Buses, games and trains – Analysis of student strategies

Link to the assessment resource, *Buses, games and trains* (NM1334)

Table 1: Frequency of use and success rates of different strategies

Strategy	a) 67 – 39	b) 127 – 35	c) 264 – 92	**Total**
Partitions to jump through tidy numbers	13 (9)	23 (19)	10 (5)	46 (33) 72%
Partitions with tidy numbers	22 (18)	9 (8)	15 (14)	46 (40) 87%
PV partitions both numbers	30 (27)	28 (25)	33 (26)	91 (78) 86%
PV partitions with negative numbers	4 (3)	4 (4)	3 (3)	11 (10) 91%
PV partitions smaller number	28 (23)	38 (34)	25 (21)	91 (78) 86%
Vertical algorithm	34 (23)	30 (24)	31 (22)	95 (69) 73%
Visual partitioning strategies	3 (2)	4 (4)	3 (3)	10 (9) 90%
Counting strategies	2 (1)	3 (1)	1 (1)	6 (3) 50%
Partition with incorrect compensation	19 (0)	28 (1)	33 (0)	80 (1) 1%
Partition with "won't go" error	23 (0)	11 (0)	9 (0)	43 (0) 0%
ALL STRATEGIES	**178**	**178**	**163**	**519**
States answer	9 (4)	9 (5)	11 (3)	29 (12) 44%
Adds rather than subtracts	2 (0)	0 (0)	1 (0)	3 (0) 0%
Other statements	6 (0)	8 (0)	11 (0)	25 (0) 0%
Missing	6 (3)	6 (3)	15 (1)	27 (7) 26%
TOTAL	**201**	**201**	**201**	**603**

Based on a representative sample of *201* students

Table 2: Mean abilities of students using different strategies

	Mean Ability* (out of 43)			
	a) 67 – 39	b) 127 – 35	c) 264 – 92	**Weighted Average****
Partitions to jump through tidy numbers	21.9	22.3	23.3	22.4
Partitions with tidy numbers	22.8	24.0	23.9	23.4
PV partitions both numbers	20.0	21.1	23.6	21.6
PV partitions with negative numbers	26.0	27.0	25.7	26.3
PV partitions smaller number	23.9	24.2	24.1	24.1
Vertical algorithm	20.3	19.8	20.6	20.2
Visual partitioning strategies	19.7	23.2	19.7	21.1
Counting strategies	19.0	15.0	22.0	17.5
Partition with incorrect compensation	19.3	18.3	19.5	19.0
Partition with "won't go" error	16.7	14.2	13.3	15.3
States answer	23.6	16.4	18.1	19.3
Adds rather than subtracts	16.5	-	6	13.0
Other statements	10.5	12.6	13.7	12.6
Missing	11.0	11.0	12.5	11.8

Based on a representative sample of *201* students

* Mean ability – average score out of 43 of all students using this strategy on a test set of seven questions.

** [Σ (mean ability × number using strategy in each part of the question)] / total using the strategy in any part of the question

e.g., for Partitions across boundaries = [10.0×1 + 15.0×4 + 18.0×5] ÷ 10 = 16.0

Patterns within the strategies used

- *Place value partitioning using hundreds, tens **and** ones* with correct compensation involving **negative** numbers was the most successful strategy (91% of students using it got the correct answer) and the one used by the students with the highest mean ability.
- *Place value partitioning the smaller number into hundreds, tens **and** ones, then subtracting in parts* in the correct direction was used by the group with the next highest mean ability and was also highly successful (86%).
- *Partitioning by rounding one number to a tidy number and compensation* in the correct direction was used by the group with the third highest mean ability and was also highly successful (87%).
- *Partitioning using rounding and compensation* or *partitioning using complementary addition to cross boundaries* with correct compensation was used by students with the fourth highest mean ability. Their success rate was markedly lower (72%) as it is hard to control the direction of compensation correctly with this strategy. This demonstrates that although the strategy is higher on the number Framework, it tends to break down with larger numbers.
- *Place value partitioning both numbers using hundreds, tens **and** ones* with correct compensation was used by the next most able group and had a high success rate (86%).
- *Visually displaying partitioning strategy* (the ones above) often with a number line was used by the next most able group of students but had a high success rate (90%).
- Students using the *vertical algorithm* had a lower mean ability and a relatively low success rate (73%).
- Students who made errors when using partitioning strategies were of lower mean ability virtually never got a correct answer.
- Students who merely stated the equation were of high mean ability for part a) [67 – 39], but lower for the other two parts. This may indicate that using mental strategies on two digit numbers is more effective than using them on larger numbers.
- Students who made the "won't go" error during partitioning strategies (subtracting the larger digit from the smaller one) were of an even lower mean ability.