive with plenty of broomsticks and owls and cinematic magic. Harry Potter has arrived and given the rate at which the author J.K Rowling is writing out her stories it looks like he's going to be around for quite some time.</p> <p>David Butterworth has written this review of the movie "Harry Potter and the Sorcerer's Stone". What is his opinion of the movie?</p> <p>A. People who know the actors will enjoy the movie better. B. The movie is too long to be enjoyed by the fans of the book. C. There are many good points in the movie though it is a bit long. D. People who believe in magic will be impressed by the special effects.</p>	<p>611</p> <p>612</p>
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Explanation: Almost 75% of the students have got this question wrong. Option D has been chosen by the highest number of students. A possible reason for choosing it is that the author does mention that the sets and effects are impressive. However, students have not read the option carefully enough as there is no mention of people believing in magic. The other option chosen by a large number of students is B. Again, the students have not read the option carefully. The author expresses the opinion that the movie may be too long for people who have NOT read the book.

11	6	611, 612	12, 3	<p>Passage Excerpt:</p> <p>.....Your enjoyment of the film is likely to be affected by whether or not you've read the book. The problem for fans, of course, is that knowing the book inside out, leaves very little as surprises. And, as with any novel turned into a full length movie, they've left a lot of stuff out. If you've not read the book, then you might wish you had, since without an in-depth knowledge of the characters "Harry Potter and the Sorcerer's Stone" is only partly satisfying.</p> <p>From this article, what can we conclude about movies that are adapted from popular books?</p> <p>A. It is difficult to make movies using all the scenes from a book.</p> <p>B. Popular children's stories turn out to be uninteresting movies.</p> <p>C. Authors of the book interfere in the production of the movie.</p> <p>D. The success of the movie depends on the special effects.</p>	<p style="text-align: center;">611</p> <p style="text-align: center;">612</p>
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Explanation: The highest wrong option chosen is option D (32.5% and 34%). There are two possible reasons for students choosing D. First of all, the author mentions special effects in the passage. A second reason could be that when movies are discussed often special effects are given a lot of importance. So, the students could be using their prior knowledge to answer this question. However, this shows that they have not read the question carefully enough.

12	6	611	23	<p>Another word for "delicate" is _____.</p> <p>A. fine</p> <p>B. gentle</p> <p>C. small</p> <p>D. wonderful</p>	
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Explanation: Almost 54% of the students have chosen the same wrong option. This suggests that a majority of the students are confused about the meaning of the word "delicate". The adjective "delicate" is closest in meaning to "fine" (option A). However, "gentle" (option B) is the answer settled upon by most of the students. A possible reason is that when we handle delicate things we need to do so gently. This may have led students to confuse the two words. Another possibility is that as an adverb "delicately" may sometimes mean "gently". This could have also caused the confusion.

13	6	612	6	<p>Choose the CORRECT EXPRESSION to REPLACE the underlined words.</p> <p>"The woman said that the little boy was her favourite child."</p> <p>A. the apple of her eye</p> <p>B. an arm and a leg</p> <p>C. all thumbs</p> <p>D. her heart</p>	
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Explanation: The word that draws one's attention in the given sentence is 'favourite'. Most of them would associate favourite to something dear/loved and the immediate image drawn for such an emotion is the heart. That is the cause for 55.7% of the students choosing the wrong option, D as the best answer. Whereas, the question asks one to find a suitable expression/idiom to replace the underlined words. To get to the right option, they children ought to know the meaning and usage of these expressions. Only 29.2% of them seemed to know the expressions and their proper usage.

14	6	612	11	<p>In the courtyard of Chennakesava (Vishnu) temple in Belur in _____ South India, stands a 12 metre tall stone pillar.</p> <p>A. a B. an C. the D. (no article)</p>	
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Explanation: This question is checking if the students know the rules of article usage. The blank is before a noun, South India. The 14% who have chosen either option A or B above are unaware that the indefinite articles are generally not used before proper nouns. Option C (49.6%), 'the' is the option chosen by the highest number of students. The rules governing the use of the definite article before proper nouns are quite complex. A rule of thumb is that when the name of a place includes a direction ('South' in this case), the definite article is not used. Most students seem unaware of this.

15	6	612	15	<p>Topsy Turvy World</p> <p>If everything was opposite <u>Why, less would be more.</u> The poor will be rich And the rich will be poor.</p> <p>Aeroplanes fly underground Ships sail up in the sky. Two will be single One will be a pair.</p> <p>The tortoise, runs fast The hare, runs slow. The green light means stop The red light means go.</p> <p>If things were opposite I would be you And you would be me.</p> <p><small>Source: 'Topsy Turvy World', Booklet V8, "BULLETIN" NIFT, New Delhi.</small></p> <p>Choose the option that MOST PROBABLY represents the poet's thoughts or feelings, as she wrote this poem.</p> <p>A. She was clearly lost in day dreaming. B. She loved to change the way things are. C. She was trying hard to solve a puzzle. D. She was playing with her imagination.</p>	
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Explanation: Option D, the answer, and option B have been chosen by almost the same number of students (Option D - 34.5% and option B - 34%). A possible reason for such a high number of students choosing option B could be that the students are unable to understand the poet's intention. She is merely imagining a world where things are different without saying whether it would be better or worse. There is no indication that she likes the changes she imagines. Yet, students have gone beyond the lines to assign an intention to the poet.

16	8	811	4	<p>Passage Excerpt:</p> <p>.....Monkey puzzles live to a great age. It is common to find individuals of about 1300 years old, while others can reach an age of 2000 years. Growing very slowly, mature monkey puzzles develop perfectly straight, column like- trunks which can reach nearly 50m in height and measure 2.5m at the base. The trees also develop a bark with a fascinating honeycomb pattern. It plays an important role in protecting the trees from the extremes of the Andean climate. The leaves of the monkey puzzle are extremely tough and are arranged in spirals. It is the curious arrangement of leaves and branches of the trees that was responsible for the name 'monkey puzzle'. Though monkeys are not found in the forests of Chile, early European settlers thought that monkeys</p>	
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				<p>would be able to climb the sharp points of the trunk, but would not be able to come down!</p> <p>The Peheuenche people however, have found an ingenious way to harvest the edible seeds of the monkey puzzle tree. They simply climb the trees using long ropes and use thin poles to knock down the seeds from the tree. The seeds form an important part of their diet and economy, especially during the long winters. The Peheuenche eat the seeds roasted or cooked and trade any surplus for clothing and household tools.</p> <p>If we were to add sub-headings for the main description of the passage, which one would MOST suit the last two paragraphs?</p> <p>A. Age and Survival B. Legend and History C. Features and Uses D. Habitat and Location</p>	
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Explanation: The key words in the question are sub-headings and last two paragraphs. Those who chose A (32.8%, the highest wrong choice) had to necessarily misread or ignore the above key phrases. Option B is not related to the text in those paragraphs and acts as a distracter primarily. Option D is not the best choice because the text here does mention the location where they grow but more in detail on the trees structure. Hence, Option C is the best and the right answer.

17	8	811	13	<p>Then they poured some of _____ that contained mosquito larvae.</p> <p>A. that oil on top of water B. that oil in top of water C. the oil over top of water D. that oil on the top of water</p>	
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Explanation: The question tests two things. First, it tests the ability of a reader to use the structure of the sentence provided to choose the right option to continue it. Then, it also tests the student's knowledge of the appropriate use of prepositions. Over 55% of them have chosen either C or D. C uses the preposition 'over' whereas oil can only spill over something but when poured, it is intentional and the right usage is 'pour oil on' something. D should have been eliminated for the sole reason of the use of an unnecessary definite article other than the use of the wrong preposition "top". B is completely wrong and can never be the right answer for this question. Hence, A is the right option but only 36.5% of the students have selected this.

18	8	811	14	<p>The next day _____ Several people decided to test the ability of the oil to chase away mosquitoes.</p> <p>A. they find that the larvae was killed. B. they found that the larvae was killed. C. they found that the larvae has been killed. D. they found that the larvae had been killed.</p>	
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Explanation: This question tests on the usage of verb-tenses. Students had to take the previous sentence as the reference to infer the correct tense for the action in the blank. From the passage, it is clear that the action had already occurred when they came the following morning, hence past tense. Options A (8.4%) and C (15.7%) could be eliminated because there is a tense mismatch between the two verbs present. Option B (39.7%) is in simple past tense form whereas option D (34.2%) uses the past perfect form of the verb. The context requires use of the past perfect and the evidence shows that students are confused about when to use past perfect and simple past.

19	8	811	20	<p>Poem:</p> <p>.....My voice is thin and raspy, So it even hurts to speak! These dastardly expanding glands, Are making me feel weak.....</p> <p>The poet refers to his voice as "thin and raspy".</p> <p>Which of these options is CLOSEST in meaning to the word "raspy"?</p> <p>A. rough B. deep C. shrill D. squeaky</p>	
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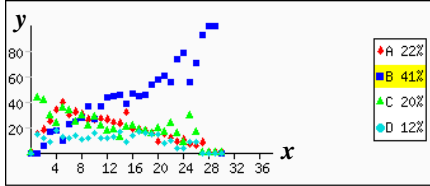
Explanation: The child needs to know the meaning of the word or should be able to refer to the context in which it is used. Let's consider the latter option; the poet says that his voice is thin and raspy that it even hurts to speak. If one's voice is thin and still hurts to speak it has to also be rough or harsh. Compare this with the given options, A (43.4%) yes, B (9.9%) no; C (20.4%) many would think as a possible answer but shrill is loud and jarring. If my voice is thin it is not loud and hence this can also be eliminated. Lastly, D (23.7%) some with thin voices also sound squeaky but if the sound from your throat was thin and squeaky it is not going to hurt when you get tonsils. Hence, the best answer is option A.

20	8	811	22	<p>Which of these words is OPPOSITE in meaning to "incessant"?</p> <p>A. relentless B. intermittent C. ceaseless D. perpetual</p>	
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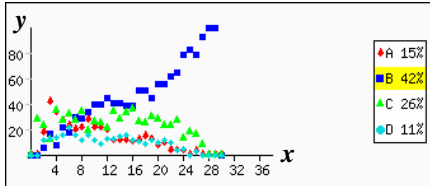
Explanation: This question is testing the extent of vocabulary knowledge in students. The given word means something that is continuous like incessant rainfall. Most of the students who have chosen the wrong answer C (25.8%) have done so because of the common letters 'cess/ceas' and hence thought them to be similar. Though one has to be clear that the task is to look out for opposites/contrasts and not similar/same kind. By which, only B is the right answer chosen by a mere 29.9% of the student population.

21	8	811	23	<p>It is raining in the city and the cricket match has been cancelled. _____ fans walked slowly out of the stadium, their feelings written large on their unsmiling faces.</p> <p>Choose the CORRECT word to complete the sentence with a blank.</p> <p>A. Interjected B. Projected C. Dejected D. Rejected</p>	
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Explanation: An example of student's inadequate knowledge of words. The word for the blank is an emotion. Students should be aware of words used to express emotions of various kinds one might encounter on a day to day basis. The clue word in the stem is 'unsmiling' which refers to a sad/disappointed feeling. If one further investigates to know the reason for displeasure, it is the cancellation of a much awaited event. One has to look out for similar emotion in the given choices. A, B and D are definitely not meeting the criteria and hence C (39.8%) is the best answer.

22	8	811	26	<p>Read the description and answer the question below.</p> <p><i>I love the view from the roof of my office. I can see the beautiful river and the wonderful skyline. I can see the divided tower, the beautiful building with a sloping roof behind me and the Prudential to my left. The Prudential is the building with a flat roof that looks like cubes placed one on top of the other.</i></p> <p>Four buildings are marked in the picture given below. Guess which one is my office?</p> 	
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Explanation: The first two descriptions are true for all the four buildings. It is the third one that acts as an eliminator. If one can view all the 3 buildings described at the same time, it can be only from B. However only 41.9% of the students were able to identify this correctly. About 21% each have chosen either A or C - both these buildings are mentioned in the third description. This shows that students in general do not read and assimilate all the information provided. They get easily fooled into a partial reading of the information and answer based on that.

23	8	811	28	<p>The expression “slightly hard of hearing” refers to _____.</p> <p>A. a person who is very rough in speaking B. a person who has a hearing problem C. a person who does not listen attentively D. a person who people say is very rude</p>	
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Explanation: Question tests one's knowledge of commonly used idioms. "Hard of hearing" refers to some kind of impairment in the ears. Also, the word "hearing" in the question phrase gives a clue that this is to do with ears. Thereby, one can eliminate A and D directly. Some children are confused between hearing and listening. 26.9% of them have chosen C but one needs to be mindful that hearing is not the same as listening or vice-versa. Thus B is the only right option and 42.3% of them have chosen this.

Quality Education Study

