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Nursery rhyme - an assessment of primary technology capability across key stage 2

J V Stapley
School of Educational Studies, University of Portsmouth

Abstract

Assessment procedures in the traditional areas of of reading, writing and arithmetic are well known. This paper describes an assessment in technology and quantifies the results obtained from over 200 pupils in key stage 2. The responses of the pupils' have been analysed by age and by gender. The activity was chosen as a typical primary technology activity in order to assess capability. It was presented as a series of focussed tasks, recorded by the children on a Design Sheet. Opportunity was provided for the children to exhibit their ability to reflect, critically appraise and to action their design intentions in a familiar classroom situation. There were few gender differences in capability. Age was a factor, with the younger children generally scoring less. The best scores were not in the oldest group and will be further investigated.

Nursery rhyme - an analysis of a Primary Technology activity across Key Stage 2

For the purposes of this paper the statistical indicators reported are first level descriptive statistics. It is intended to re-analyse the data to test strength of positive relationships using appropriate non-parametric tests at a later date.

Background

As part of an investigation into covertly gifted children and technology, I wished to ascertain whether there was a development of technological capability across key stage 2. The interactive process model of technology proposed by the Assessment of Performance Unit[1] was used to provide an initial conceptual framework.

The dimensions of capability in technology include:
  i) conceptual understanding
  ii) designing and making
  iii) critical appraisal.

The activity 'NURSERY RHYME' was one facet of the investigation. It was intended to provide opportunities to assess a number of procedural domains in the development of technological capability.

In the APU model of technological activity integrates the domains of the reflective and active dimensions which are mediated by critical appraisal and age.

REFLECTION	ACTION
hazy impression	play
exploration of possibilities	telling
speculation	discussion with peer or adult
clarification	draws intention
investigates alternatives	2D modelling
validation	3D modelling

The research

The school used for the study is a Church (Controlled) First and Middle School of 468 pupils in a large city on the South coast. Whilst not situated in a deprived area, a number of families, risen to 21% during the course of the study, are in receipt of free school meals and some are in temporary accommodation.

The study took place between July 1993 and February 1994; as it spanned two academic years there were no Year 5 pupils available. The ages of the pupils were recoded into sets of four months that equated with terms in school.

Key stage 2 - Puplis involved in nursery rhyme
Recoded ages

Mean age	Total
7yrs 5mnth	14
7yrs 9mnth	17
8yrs 2mnth	23
8yrs 5mnth	13
8yrs 9mnth	20
9yrs 2mnth	35
9yrs 5mnth	15
9yrs 9mnth	13
10yrs 2mnth	0
10yrs 5mnth	9
10yrs 9mnth	22
11yrs 2mnth	29
11yrs 5mnth	17
11yrs 9mnth	8

The activity

The activity 'Nursery Rhyme' was a practical planning - making - evaluating activity under the direction of the usual class teacher. The activity was introduced to each class by means of a script in order to be fair to every class. In each case the pupils had known

they were going to make something so had had the opportunity to bring to school 'junk' from home. This was in line with the teachers' normal practice; other material, tools and equipment were as available as they would usually be in a practical session. (This was important - in a pilot study in a primary school on the Isle of Wight the children made very inappropriate use of coloured cellophane which they had never before utilised).

In the report 'The Assessment of Performance in Design and Technology'[1] it was found the best results occurred when pupils were given a clear structure and knew what to expect before they started the task. Consequently, the 'Design Sheet' given to the children was explained step by step. The children were reminded that they could communicate either graphically or textually because the sheet was intended to help them make the model.

Nursery rhyme - Part 1 "These are the Nursery Rhymes I know"

This part enabled the children to initially write down all the Nursery Rhymes they knew. The two example rhymes, Jack and Jill and Humpty Dumpty, were not counted in the number of rhymes known. They were reminded of the ways they could communicate on paper and a response was recorded whether it was written or drawn.

Nursery Rhymes known - gender differences

	Total	Mean
Girls	269	2.26
Boys	207	1.88
Total	476	2.07

The girls were able to communicate, on average, more rhymes than the boys.

Nursery Rhymes known - age differences

Mean age	Total	Mean
7yrs 5mnth	19	1.36
7yrs 9mnth	19	1.12
8yrs 2mnth	34	1.48
8yrs 5mnth	10	1.23
8yrs 9mnth	54	2.70
9yrs 2mnth	64	1.83
9yrs 5mnth	32	2.13
9yrs 9mnth	31	2.84
10yrs 5mnth	20	2.22
10yrs 9mnth	65	2.95
11yrs 2mnth	74	2.55
11yrs 5mnth	47	2.76
11yrs 9mnth	20	2.50

The children were all allowed the same amount of time, which was two minutes. In the younger classes, where the mean is lower, the 'atmosphere' of having finished within the two minutes was similar to the older classes. The number of rhymes known peaks at 10years 9months, not the oldest group; it had increased irregularly across the groups.

Nursery rhyme - Part 2 "This is what I know about young children"

Here the pupils were asked to consider what they knew about young children that they might need to take into account when designing and making a model for them. As it is a First and Middle school, all the pupils are familiar with children in key stage 1 as they associate with them at breaktimes even if they have no younger siblings.

The pupils were reassured that although they were designing and making their model for a young child, they would be allowed to keep it themselves - an important consideration in the light of the very positive comments they made about their models in the evaluation section of the Design Sheet. Some teachers took their classes to the First School to show the young children what they had made. The comments the children made were coded to indicate whether they were irrelevant to the task in hand, e.g.. "...they are naughty..." ; relevant to the task "...like funny things..."; or are highly pertinent e.g.. "...they can swallow small things so it must be strong...".

Task - irrelevant comments

Mean age	Total	Mean
7yrs 5mnth	19	1.36
7yrs 9mnth	12	0.17
8yrs 2mnth	29	1.26
8yrs 5mnth	16	1.23
8yrs 9mnth	28	1.40
9yrs 2mnth	24	0.66
9yrs 5mnth	14	0.93
9yrs 9mnth	8	0.62
10yrs 5mnth	5	0.56
10yrs 9mnth	12	0.55
11yrs 2mnth	21	0.72
11yrs 5mnth	18	1.06
11yrs 9mnth	4	0.50

The most irrelevant comments were made by the youngest and oldest pupils, with the least irrelevant comments in the age group 10years 9months. As with age, the mean gender differences in the irrelevant comments are very slight. The mean for the whole sample was 1.06 irrelevant comments, the same as the mean for the girls. The boys mean was also 1.06. All means have been rounded to two

decimal places.
Task - relevant comments

Mean age	Total	Mean
7yrs 5mnth	6	0.43
7yrs 9mnth	5	0.29
8yrs 2mnth	10	0.43
8yrs 5mnth	8	0.61
8yrs 9mnth	16	0.80
9yrs 2mnth	43	1.23
9yrs 5mnth	19	1.27
9yrs 9mnth	13	1.00
10yrs 5mnth	6	0.67
10yrs 9mnth	18	0.82
11yrs 2mnth	29	1.00
11yrs 5mnth	24	1.41
11yrs 9mnth	14	1.75

There is an irregular increase in the number of relevant comments made as the groups get older, the most relevant comments being made by the eldest group. The boys made, on average, one more relevant comment than the girls did.

Task - highly pertinent comments

Mean age	Total	Mean
7yrs 5mnth	0	0
7yrs 9mnth	3	0.18
8yrs 2mnth	1	0.43
8yrs 5mnth	0	0
8yrs 9mnth	0	0
9yrs 2mnth	11	0.31
9yrs 5mnth	9	0.60
9yrs 9mnth	6	0.46
10yrs 5mnth	19	2.11
10yrs 9mnth	46	2.09
11yrs 2mnth	37	1.28
11yrs 5mnth	19	1.02
11yrs 9mnth	12	1.50

The increase in the number of highly pertinent comments, which appears in the age group 10years 9months, will be further investigated at a later date. The mean of this sample is 0.73, with girls giving, on average, slightly more highly pertinent comments, 0.79, than those of the boys, 0.67; this is the reverse of the situation that occurred with pertinent comments. Then they were weighted as follows to give an overall COMMENTS SCORE.

    irrelevant comments = 0
    relevant comments = 1
    highly pertinent comments = 2

The relationships between the COMMENT SCORE with age and with gender were considered.

Comment score - age related

Mean age	Total	Mean
7yrs 5mnth	7	0.50
7yrs 9mnth	14	0.82
8yrs 2mnth	17	0.74
8yrs 5mnth	9	0.69
8yrs 9mnth	18	0.90
9yrs 2mnth	58	1.66
9yrs 5mnth	44	2.93
9yrs 9mnth	28	2.15
10yrs 5mnth	44	4.89
10yrs 9mnth	115	5.23
11yrs 2mnth	107	3.69
11yrs 5mnth	62	3.65
11yrs 9mnth	38	4.75

As would be expected, the mean score for the Comments Score increases with age, although it peaks at 10years 9months, mean 5.23, which is not the oldest group. At a later date thes scores will be investigated in relation to the scores obtained at the same time on the NFER-Nelson Non Verbal Reasoning Test. The girls had a mean Comments Score of 2.58, the boys mean score was lower, 2.39. The mean comments score for the whole population was 2.49.

Nursery rhyme - Part 3 "Put all your ideas for models here"

In Part 3 the children were encouraged to think of and note down as many different ideas for models as they could. They were told they could refer back to Part 1, to remind themselves of Nursery Rhymes they knew, if they wished, and it was noticed that a few did. Each idea was tallied, and suggestions for the rhymes used as examples were included.

Number of ideas suggested

| Mean age	Total	Mean
7yrs 5mnth	35	2.50
7yrs 9mnth	43	2.53
8yrs 2mnth	60	2.61
8yrs 5mnth	31	1.55
8yrs 9mnth	43	2.15
9yrs 2mnth	68	1.92
9yrs 5mnth	33	2.20
9yrs 9mnth	35	2.69
10yrs 5mnth	29	3.22
10yrs 9mnth	66	3.00
11yrs 2mnth	65	2.24
11yrs 5mnth	32	1.88
11yrs 9mnth	20	2.50

The girls had a mean of 2.60 and the boys had a slightly lower mean of 2.46. The mean for the whole sample was 2.53. There does not appear to be a correlation between the number of ideas and the

Nursery rhyme -Part 4 "Design the model you want to make"

All the classes have had experience of designing before making. When considering the wide variation in the quality of the children's design, it was decided to score the design in the following way:

    0 for no design

    1 for a picture of the Nursery Rhyme

    2 where there was a drawing of their intentions for the model

    3 the drawing gave an indication of how it was to be constructed or move

    4 more details of movement and/or construction

    5 detailed design, showing several views or how parts of the model were to be made
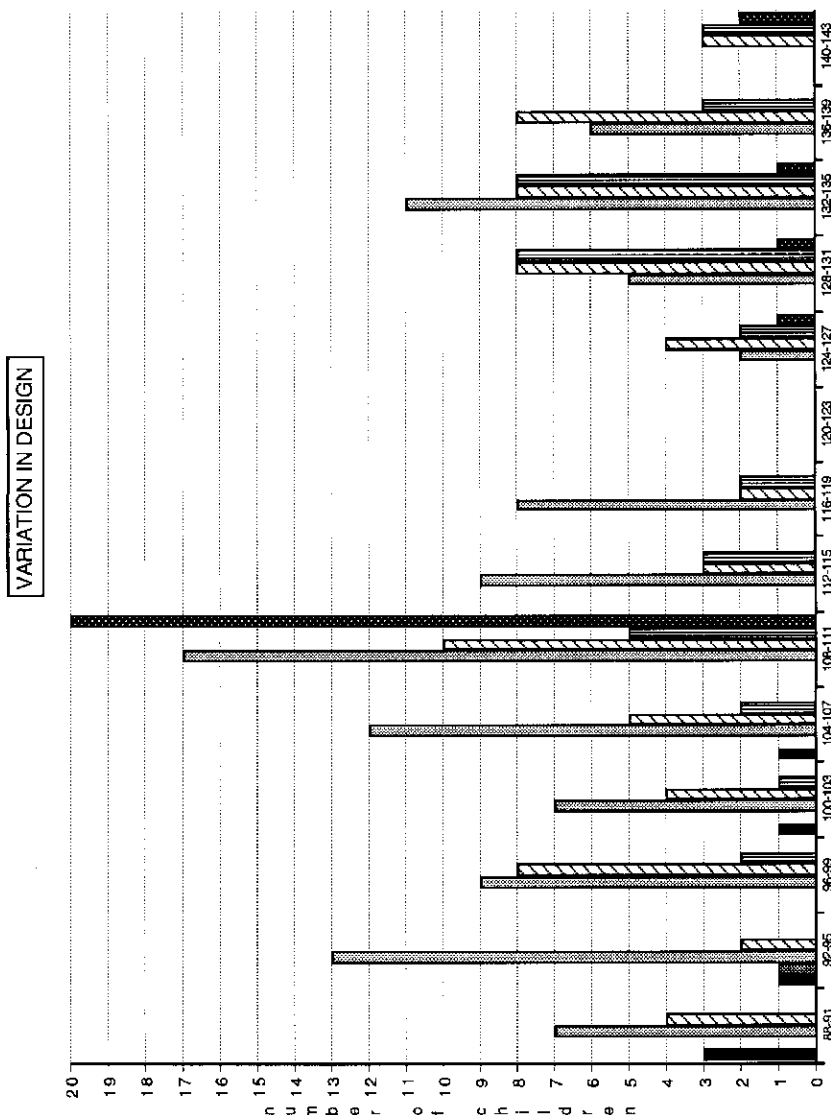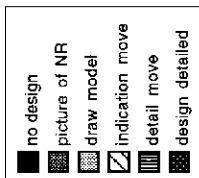
Design score

Of the children who did not draw a design, two were girls and six were boys. Only onw, a boy, drew a picture of a Nursery Rhyme whilst 40 boys were judged to have drawn Nursery Rhyme models. Rather more girls than boys indicated movement on their design, 67 as opposed to 40; but 22 boys showed more construction details, whilst 17 girls did. Of the most sophisticated designs, showing how it would move and be constucted, five out of seven were drawn by boys.

Nursery rhyme Part 5 "Up to 2 hours to make your model"

With the actual making of the model the child's capability in the action dimension was being assessed. In a pilot study the models were holistically judged. The criteria used to form that judgement were made into a marking scheme which was employed in the assessment of all the completed models.

57 girls and 36 boys made models which were not intended to have moving parts. Where there was one part of the model intended to move, the numbers of children were similar - 41 girls and 46 boys. Far more boys, 22, than girls, 14, intended to have two moving parts. Three moving parts were attempted by three girls and three boys. One girl tried to make five parts move and the most ambitious was a boy who wanted seven parts to move.

There were various complications when it came to actually making the mechanisms work. 67 girls and 53 boys had nothing working; these figures include the models that were not designed to have moving parts. A similar number of girls, 37, to boys, 40, had one working part on their model. Rather more boys had two working parts, 14 to 9 girls. But three girls succeeded in making three different parts move on the model compared to one boy.

As every class had slightly different materials available, their choice of material was assessed in relation to what the children were able to use. A functional choice was made by 52 girls and 55 boys. There were other materials available that would have been better. Girls selected the materials they used better than the boys did, 60 girls and 45 boys chose well from the materials available. A particularly good choice was made by similar number of girls, four, and boys, five. Three boys made an inappropriate choice - there were far more suitable materials available.

An almost equal number of models made by boys, 20, and girls, 21, looked unattractive when finished. Some consideration to the model's aesthetic qualities was given by 52 girls and 68 boys. The girls, 36 of them, were more successful in producing an attractive model, than the boys, 16. Eleven finished models were particularly aesthetically pleasing, seven made by girls and four by boys. Lack of skill in model making with the equipment and materials avaiable was equally spread between boys and girls. 16 boys and 16 girls were poor, 71 girls and 70 boys were judged to have reasonable skill. There were three very skilled girls and three very skilled boys. More girls, 26, as opposed to nine boys, were moderately skilled.

A final score for the child's model was calculated by finding the sum of the number of ideas, how many moving parts it had and how many actually worked; plus the score given for the child's choice of the materials available, how skilful they had been and the finished model's aesthetic qualities.

Model score

Mean age	Total	Mean
7yrs 5mnth	110	7.86
7yrs 9mnth	150	8.82
8yrs 2mnth	161	7.00
8yrs 5mnth	104	8.00
8yrs 9mnth	188	9.40
9yrs 2mnth	308	8.80
9yrs 5mnth	146	9.73
9yrs 9mnth	135	10.38
10yrs 5mnth	132	14.66
10yrs 9mnth	241	10.95
11yrs 2mnth	288	9.93
11yrs 5mnth	184	10.82
11yrs 9mnth	103	12.88

The mean model score for the girls is 9.83, with the boys' score being almost identical, 9.84. The mean for the whole population is 9.82.

Nursery rhyme Part 6 "Evaluation"

The child's evaluation of the finished model was called for in Part 6, aided by questions to assist focussed thought. The questions were read through to the classes and they were then free to write their comments. These were weighted according to the insight they gave about the activity. Comments marked as irrelevant did no more than reiterate part of the question e.g.. "Yes, I made what I wanted." Relevant comments referred to the model and explained a bit more about how the child felt e.g.. "The wall needed to be neater." There were very few highly pertinent comments because they needed to refer not only to the model, but also to the task of making it for a younger child to enjoy Nursery Rhymes even more with.

Evaluation - irrelevant comments - age

Mean age	Total	Mean
7yrs 5mnth	0	0.00
7yrs 9mnth	0	0.00
8yrs 2mnth	2	0.12
8yrs 5mnth	6	0.77
8yrs 9mnth	16	0.80
9yrs 2mnth	19	0.54
9yrs 5mnth	8	0.53
9yrs 9mnth	6	0.46
10yrs 5mnth	10	1.11
10yrs 9mnth	18	0.82
11yrs 2mnth	25	0.86
11yrs 5mnth	14	0.82
11yrs 9mnth	5	0.63

The girls had a mean of 0.62 and the boys had a slightly lower mean of 0.54. The mean for the whole sample was 0.58.

Evaluation - relevant comments - age

Mean age	Total	Mean
7yrs 5mnth	11	0.79
7yrs 9mnth	12	0.71
8yrs 2mnth	7	0.30
8yrs 5mnth	10	0.77
8yrs 9mnth	29	1.45
9yrs 2mnth	68	1.94
9yrs 5mnth	32	2.13
9yrs 9mnth	29	2.23
10yrs 5mnth	25	2.78
10yrs 9mnth	84	3.82
11yrs 2mnth	65	2.24
11yrs 5mnth	46	2.71
11yrs 9mnth	18	2.25

When rounded to two decimal places the mean number of relevant remarks of the complete sample

was the same as that for both boys and girls, 2.04.

Evaluation - highly pertinent comments - age

Mean age	Total	Mean
7yrs 5mnth	0	0.00
7yrs 9mnth	0	0.00
8yrs 2mnth	0	0.00
8yrs 5mnth	0	0.00
8yrs 9mnth	3	0.15
9yrs 2mnth	3	0.09
9yrs 5mnth	3	0.20
9yrs 9mnth	2	0.15
10yrs 5mnth	0	0.00
10yrs 9mnth	6	0.27
11yrs 2mnth	6	0.20
11yrs 5mnth	2	0.12
11yrs 9mnth	2	0.25

The girls had a mean of 0.12 and the boys had a slightly lower mean of 0.10. The mean for the whole sample was 0.11. Again there was apeak at 10years 9months.

The score for the 'EVALUATION COMMENTS' of each child was calculated by ignoring irrelevant comments and giving each highly pertinent comment twice the weight of relevant comments.

Evaluation score

Mean age	Total	Mean
7yrs 5mnth	11	0.79
7yrs 9mnth	12	0.71
8yrs 2mnth	7	0.30
8yrs 5mnth	10	0.77
8yrs 9mnth	35	1.75
9yrs 2mnth	74	2.11
9yrs 5mnth	40	2.67
9yrs 9mnth	33	2.54
10yrs 5mnth	21	2.33
10yrs 9mnth	94	4.27
11yrs 2mnth	91	3.14
11yrs 5mnth	64	3.76
11yrs 9mnth	15	1.88

The girls had an Evaluation Score mean of 2.28 and the boys had a slightly lower mean of 2.25. The mean for the whole sample was 2.27. The evaluation of the morning's activity was focussed to provide opportunity for constructive reflection.

166 children (69.1%) had made what they wanted to make; 87 girls and 76 boys. 172 children (72.9%) were actually pleased with their finished model, equally spread between boys and girls (86 each). 17 (7.2%) were not sure if they had made what they wanted to, 10 of these were girls, seven boys. 20 (8.5%) were not sure if they were pleased or not! Of these 14 were girls and six boys.

Nine children (3.8%) did not indicate whether or not they had made what they wanted to and 9 (3.8%) did not respond to the question asking if they were pleased with what they'd made.

160 children (67.8%), 82 girls and 78 boys wanted to improve their model. The suggestions they gave for its improvement were each counted as a relevant comment. 62 children (26.3%), 32 girls and 30 boys, did not want to do anything to improve the model; 3 (1.3%) were not sure and 11 (4.7%) did not respond.

135 children (57.2%), 69 girls and 66 boys did not want to comment, whilst 82 (34.7%) did. Again they were quite evenly distributed by gender, 42 girls and 40 boys. 19 (8.1%) did not respond to the opportunity.

These results indicate that children in key stage 2 are not at the validation stage in the model of technological capability proposed earlier. There was no suggestion that the model they had made should be a prototype for a further development. Had any of the children been at the 3D modelling stage of capability the opportunity was available to comment appropriately. It would be illuminating to undertake this activity with pupils in Key Stage 3 to discover when this level of capability occurs.

Nursery Rhyme score

An overall score for the activity Nursery Rhyme was calculated by adding the scores given for the comments they made about young people in relation to the task, with their number of ideas, the design score, the model's score and the final score of their evaluation. The minimum scored by any child was 7.00, with the maximum of 48.00. The mode was 17.00 and the standard deviation was 7.7.

The girls had an composite mean score of 19.83 for Nursery Rhyme, the boys' mean score was 19.92; the composite mean for the whole sample was 19.88.

Conclusion

The activity Nursery Rhyme will be subject to further statistical analysis but does show a number of interesting features.
i)   There is an increase in scores across the ages, but with a peak that requires further analysis just before the oldest group.
ii) Gender differences are not always as marked as might have been anticipated. This is particularly

noticeable in the sub-set 'MODEL SCORE'.

iii) Irrelevant comments about young children, ie. those comments which are unrelated to the task of making the model for a young child, are made as much by girls as boys. The girls made, on average, one less task-relevant comment than the boys, but they made slightly more comments that were highly pertinent to the task.

iv) The Evaluation Score did increase with age, as would be expected if the child's capacity for critical appraisal is age related. The peak score is not with the oldest group and will be subject to further analysis including a consideration of non-verbal reasoning scores.

v) Girls were able to communicate a wider knowledge of Nursery Rhymes than boys.

It is intended to extend the data-base and re-analyise the data to include other variables e.g. non-verbal reasoning ability and laterality. There are sufficient indications to suggest that the assessment of technological capability is amenable to quantitative analysis.

References

1   Kimbell R., *et al. The Assessment of Performance in Design and Technology*, School Examinations and Assessment Council, London (1991)