



Selection in Arithmetical Examples

Author(s): R. S. Williamson

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SELECTION IN ARITHMETICAL EXAMPLES.

SELECTION plays an important part in the life of the individual. It is a fundamental process which he must be able to apply in order to understand the world into which he is born. An individual placed amidst any set of circumstances does not assimilate the whole of them. He does not act like a camera plate, which reproduces automatically every feature of an external situation. The complex mental image which he forms from his surrounding circumstances is not an exact copy of the original environment.

In any situation some circumstances, on account of their nature, may stand out more prominently than others. On a gala day in a town, the decorations, the procession and the noise of the band are distinctive features. They are inherently more noticeable than other features in the town, and they, in particular, would impress themselves on a more or less passive spectator. But there is another factor in determining what constituents of a person's surroundings shall influence him. He himself may choose which elements he will assimilate. He may disregard procession, band and decorations on a gala day and wander round simply noting one thing here and another there in a discursive sort of way. Or he may make a more purposive selection; he may be concerned to describe the affair from a particular point of view, *e.g.* as a relic of the mediaeval fair or as a mode of popular enjoyment, in which case he will select and group together the elements which serve to illustrate his purpose. The portion of his surroundings which is to survive as part of his experience is largely determined by his mental outlook.

Any situation then consists of elements which may be associated in groups, each of which gives a meaning to the situation. To grasp a situation thoroughly is to see the elements in all their inter-relations and to apprehend the meanings implied in all their associations; this involves selection in the first place. Selection, therefore, is a fundamental process.

In the early days of civilisation, when facts were few, knowledge meagre and the activities of life simple, any situation in which an individual became involved was necessarily uncomplicated. The child therefore could be gradually trained to assimilate his environment merely by sharing in the life of his elders. But as higher stages of development were reached and civilisation increased in complexity, this became impossible. The gap between the child's capacity and the achievements of the race became too great. Hence schools arose wherein the products of civilisation were presented to the child piecemeal. Such is the condition of affairs to-day. The facts and circumstances of the world at large are too complicated and too abstruse for the immature mind of the child. Things are too vague and undifferentiated. Situations are too full of incident. He lacks the knowledge and power to select related elements from his environment and apprehend their collective implication. He cannot see wood for trees. The school exists to meet this difficulty. In school only such portions of racial knowledge and experience are placed before him as are suitable to his stage of development. Selection is done for him. Eventually, however, he must select for himself, and one function of the school is to train him in the process of selection. Practice in selection therefore should be an important feature of school work.

Mathematics, in its early stages, is one of the best subjects for training the immature mind in selection, since the facts dealt with are few and uncomplicated. Thus, in forming a number concept, he must fix his attention on one element of a situation only. He sees seven boys, seven desks, seven strokes, etc., and must select the common element, *viz.* the "seven-ness" in each set of circumstances. It is because the number of irrelevant elements in sticks or strokes is a minimum that these articles are particularly suitable for number teaching, *i.e.* for the cultivation, in its early stages, of a quantitative outlook on circumstances.

In higher work selection of this nature is not frequent. Probably it is most commonly met with in Geometry, where it is often necessary to isolate mentally some lines and angles from the rest of the figure. But in this case, of course, the situation from which selection is made is not a natural one, *i.e.* does not involve circumstances taken from everyday life.

Arithmetic offers a most useful field for training in selection, and could well be developed on lines furthering this aim more than it is furthered at present. Arithmetical teaching is still suffering from the old conception which required a certain proficiency in carrying out mechanical processes and applying them to standardised problems. The cultivation of a mathematical outlook on the facts and circumstances of everyday life as an aim of arithmetical teaching has not yet come into its own. Quantitative considerations now enter largely into most of the circumstances of life. Ability to deal with statistics of various kinds, in particular, is becoming increasingly desirable. The pressing problems of the day are being considered more from a mathematical point of view. If the individual is to be able to view matters in this light, he must be trained to do so. To appreciate a situation in its mathematical aspect he must select the elements which have a mathematical bearing on each other and apprehend them in this relation. This means that the old type of arithmetical example, which provided for training only in appreciating the mathematical relation between facts already selected, is insufficient. The arithmetical problem should involve selection of data as well.

It has been urged against problems of this nature that they involve the very difficulty which it is the purpose of the school to remove, *i.e.* that they are too complicated and tend to produce confusion in the mind of the pupil. If, however, the concrete material from which they are formed is carefully watered down to suit the capacities of the pupils, this danger disappears. Some years ago experiments were tried in setting examples involving selection at a series of examinations for Entrance Scholarships to Secondary Schools. A few of the examples are given below, and comments taken from or based on the examiner's reports are added.

Candidates aged 12 and 13.

I. A man pays £3. 16s. 6d. in rates. How much of this is spent on education if each 4s. 6d. is spent as follows :

		<i>s.</i>	<i>d.</i>
Poor Rate -	- - - - -	1	0½
Highway Rate -	- - - - -	10	½
City Rate—			<i>d.</i>
Police Department -	- -	4	05
Education Department -	-	15	97
Other Departments -	- -	10	98
		31-00	2 7
		Total	<u>4 6</u>

Comment.—In this case only a few candidates failed to select the Education Rate, 15·97d., correctly.

II. If the figures in the table below are correct, which of the statements is inaccurate ? How would you alter it so as to make it accurate ?

Kind of food.	Percentage of water.	
Fish	75	When you buy <i>fish</i> ninepence out of every shilling goes for water.
Bread	39	When you buy <i>bread</i> fourpence out of every shilling goes for water.

Comment.—This question offered little difficulty to the majority of the candidates. Very few selected the *four* given numbers, *e.g.* 100, 75, 1s., 9d., and showed that they were proportional. The general method was to calculate one of the four from the remaining three.

III. A copy of a butcher's bill is given below. Find the price per pound of the neck of mutton.

					<i>s.</i>	<i>d.</i>
Shin of beef, 2 lbs. 2 ozs.	Neck of mutton,					
3 lbs.	-	-	-	-	4	11½
Sirloin, 5½ lbs.	Tripe, 1 lb.	-	-	-	7	0
Sausage, 1 lb.	-	-	-	-		9
Neck of mutton, 2 lbs. 8 ozs.	Tripe, 1 lb.					
Cow-heel, 6d.	-	-	-	-	3	7
Sirloin, 5¼ lbs.	-	-	-	-	6	1½
					<hr/>	<hr/>
					£1	2 5

Comment.—Many failed to select the last line as the starting-point of the solution. The commonest incorrect method was to select the wrong line and ignore the difference in the kind of meat, *e.g.* item 1 was taken as 5 lbs. 2 ozs. for 4s. 11½d. Another method was to assume a price for one item, such as the tripe in line 2, and hence obtain a price for the other item.

IV. A copy of an advertisement is given below. Find out whether the advertiser's calculation is accurate, and if not correct it.

1,190 per cent. Profit from Poultry.
How 24s. became £15. 10s. 0d.

Comment.—This was done moderately well, three of the four given numbers being selected in practically all cases. Many performed the required calculation but failed to correct the statement.

Candidates aged 10 and 11.

I. A man uses a penny-in-the-slot gas meter and burns the same amount of gas each day. How many pennies per day must be put in the meter to obtain the gas charged for in the bill below ?

Mr. J. Smith

**Dr. to the Barton Gaslight Company,
For Gas during the Quarter ending June 30th, 1911.**

<i>State of Meter</i>	-	14300 c. ft.		£	<i>s.</i>	<i>d.</i>
<i>Last Index</i>	-	5200 „				
<i>Quantity consumed</i>	-	<u>9100</u> „	at 2/6 per 1000 c. ft.	-	-	1 2 9

Comment.—A large number of candidates obtained full marks. Solutions involving cubic feet were very frequent. Many candidates ignored the given date, June 30th, and obtained the number of days in a quarter by dividing 365 by 4. Many made a more or less neat copy of the bill as set out in the question ; usually they failed to score marks.

II. Below is given a drawing, to scale, of a clock-face without minute hand. Find, as nearly as you can, what time is shown by the clock. Explain how you obtain your answer.

(The hour hand pointed to the second minute division after 2 o'clock.)

Comment.—"This was a popular question. Less than half the candidates obtained the correct answer, 2·24, and nearly half gave 2·30. There were also many answers near to 2·24, *e.g.* 2·20, 2·25, given by candidates who stated that the time was not quite 2.30, but who made no attempt to *calculate* the exact time. The answer 2·12 was common."

III. A question about using a tablet of soap was worked in an advertisement as shown below. Write out the question of which this is the working. Then work it as you think it ought to be done.

$$\begin{array}{r}
 1917 \\
 \text{January} \quad 31 \text{ days} \\
 \text{February} \quad 28 \quad , \\
 \text{March} \quad 31 \quad , \\
 \hline
 90 \text{ into } 4\frac{1}{2}d. \\
 \frac{9 \times 1}{2 \times 90} = \frac{9}{180} \text{ of } 1d.
 \end{array}$$

Comment.—"Only a minority attempted this question. The answers to the first part were varied, most of them being poor to moderate. Only a few candidates introduced all the points in their question, *e.g.* date 1917, months, etc. One of the best answers was: 'A person bought a tablet of soap on Jan. 1st, 1917, which cost $4\frac{1}{2}d.$ and it lasted until Mar. 31st, how much is this per day (both days inclusive).' One solution was terse enough to be worthy of an advertising agent: 'Use Pears' Soap. Only $4\frac{1}{2}d.$ a tablet. Lasts 90 days. Costs $\frac{1}{20}$ of a penny a day.'"

The second part was moderately well done. Some candidates, apparently deceived by the simplicity of the question, attempted fanciful solutions. Most candidates performed the cancelling at the proper stage, but followed too closely the given solution. A few well reasoned solutions were received.

The general conclusions arrived at as a result of these experiments were

(1) It is possible to frame "selective" examples suited to the capacity of children of elementary school age.

(2) Children who do well at ordinary Arithmetic usually show the same ability in solving these selective problems.

(3) Examples of this type are more suited than the traditional problem to many children.

It was found that some candidates had no difficulty with the selective type although they did poorly in the rest of the paper.

Cam. Univ. Training Coll.

R. S. WILLIAMSON.

GLEANINGS FAR AND NEAR.

79. In his early days Bishop Blomfield took pupils. On one occasion, when they were struggling with Euclid, Sheridan asked him: "Pray, Sir, was Euclid a good man?" "What do you mean?" said the tutor. "I mean was he a good, honourable, truthful person?" "Oh, yes!" said Blomfield, "I never heard anything to the contrary." "Then, Sir," replied the pupil, "don't you think we might take his word for this proposition?" —[Blomfield (1786-1857); Richard Brinsley (1751-1816); Charles Francis, his brother (1750-1806). None of the famous Sheridans fits in with the story.]