22 Response Analysis: Understanding Children from their Frame of Reference

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Very often, we are so fascinated with the idea of 'right' and 'wrong' answers that we forget (or refuse) to explore the cause behind a child's response to an item. We are so engrossed in the "wrongness" of a response that we fail to appreciate the beauty of that response. This paper attempts to propose a more rational way of looking at children's responses rather than what we have been doing as part of 'assessing' our children's work. It is an attempt to build perspective on knowing what a child has learnt rather than what she hasn't learnt. In doing so, we also acknowledge the fact that we would never be able to definitely know how a child has understood a concept, as our inferences would be based on a few educated guesses, made on the basis of available evidence. In this attempt we believe that all forms of assessments of children's responses carry some diagnostic information.

Our understanding of Response Analysis is an outcome of an internal study performed on 1500 answer scripts of children. Such a process should, we envision, inspire the teacher and definitely add value to an active classroom teaching-learning environment. In this version of the paper we restrict ourselves to the concept of response analysis while keeping the results of the study at bay.

Background

There is more than general consensus that the present education system is examination-driven and this impacts all classes from the Board Examination downwards. Moreover, the examinations are essentially content based and merely test the child's capacity to memorize facts and recall concepts without testing, understanding or application of these concepts. This examination system needs reform and the Government is attempting it in a gradual manner.

Considering the importance given by stakeholders to examinations and assessment, assessment-driven education reforms will be critical. The need to move towards competency-based testing of a child's learning [as opposed to text book and rote memory-based testing] is urgent.

The Learning Guarantee Programme, an assessment led reform programme of the Azim Premji Foundation, aims at changing the classroom teaching-learning processes through bringing about desired changes in assessment tools and practices. In Learning Guarantee Programme, we tried to change the way children's responses were looked at, i.e. we attempted to bring in a more rational way of looking at the responses while 'assessing' children's work. While we do not claim to be the first to attempt this, we do feel that this aspect has not been given its due by practitioners.

> *It is necessary to explore the reasons for a particular response so as to establish "what the child has learnt" for making any further plan of action. Remember, an educated guess is better than just a guess, and similarly, a calculated risk is better.*

Building conceptual understanding of Response Analysis

Assessment is a continuous process to ascertain the present learning level of children. Practitioners broadly divide it into two types:

1. Formative or continuous and
2. Summative or end of the academic cycle.

While assessing, we try to establish the learning levels of the children from responses to a few items/questions. Often, these responses of children are categorized into 'right' or 'wrong' or in rare cases 'intermediate' and we conclude that children who have responded correctly to an item have achieved the said competency and those who have not, have not achieved that particular competency.

Such inferences often demean the purpose of assessment and only provide inadequate insights, if any, into the child's learning. We will now try and explore this with the help of an example:

Q. Solve

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  21
 -17
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R : 16

Typical Inference – child does not have the understanding of 2 digit subtractions with borrowing. Plan of Action – Will need to practice it again with the child.

Some reflections on this inference and plan of action:

- The above inference elucidates what the child has not learnt rather than what she has learnt. Hence this is incomplete information. So if we want to start with the child, what is a good start point?
- Before making the above inference, we have not examined why the child is making this mistake. This might pan out the wrong road map for our further plan of action. For, who knows whether the problem is with the concept of subtraction or something else?

If we want to further explore the child's response we will have to raise the level of analysis from simply considering a response 'wrong' or 'right'. Any inference made (in any form of assessment) needs a logical basis that particularly emphasizes what the child has learnt rather than what she has not leant. To go back to our initial example:

Q. Solve

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  21
 -17
```

R 16

First of all, let us try and gather some information from the response:

Information:

1. At the unit's place, the child is subtracting the numbers in the reverse order (7-1 = 6)
2. At the ten's place, the calculation is correct and child has made no errors according to her frame of reference.

Analysis Points: What has the child learnt?

1. The child has developed first-stage understanding of the concept of subtraction because her calculations are correct.
2. The child might have generalized the rule which she has learnt with single digit to two-digit problems, i.e. we always subtract a smaller number from the bigger one. for example: 7-1 = 6.

Analysis Point: What has the child not learnt?

1. From the generalization, you can see that the child is not able to differentiate between a 'digit' and a 'number'.
2. Concept of place value therefore needs attention.

With whatever limited information we have, we can infer that with this child, we need to direct our efforts towards building the concept of place value, number and digits and not on subtraction.

Let us take another example:

Q. Arrange the following numbers in ascending order

121,222,117

R. 117,222,121

Information Available – Numbers have been arranged in the wrong order.
Some critical analysis points:

1. The child is not able to arrange the three 3-digit numbers in an ascending order. But who knows, perhaps she can arrange two 2-digit numbers?
2. It is possible that child does not know the meaning of the word “ascending”. If we had framed it “from smaller to bigger”, then she might have solved it.
3. Who knows whether this child can identify a 3-digit number?

It is possible that she has not developed any understanding of ordering numbers.

Some more Analysis

Looking at all these analysis points, our inference seem

inconclusive, hence where do you start with this child? What this implies is that we have limited information. So for making any inference, we need to gather more information. For instance, we now correlate information gathered during oral assessment; the same child was not able to recognize any 3-digit number correctly. But still, there are questions which remain unanswered: like, "can she identify 2-digit numbers? Can she compare two 2-digit numbers? Can she order numbers?" The point here is that we will need more than one response to analyze the present level of learning of a child, on a particular competency.

With the above two examples, the learning can be summarized as:

1. We need to analyze more than one response to make any inference about a child's learning. Therefore, we need to look at the responses of the linked items in hierarchy of concepts as well. (We shall be talking about linked items in detail in the next section.)

2. It is necessary to explore the reasons for a particular response so as to establish "what the child has learnt" for making any further plan of action. Remember, an educated guess is better than just a guess, and similarly, a calculated risk is better.

3. Every response of a child provides diagnostic information to work with, however irrelevant it may seem.

An attempt to understand linked items

It would be wise here to use a familiar frame of reference rather than resorting to a fresh example. We have discussed the problem related to ascending order.

Q. Arrange the following numbers in ascending order

121,222,117
R. 117,222,121

Possible Linked Items:
Q. Use the appropriate sign <,> between the numbers

R 943 > 934
R 498 < 589

Q. Underline the smallest 3 digit numbers
R 1000, 699, 969

Q. Arrange the following numbers from bigger to smaller while earlier, we had only one. The reader can see the difference.

For whom is this perspective relevant?

This perspective enables the **teachers** and **practitioners** to reflect upon their classroom teaching-learning processes more rationally, as it equips the practitioners with a process that can reasonably ascertain the learning levels of a child. But one of the contentions that can be raised is: "how is it possible for a teacher to analyze 60 answer scripts thus?" What one needs to understand is that response analysis is nothing more than a perspective and once a teacher has built it, she is no longer dependent solely on written test tools. Her understanding will penetrate the classroom processes. Some carefully framed questions/items can always be asked orally, or some games can be played during day-to-day classroom transactions, to assess the learning. But the perspective here will reflect in the design of that particular item or game.

Here is another example: a teacher is trying to test whether children of Class I have been able to establish the link between numbers (symbolic representation – 10, 11, 12….) and 10 to 20 concrete objects. So she designs a game (assuming that there are 40 children in class I). They are divided into two groups (20 each).

Group1 will have cards from 1 to 20 and each member of group2 will have pebbles.

The task is: group1 shows the card and all members of group 2 have to show the pebbles individually (can be done vice-versa as well). Equipped with the perspective of response analysis, the teacher will not give all the cards 1-20 to Group 1 right away. She will sequence this as she likes - perhaps, in groups of 5. It may be that cards of 6-10 will be flashed first, then 1-5, and then 11-15, – the rest of the sets of 5. Thus, this will help her identify and observe who (and how many) can identify numbers till 5, who can do it till 10 and so on.

This game is a very good activity to make children identify numbers, even if you give all the 20 cards to group 1,with a

few modifications, the element of assessment emerges from within it. This change in methodology reflects the shift in perspective. All this equips the teacher to think logically and rationally. This should enable the teacher to think through the classroom processes which, in themselves, have the elements of assessment.

For the Tool/Question Paper Developers (who, eventually, are the practitioners) – understanding of the processes can improve the quality of tools and make them more diagnostic in nature. A field test of the tool, followed by such a response analysis will help the practitioner design better tools, because such analysis is only effective with "diagnostic tools". Let us try and understand this:

An example of a set of Diagnostic and Less-Diagnostic Items are mentioned below.

competency mentioned, it is also trying to take care of the immediately preceding competency. For example, if a child cannot count beyond 20, can she at least count till 10 or 20?

Or, if she cannot identify two digit numbers, can she at least identify single digit numbers? Moreover, if you look at the set of diagnostic items, it is also following the same pattern and has lots of linked items.

But that does not mean that the other set of items is not at all diagnostic in nature. It just shows that the other set is less diagnostic. Otherwise, every item has the potential to provide some diagnostic information, provided a child attempts that item. Thus, by the very design of assessment tools, a teacher can save time and effort in detailed analysis later, as good tools allow such (linked and tangential) diagnosis to happen online.

Sl.no:	Competency Tested (Class I)	Set of Diagnostic items	Set of less Diagnostic Items
1.	Counting from 20 to 50.	Q. Keep 10 pebbles in front of the child and ask the child to count them. If the child has counted correctly, add 25 more pebbles to this set, and ask the child to count them again.	Q. Keep 35 pebbles in front of the child and ask the child to count them.
2.	Identify and recognize two digit numbers.	Q. Show the below- mentioned numbers to children with the help of flash cards, and ask them to identify the nos: 21, 52, 8	Q. Show the below- mentioned numbers to children with the help of flash cards, and ask them to identify: 21, 52, 62
3.	Arranging two digit numbers in ascending or descending order.	Q1. Circle the biggest number out of the following: 25, 52, 39 Q2. Arrange the following numbers in increasing order: 7, 28, 9, 16	Q. Arrange the following numbers in ascending order: 25, 39, 52

If we look carefully at both the sets, we recognize that one set will be able to provide us enough information to assess the child's learning, while the other set of items restricts this assessment somewhat. While (in the column marked "diagnostic item") each item is taking care of the

For Organizations – Any organization who wishes to bring in qualitative changes in the class room teaching learning process can utilize Response Analysis as a tool.

[Note – The perspective presented here is an outcome of the organizational learning and experiences put ogether to improve classroom teaching-learning practices.Though not new, the perspective remains unexplored by many of the practitioners and, if pursued, should benefit the larger section of the teaching-learning community.]

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Why 1 means "one", and 2 means "two"?

The numbers we all use (1, 2, 3, 4, etc.) are known as "arabic" numbers to distinguish them from the " Roman Numerals" (I, II, III, IV, V, VI, etc). The Arabs popularized these numbers but they were originally used by the early Phonecian traders to count and keep track of their trading accounts.
Have you ever thought why..... 1 means "one", and 2 means "two"? The Roman numerals are easy to understand but what was the logic behind the Phoenician numbers?

It's all about angles!

If one writes the numbers down (see below) on a piece of paper in their older forms, one quickly sees why. Notice the angles have been marked with "o"s.

No 1 has one angle.
No 2 has two angles.
No 3 has three angles. etc.
and "O" has no angles