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ABSTRACT

This study investigated the ability of preschool children in Singapore to conserve number, length, and quantity. Participants were more than 200 children of 3 to 6 years who attended one of six different types of preschool centers. Findings indicated that more than half of the 5.5-year-old children were able to conserve number, but less than 15 percent attained conserver status on length and quantity (liquid substance) tasks. Children in private kindergartens appeared to conserve earlier than did age-mates at nonprivate centers, but were eclipsed by the preprimary pupils in the senior age cohort. Though nonprivate pupils in the younger cohort appeared to lead in conserving length, private center students soon surpassed them. The preprimary children did not do well on the length task. Subjects from nonprivate kindergartens did better than private kindergarteners in conserving quantity. On the whole, results on length and quantity tasks were erratic. Use of the child's preferred language during testing supported previous findings concerning the effectiveness of such language use. It is concluded that provision of relevant activities is important in the development of the ability to conserve. Such activities need not be sophisticated or expensive. Practice in verbalization and causal reasoning give added advantage in tasks involving explanation. Numerous charts and graphs are provided, and nearly 50 references are cited. (RH)

ARE THERE AS MANY DOLLS IN THIS ROW AS THAT ROW?

by

AGNES CHANG, POON TSUI YEONG AND SAW HOOI BIN

1. INTRODUCTION

As the title suggests, this paper deals with "conservation".

The term "conservation" is usually used to refer to the constancy or invariance of certain properties such as number, length, area, volume of matter in spite of the transformation that can be performed on the material involved.

Briefly, during the stage of concrete operations (approximately seven to eleven years), flexible and systematic thought organizes and classifies information. Thinking is no longer focussed on a particular state of an object. It can follow successive changes through various types of reversal, but they are concrete rather than abstract. The attainment of the act of reversibility is the main feature in the development of the child's transition from pre-operational to concrete-operational thought. (Inhelder, 1968).

The importance of conservation as a feature in cognitive development is well illustrated by Lunzer (1968) when he observed that "invariants" serve as elements in the logical conceptualization of the world in terms of its quantifiable, spatial and physical properties.

The principle of constancy (conservation) undergoes a period of development and it is a long time before it can be applied to all possible concrete content. For example, conservation is applied

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to quantity of matter earlier than to weight, and to volume still later.

It is the purpose of this paper to investigate the ability of the Singapore pre-school children in conserving

(a) number,

(b) length, and

(c) quantity (liquid substance).

Western literature has identified specific age ranges at which children could conserve these three proprties. Are our pre-schoolers holding their own against their Western counterparts?

2.1 CONSERVATION OF NUMBER

According to Inhelder (1968), conservation of number can be employed to demonstrate the emergence of concrete operation, since number is among the first dimensions an individual conserves.

As the test used in this study involved verbal justification, only experimental findings of tests using a similar criterion are shown. The following summary of research finding gives an indication of the competency in number conservation of children in the West.

	SOURCE	AGE	N	CONSERVATION (%)
1.	Beard (1963) English subjects	4y 10m 7y 2m	1224	85.3%
2.	Beard (1963) English subjects	4y 10m 7y 2m	1224	70.1%
3.	Beard (1963) English subjects	4y 10m 7y 2m	1224	56.1%

	SOURCE	AGE	N	CONSERVATION (%)
4.	Wallach and Sprott (1964) American subjects	6y 5m 7y 8m	62	45.0%
5.	Wallach, Wall and Anderson (1967)	6y 1m 7y 6m	56	43.0%

There is an immediate contrast between the results obtained from English children (Beard, 1963) and those of American children (Wallach and Sprott, 1964; Wallach et. al. 1967). The better performance of the English children may be due to the fact that they attend school at an earlier age.

2.2 CONSERVATION OF LENGTH

Piaget (1964) and Murray (1965) have shown that the age for the acquisition of conservation of length is between seven and eight. But like that for the conservation of number, Braine (1959) was able to demonstrate that by using non-verbal techniques, it is possible to lower some of Piaget's age norms by more than two years. Based on Braine's conclusions, one could hypothesize that the use of essentially non-verbal techniques would allow the child to reveal his acquisition of the conservation of length at an age younger than seven or eight. Braine's position was reinforced by Sawada and Nelson's (1967) study. They found that with the use of a non-verbal method for training and assessing conservation of length, 60% of the children between 5 years 4 months and 6 years 2 months could conserve length. This summary will indicate the range of ages at which children in the West can conserve length. Explanation was the required criterion for conservation.

	SOURCE	AGE	N	CONSERVATION (%)
1.	Smedslund (1964)	4	10	10%
		5	27	22%
		6	24	58%
		7	31	65%
		8	35	88%
		9	20	95%
		10	11	91%
2.	Vernon (1965)	10-11	100	94%
3.	Lovell, Healey and Rowland (1962) - (Task used was similar to IE-BVL Task)	5	10	0%
		6	15	13%
		7	15	26%
		8	15	53%
		9	15	67%
4.	Gruen (1965)	4y 6m to 6y 4m	90	32%
5.	Elkind (1966)	4	15	26.8%
		5	20	35.0%
		6	16	62.5%
		7	17	76.7%

Comparison of the results shows that the children in the above experiments seemed to conserve length rather well. The only exception is the findings by Lovell, Healey and Rowland (1962). The reason lies in the stringent criterion for conservation used by Lovell et al. (1962). Subjects had to answer three questions correctly before being judged as conservers. Of all the tasks and criteria used in the cited experiments, Lovell's et al task and criterion were the closest to the Singapore study.

2.3 CONSERVATION OF LIQUID SUBSTANCE

When the child realized that pouring a liquid from one container into another does not change the amount, he has achieved liquid conservation. The child has discovered that a lower level of liquid combined with a wider container results in equal quantity by compensation. Piaget considers compensation to be a necessary condition for conservation.

Cohen (1967) demonstrated that four and five year old children could anticipate the level to which liquid would rise when poured into a container of different width. Piaget and Inhelder (1969) however reported that only 5% of subjects tested conserved without also passing the anticipation of level task.

In 1966, Frank tested children from the ages of four to seven, and found that verbalization contributed to the acquisition of liquid conservation. The following summary will give an indication of the range of ages at which children attain conserver status for liquid substance.

	SOURCE	AGE	N	CONSERVATION (%)
1.	Beard (1963)	4y 10m/5y 9m	49	10.2%
		5y 10m/6y 9m	72	20.2%
		6y 10m/7y 9m	42	40.5%
		7y 10m/8y 9m	53	58.5%
		8y 10m+	27	63.0%
2.	Beard (1963) - (more difficult task)	4y 10m/5y 9m	49	4.1%
		5y 10m/6y 9m	72	6.9%
		6y 10m/7y 9m	42	7.3%
		7y 10m/8y 9m	53	23.4%
		8y 10m+	27	29.6%
3.	Wallach, Wall and Anderson (1967) - (Task used was similar to IE-BVL task)	6y 1m to 7y 8m	56	55%

It is perceived from the above set of findings that the difficulty and complexity of the task would affect the conservation operativity of the children.

2.4 LANGUAGE AND CONSERVATION

In the review of research on conservation, it is noticed that investigations have been restricted to children 4 years of age and

older, with most studies dealing with children not younger than five years (Flavell, 1963; Mehler and Bever, 1967). The primary reason for this exclusion of the younger ages is based on Piaget's (1952) belief that conservation of number and quantity is not usually present until age six or seven. These contentions as well as the findings of most investigations (Elkind, 1961; Hood, 1962; Wohlwill and Lowe, 1962; Gruen, 1965; Rothenberg, 1969) indicate that conservation operativity is not commonly present at least until six.

Braine (1964), Braine and Shanks (1965), Bruner (1966), Mehler and Bener (1967) and Winer (1974) have provided contrary evidence from their studies. Their findings suggest that children of four years are able to conserve.

Gruen (1966) pointed out that the conservation criterion used is crucial because it reflects 'the very nature of the process which underlies the concepts with which Piaget's theory deals'. Use of the criteria which do not demand response justification tends to yield markedly lower age norms for conservation ability than when the tasks includes the requirement for an adequate verbal justification of a response.

Rothberg (1969) demonstrated that conservation was rarely present among four and five year old children, when justification is required. She pointed out that data showing conservation in very young children (e.g. Mehler and Bruner, 1967) are confounded by the fact that subjects tended to agree with the investigator more frequently than they disagreed.

The studies cited above more than hint at the vital role of language in conservation. Piaget's use of comparative terms such as 'same', 'less', 'more', 'long', and 'longer' has been criticized for failing to take into account the child's ability to understand such terms.

In the investigation of the cognitive and linguistic development of pre-school children, Donaldson and Wales (1970) concluded that the mastery of 'same' and 'different' is a very complex task. In another related study, Donaldson and Balfour (1968) provided similar data on tasks involving the terms 'more' and 'less'. As with 'same/different' they suggested that the terms 'more' and 'less' varied considerably according to the context of application.

Donaldson and Wales (1970) cautioned that it may be unwise to attribute the finding to the children's cognitive as opposed to their linguistic ability.

Holland and Palermo (1975) concluded from the study on the use of 'more' and 'less' in conservation tasks that conservation operativity is dependent on the capacity to distinguish 'more' and 'less'. Findings from Palermo's (1974) study further showed that 'more' was acquired before 'less' and children who did not know 'less' tended to treat it as a synonym of 'more'. Riegel (1973) observed that a young child tended to use expressions such as 'more' as imperative demands without comparative implication. It is much later that the child could operate simultaneously with three terms (more, less, same) that comparatibility is established.

Studies by Darcy (1963), Lambert (1962) and Macnamara (1966) examined the performance of bilingual children in which language development has been related to varied aspects of intellectual ability. Keats and Keats (1974) made a study of bilingual children who were first pre-tested in one language, given training in the acquisition of the concept of weight in the other language and than post-tested in the first language. Delayed post-tests were administered four weeks later in both languages. The results showed that the concept could be acquired in either language and that concept might be acquired in either language and that concept might by considered independently from the language by which it was acquired. In extending their 1974 work, Keats, Keats and Rafaei (1976) pre-tested in both languages a group of five-year-old Malaysian children, bilingual in English and Malay and, English and Chinese. They were then trained in one langauge on the conservation of weight, post-tested in the other language and again later in both languages. It was concluded from these studies that language plays only a minor part in the acquisition of cognitive concepts and that young children will perform at a slightly higher level on the tasks if tested in their preferred language.

Conservation behaviour in children exposed to two cultures (English and Greek) was examined by Kelly, Tenezakis and Huntsman (1973). Though the subjects were taught in English and had passed the language pre-test, they failed to conserve in English both in the pre- and post- tests. Similar resuts were obtained by Kelly and Philp in 1975.

3. METHODOLOGY

3.1 SAMPLE

Pre-school children of age ranging from three to six years participated in the study. They were grouped into seven age groups with a six month difference between them. These subjects were drawn from six different types of centres viz., *MOE, PAP, PA, NTUC, YWCA and Private.

Four age cohorts of 200 children were specially selected for a longitudinal study of their cognitive development during the whole testing phase. The subjects were tested on four occasions with a six month break in between. Individual testing was carried out by trained research assistants.

3.2 INSTRUMENTATION

(a) Conservation of Number Task

There were two parts to this task. First the experimenter arranged five dolls in a row facing the child and then invited the child to arrange another five (similar) dolls parallel to the first row. The child was asked whether the number of dolls in the two rows

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NOTE: *MOE : Ministry of Education
PAP : People's Action Party
PA : People's Association
NTUC : National Trade Union Congress
YWCA : Young Women Christian Association
Private: Managed by Churches or Individuals

was the same. In the second part, the experimenter knocked down one row of dolls and asked about the equivalence of number in the rows again. Justification of the answer was also required.

(b) Conservation of Length Task

In the first part of this task, the equivalence in length of two pieces of wood was established.

In the next part, the two sticks were placed parallel to one another but not aligned (See Figure 1). Again the

Figure 1 here

child was asked whether the lengths of the two were equivalent. The child was further asked to give an explanation to his answer.

In the last part, the two sticks were arranged into a T figure (Figure 2). The same questions were asked of the child as in the second part.

Figure 2 here

(c) Conservation of Liquid Substance Task

Equivalence was first established by pouring an equivalent amount of coloured water into two similar containers.

The second part involved getting the child to use his/her imagination to hypothesize whether the liquid in one of the containers when poured into a cylinder (taller but narrower) would be the same in amount as in the other container. The answer must be further justified.

After this, the actual act of pouring the liquid was carried out and the child was asked to compare the amount of liquid in the container and the cylinder. Again, an explanation to the answer was expected.

4. RESULTS

After the first data collection, the conservation tasks were modified. Hence only the second to fourth sets of data were presented and analysed here.

The frequencies given in the tables indicate the number and percentages of children attaining conservation status in the tasks.

Both the cross-sectional and longitudinal data for the three data collections are presented and discussed. The data for each conservation task are first analysed and then compared. Further comparisons are made between the performances in the three conservation tasks by the different types of pre-school centres.

4.1 Cross-sectional Data

The frequencies of conservation attainment for each conservation task (number, length and liquid substance) in

the three data collections are presented in Table 1. The graphical revision is given in Figure 3.

The results show that a positive developmental trend was generally observed for the Conservation of Number Task in all the three data collections. Moreover, the improvement with age was also quite substantial, as illustrated by the sharp gradients in igure 3. But there was no observable improvement in performance in Data Collection's 3 and 4 over Data Collection 2. This is unusual as some subjects had attempted the task more than once.

Developmental trends could also be perceived in the data for the Conservation of Length Task and Conservation of Liquid Substance Task but were less obvious than those for the Conservation of Number Task. One could describe these trends as being erratic. There were improvements in the performances of the older age groups in Data Collection 4 over the previous two collections.

For all the three Data Collections, it is quite clear that the children performed best in the Conservation of Number Task. By the age of 5½ years old, more than 50% of the children were able to conserve number. In contrast, the children did not seem to do too well in the other two tasks. Even with improved performances in Data Collection 4, the percentage of 5½ years old attaining conservation status was less than 15% for both tasks. Though the children seemed to do slightly better in conserving liquid substance for Data Collection 2, the difference in the number of children

achieving conservation of length and of liquid substance was less obvious for Data Collections 3 and 4.

Table 1 and Figure 3 here

The longitudinal data of four age cohorts of children were also examined to see whether similar patterns of development were observed here.

4.2 Longitudinal Data

The longitudinal data (Table 2) on the Conservation of Number gave support to the cross-sectional data analysed in the earlier section. Positive development trends were noted for all the cohorts across the three Data Collections. Furthermore, each cohort gave better performances with an increase in age for the cohort.

The positive trend in development was not perceivable for the other two conservation tasks in all the four cohorts. The only exception was observed in the 4-4½ year old cohort (C) for the Liquid Substance Conservation Task.

Once again for the longitudinal data, each cohort was better able to conserve number than length and liquid substance. Though initial data promised better results for liquid substance, the trend was not evident in the older cohorts.

Table 2 here

ANOVA tests were carried out on the data for each task across the three collections for each cohort. Only Cohort A (3-3½) and Cohort B (3½-4) showed gains across the 3 collections to give significant F-ratios in the Number Conservation Task ($P_A < .002$, $P_B < .038$). Non-significant F-ratios were obtained for the other computations.

Tables 3, 4 and 5 here

Though conservation tasks are considered cognitive tasks which are dependent on maturation, researchers have indicated that relevant activities and training can bring about earlier competence in the conservation tasks. Moreover, there is research evidence to show that the performance on conservation tasks is very much affected by language competence (Sigel, 1960; Kingslay and Hall, 1967; Whitman and Peisach, 1970). Hence in the next section, we are going to compare the performances in the three conservation tasks by the different centre types which vary considerably in terms of curriculum activities.

4.3 Centre Type Differences

The centres were re-grouped into three categories for comparison. They were the private and non-private kindergartens and MOE pre-primary classes.

Both the private and non-private kindergartens run classes for the three to six years old. But the similarity between the two centre-types ends there. The private kindergartens

offer a longer programme (2½ to 3 hours) and their teachers are trained instructors. As the fees are high, most of the pupils come from families who can afford the relatively high fees. In contrast, the non-private kindergartens usually offer 1½ to 2 hour programmes to children from the neighbouring housing estates. Most of their parents are from the working class. In addition, many of the teachers are not formally trained.

The MOE pre-primary classes are attended by five and six years old children for a year before they join the primary classes in the same schools. The total duration of lessons is 4 hours daily. The classes are manned by certified teachers. Pupils attending the MOE pre-primary classes come from families of varied socio-economic status.

For the three to five years old, comparison is only made between the private and non-private kindergartens.

Table 6 gives the comprehensive presentation of the number of pupils attaining conservation status in the three conservation tasks across the 3 Data Collections, while the graphical comparisons between the centres were found in Figures 4.1, 4.2 and 4.3.

Table 6 here

4.3.1 Conservation of Number

An examination of Figure 4.1, will give you this interesting picture of comparisons.

For Data Collection 2, the younger children from the non-private centres seemed to perform better than the private centres. But the children in the 5-5½ Age Group in the private centres caught up and even surpassed their counterparts in the non-private centres. However, it is noticeable that for both centre-types, there was a fall in performance for the 5½-6 Age Group. For the pre-primary group, comparison could only be made for the 5-5½ and 5½-6 Age Groups. The younger group trailed behind the private and non-private groups but the older group was able to eclipse the other two centre-types.

Data Collection 3 saw the private centres maintaining a steady lead ahead of the non-private centres for most groups. The same pattern was repeated for the Pre-primary Group here as in Data Collection 2.

In terms of the performances of the three centre-types in Data Collection 4, the pattern was very similar to that of the second Data Collection, i.e., the non-private centres taking the lead in the younger age groups and the pre-primary centres outperforming the other two in the oldest age group.

Two points of interest should be noted here. For the private centres, the 5-5½ Age Group in Data Collections 2 and 4 and the 5½-6 Age Group in Data Collection 3 seemed to perform better than the older pupils. The second observation that deserves some attention was

the substantial gain made by the pre-primary group. The younger pre-primary pupils were trailing behind the private and non-private counterparts while the older pupils had forged ahead of the other two centre-types, especially in the fourth Data Collection.

Figure 4.1 here

4.3.2 Conservation of Length

The results of the three centres types on this task were by no means brilliant (Table 6, Figure 4.2). At best, only 25% of one group of pupils (pre-primary) were able to conserve length. It is noticeable that for Data Collection 2, the non-private centre pupils in the younger age groups were doing better than the private centres. The older pupils in the private centres (5-6 years old) took over the lead from the non-private centres. The pre-primary pupils did not show up well in this task.

For both Data Collections 3 and 4, the private centres had an edge over the two other centre types for most age groups. The only exception was the 6+ Age Group in the third Data Collection. No one in that group could attain conservation status for length!

The pre-primary pupils did not give the same sterling performance in this task as in the task on number.

Figure 4.2 here

4.3.3 Conservation of Liquid Substance

The results for the Conservation of Liquid Substance were comparable to those of the Conservation of Length (Table 6, Figures 4.2, 4.3). Most of the age groups for all the three centre types scored below 20%.

For Data Collections 2 and 4, the non-private centres were ahead of the private centres all the way. The 6+ Age Group of the non-private centres lost out to the private centres in Data Collection 3.

Generally, the older pre-primary pupils did better than the younger pupils but the reverse was observed in the fourth Data Collection. Their better scores were comparable to those of the private and non-private centres.

Figure 4.3 here

5. DISCUSSION

According to the studies by Smedslund (1961), Elkind (1961), Mannix (1960) and Beard (1963), six-year old children do not understand the Conservation of Number. Wallach et al. (1964,

1967) tested a sample of older children (6+ years to 7+ years) and found that less than 50% were conservers of number. Hence our young pre-schoolers were not doing too badly when compared to their Western counterparts. More than 50% of our 5½ years old were able to conserve number. This is borne out also by the commendable results they have achieved on the other Mathematical Tasks. According to Piaget (1952), Conservation of Number plays a significant role in developing the concept of number.

That number is among the earlier dimensions to be conserved compared to others like length and liquid substance is illustrated by the results of the other two concepts. The number of 5½ years old children attaining conserver status on the tasks on length and liquid substance was less than 15% for both tasks. Bearing in mind that the local tasks required correct judgements in 2-part tasks and verbal explanations, it was indeed not easy.

Piaget (1964) and Murray (1965) concluded from their studies that children can only show an understanding of length conservation after the age of seven when verbal explanation is the criterion. Lovell (1962) who had carried out an experiment on length conservation using a task similar to the local task found that only 13% of his six-year old children were conservers.

Beard (1963) found that the percentage of conservers in the liquid substance task varied quite dramatically according to the complexity of the task. In a difficult task involving more verbalization, only 6-9% of Beard's 5 year 10 month/6 year 9 month cohort were able to demonstrate conservation. Using a task similar to our local task, Wallach et al showed that 55% of their

children between the age of 6 years 1 month and 7 years 8 months were conservers.

In making a quick comparison between the results obtained in classsical studies using Piagetian tasks and our own findings, we could safely say that our children are holding their own quite well against their Western counterparts.

According to Wheatley (1970), the age of attainment of conservation is dependent on the socio-economic level and the experiences of the child. As most of the children attending the private kindergartens come from homes which can provide better material support, one may expect them to be conservers at an earlier age. This is further reinforced by the activities and experiences such as building blocks, lego, water and sand play, provided by the private centres. Indeed, they appeared to be ahead of the pupils in the non-private centres for the Conservation of Number. But they were eclipsed by the pre-primary pupils in the most senior age cohort.

Though the non-private pupils appeared to lead in the younger cohort for the Conservation of Length, the lead was soon taken over by the private pupils. The pre-primary children were not doing too well on the task on length.

The non-private kindergartens did better on the Conservation of Liquid Substance Task than the private kindergartens despite their lack of facilities. This is indeed intriguing for the non-private pupils to show better understanding of the Conservation of Liquid Substance. Perhaps the home experiences of these children provide

the necessary training. Children from the non-private generally do not have the luxury of having domestic help to do the house chores. Hence they may have to help out with the simplier chore of washing up after a meal. The experience of filling containers of different sizes and shapes with water probably provides the necessary training. This heralds good news for the use of simple activities in teaching children reversibility which is so vital in conservation operativity.

On the whole, the results on the Conservation of Length and of Liquid Substance were found to be erratic.

The initial fear of the problem with language is alleviated when the use of the preferred language of the child during testing helped to place all the children on an equal footing. This gives support to the findings by Keats and Keats (1974) and Keats, Keats and Rafaei (1976). These studies indicate that children perform better when tested in their own ethnic languages.

6. CONCLUSION

The results on the performance of Singapore pre-schoolers in conservation tasks show that our young children are doing as well as their Western counterparts, albeit erratic at times.

Provision of relevant activities is important in the development of conservation operativity. However, the activities need not necessarily be sophisticated and expensive. Practice in verbalization and in causal reasoning will give added advantage in tasks involving explanation.

Figure 1: Conservation of Length

Task 1

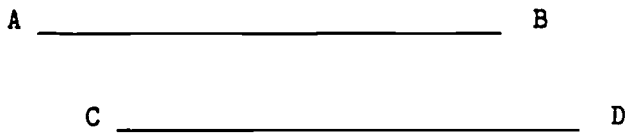

Figure 2: Conservation of Length

Task 2

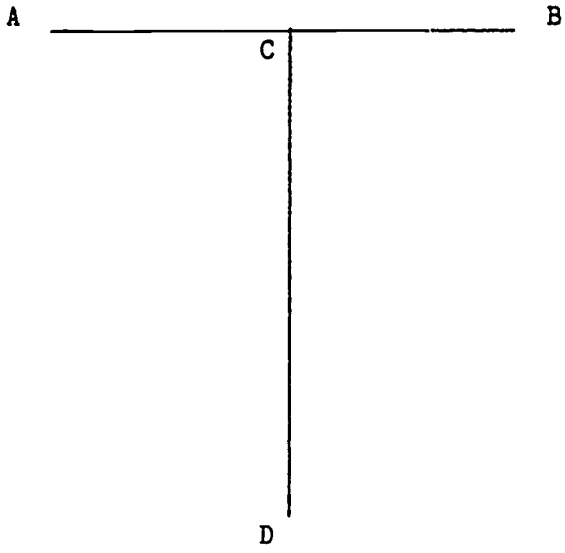

Table 1: Frequencies of *Three Conservation Tasks for Three Data Collections (Cross-Sectional)

Age Group	D2			D3			D4		
	CNG	CLG	CSG	CNG	CLG	CSG	CNG	CLG	CSG
3y-3y5m	10 9.62	3 2.88	9 8.65				8 9.88	2 2.47	6 7.41
3y6m-3y11m	11 10.09	4 3.67	7 6.42	12 11.88	1 0.99	2 1.98	7 7.22	2 2.06	8 8.25
4y-4y5m	26 22.41	4 3.45	4 3.45	19 26.76	1 1.41	3 4.23	32 27.12	5 4.24	9 7.63
4y-4y11m	31 25.83	5 4.17	7 5.83	51 41.46	4 3.25	6 4.88	36 36.00	6 6.00	4 4.00
5y-5y5m	51 54.26	6 6.38	8 8.51	31 40.26	5 6.49	2 2.60	56 45.90	15 12.30	14 11.48
5y6m-6y	54 51.92	7 6.73	7 6.73	71 54.62	15 11.54	10 7.69	57 55.88	15 14.71	15 14.71
6+				43 57.33	5 6.67	7 9.33			

NOTE: * CNG (Conservation of Number)
CLG (Conservation of Length)
CSG (Conservation of Liquid Substance)

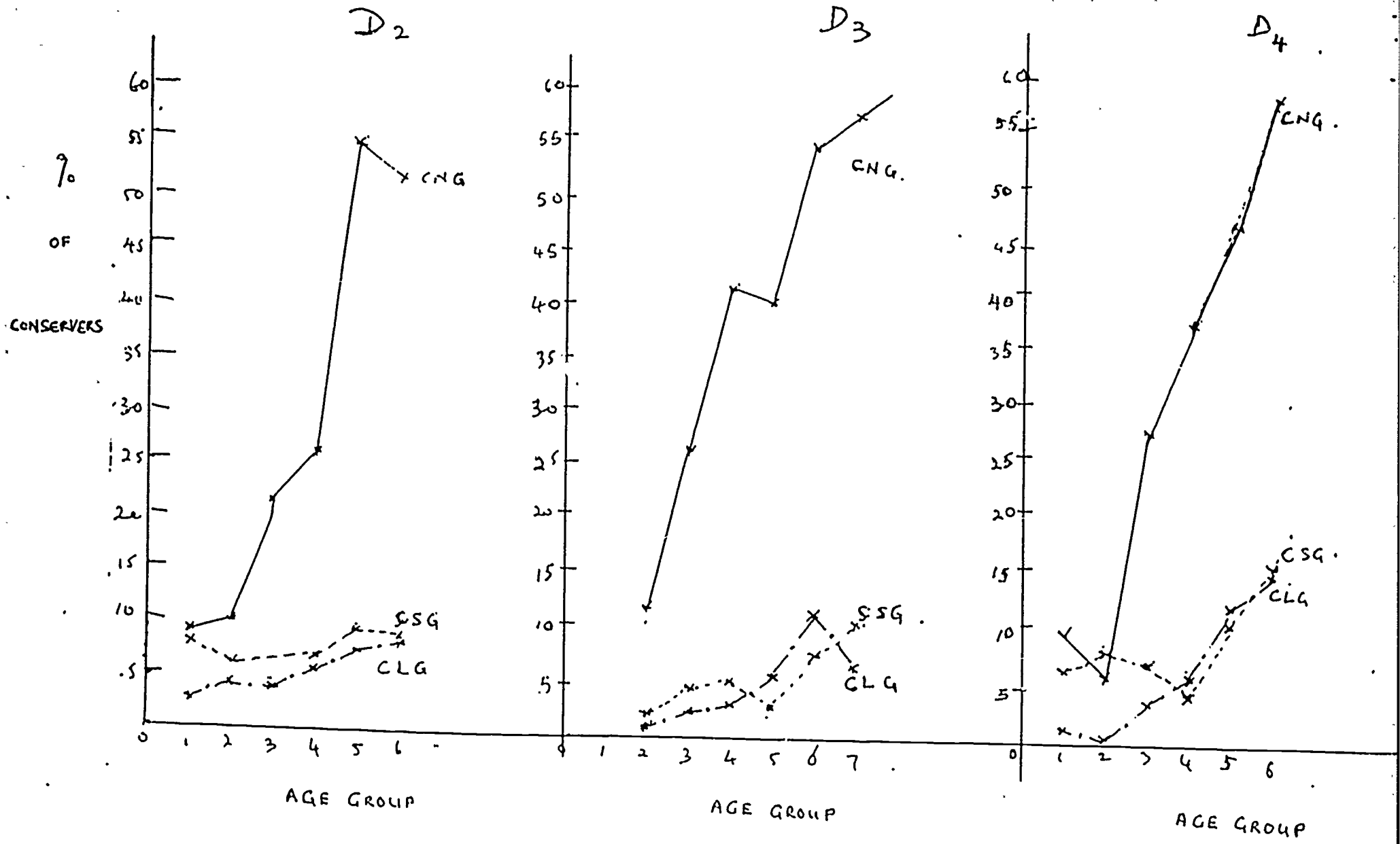

Fig 3. Graphical Presentation of Data of 3 Conservation Tasks for 3 Data Collections.

KEY:

CNG : Conservation of Number
CLG : Conservation of Length
CSG : Conservation of Liquid Substance.

D2 : Data Collection 2
D3 : Data Collection 3
D4 : Data Collection 4.

Table 2: Frequencies of Conservation Attainment of *Three Conservation Tasks for Three Data Collections (Longitudinal)

Cohort	D2			D3			D4		
	CNG	CLG	CSG	CNG	CLG	CSG	CNG	CLG	CSG
COHORT A 3y-3y5m (N=52)	5 9.62	1 1.92	3 5.77	6 11.54	1 1.92	1 1.92	16 30.77	1 1.92	5 9.62
COHORT B 3y6m-3y11m (N=58)	5 8.62	3 5.17	5 8.62	14 24.14	1 1.72	1 1.72	18 31.03	5 8.62	4 6.90
COHORT C 4y-4y5m (N=47)	11 23.40	1 2.13	2 4.26	18 38.30	1 2.13	3 6.38	21 44.68	5 10.64	4 8.5:
COHORT D 4y6m-5y (N=43)	10 23.26	3 6.98	3 6.98	17 39.53	4 9.30	3 6.98	20 46.51	3 6.98	6 13.95

NOTE: * CNG (Conservation of Number)
CLG (Conservation of Length)
CSG (Conservation of Liquid Substance)

Table 3: ANOVA on Longitudinal Data of Conservation of Number for 4 Cohorts

	COHORT A N=52	COHORT B N=58	COHORT C N=47	COHORT D N=43
D2 $\bar{X}$	2.83	2.64	2.98	3.09
D3 $\bar{X}$	2.23	2.67	3.04	3.16
D4 $\bar{X}$	3.19	3.17	3.49	3.56
DF	2	2	2	2
ANOVASS	24.50	10.38	7.28	5.41
F	9.24	3.33	1.72	1.37
P	.0002	.038	.184	.257

Table 4: ANOVE on Longitudinal Data of Conservation of Length for 4 Cohorts

	COHORT A N=52	COHORT B N=58	COHORT C N=47	COHORT D N=43
D2 $\bar{X}$	2.21	2.36	2.11	2.42
D3 $\bar{X}$	2.10	2.16	2.28	2.44
D4 $\bar{X}$	2.12	2.40	2.43	2.33
DF	2	2	2	2
ANOVASS	0.397	1.98	2.397	0.33
F	0.75	1.90	2.46	0.23
P	.474	.152	0.09	.798

Table 5: ANOVA on Longitudinal Data of Conservation of Liquid Substance for 4 Cohorts

	COHORT A N=52	COHORT B N=58	COHORT C N=47	COHORT D N=43
D2 $\bar{X}$	2.27	2.55	2.15	2.42
D3 $\bar{X}$	2.25	2.22	2.45	2.44
D4 $\bar{X}$	2.38	2.41	2.51	2.33
DF	2	2	2	2
ANOVASS	0.55	3.14	3.50	0.60
F	0.45	2.57	2.71	0.37
P	.64	.08	.07	0.69

Table 6: Frequencies of Conservation Attainment of *Three Conservation Tasks
(According to Centre-types)

Age Group	D2									D3									D4								
	Non-Private			PTE			Pre-Primary			Non-Private			PTE			Pre-Primary			Non-Private			PTE			Pre-Primary		
	CNG	CLG	CSG	CNG	CLG	CSG	CNG	CLG	CSG	CNG	CLG	CSG	CNG	CLG	CSG	CNG	CLG	CSG	CNG	CLG	CSG	CNG	CLG	CSG	CNG	CLG	CSG
3y-3y5m	5	1	3	2	0	2	-	-	-	-	-	-	-	-	-	-	-	-	3	1	2	4	1	3	-	-	-
	15.15	3.03	9.09	6.06	0	6.06	-	-	-	-	-	-	-	-	-	-	-	-	3.04	4.35	8.70	12.50	3.13	9.38	-	-	-
3y6m-3y11m	6	2	2	3	1	0	-	-	-	4	0	0	5	1	0	-	-	-	4	1	4	1	1	3	-	-	-
	16.22	5.41	5.41	9.38	3.13	0	-	-	-	12.90	0	0	13.89	2.78	0	-	-	-	11.76	2.94	11.76	2.94	2.94	8.82	-	-	-
4y-4y5m	12	2	2	6	1	1	-	-	-	7	0	0	7	1	0	-	-	-	11	1	2	6	1	2	-	-	-
	25.00	4.17	4.17	22.22	3.70	3.70	-	-	-	25.92	0	0	38.89	5.56	0	-	-	-	23.91	2.17	4.35	18.75	3.13	6.25	-	-	-
4y6m-4y11m	16	2	4	4	0	0	-	-	-	22	1	1	10	1	1	-	-	-	18	4	4	8	2	0	-	-	-
	29.09	3.64	7.27	23.3	0	0	-	-	-	40.74	1.85	1.85	40.00	4.00	4.00	-	-	-	36.73	8.16	8.16	42.11	10.53	0	-	-	-
5y-5y5m	14	0	3	16	3	2	10	0	0	15	3	2	6	1	0	-	-	-	23	4	7	13	4	2	5	2	3
	63.64	0	13.60	88.89	16.67	11.11	41.67	0	0	45.45	9.09	6.06	42.86	7.14	0	-	-	-	46.94	8.16	14.29	36.52	17.39	8.70	35.71	14.29	21.43
5y6m-5y11m	12	1	0	8	1	0	12	1	3	18	4	4	17	5	2	15	2	3	16	4	6	9	5	3	20	4	3
	50.00	4.17	0	50.00	6.25	0	52.17	4.35	13.09	52.94	11.76	11.76	62.96	18.52	7.41	48.38	6.45	9.68	51.61	12.90	19.35	45.00	25.00	15.00	71.43	14.29	10.71
6+	-	-	-	-	-	-	-	-	-	9	2	0	7	0	3	11	2	3	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	52.94	11.76	0	53.85	0	23.08	68.75	12.50	18.75	-	-	-	-	-	-	-	-	-

NOTE: * CNG (Conservation of Number)
CLG (Conservation of Length)
CSG (Conservation of Liquid Substance)

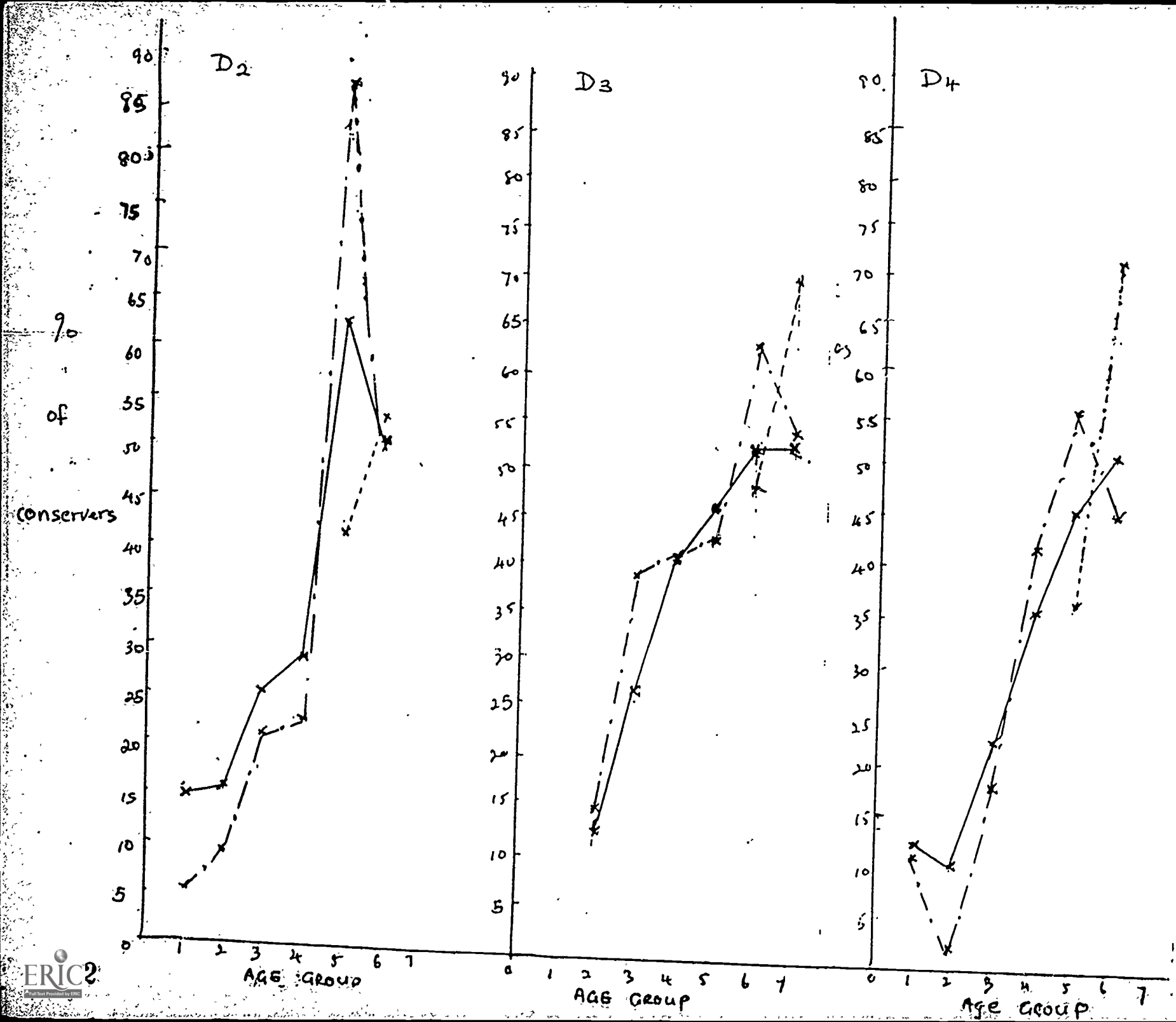

Fig 4.1: Graphical representation of data on Conservation of Number for Centre-types

KEY

——— Non-Pt

—·—·— Pte

- - - - - - Pre-Pri

Age Group

1 : 3y - 3y5m
2 : 3y6m - 3y11m
3 : 4y - 4y5m
4 : 4y6m - 4y11m
5 : 5y - 5y5m
6 : 5y6m - 5y11m
7 : 6+ y.

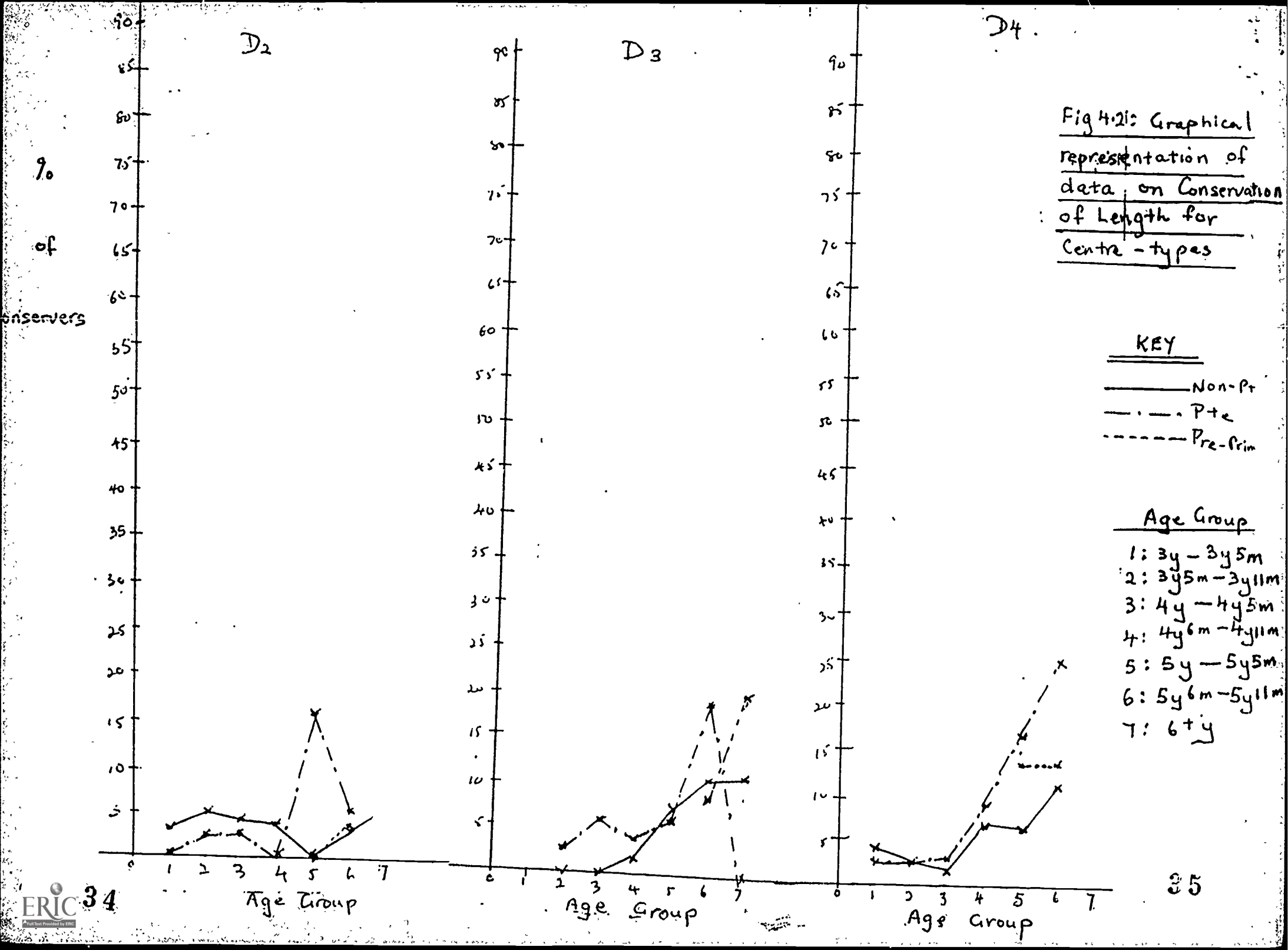

Fig 4.21: Graphical representation of data on Conservation of Length for Centre-types

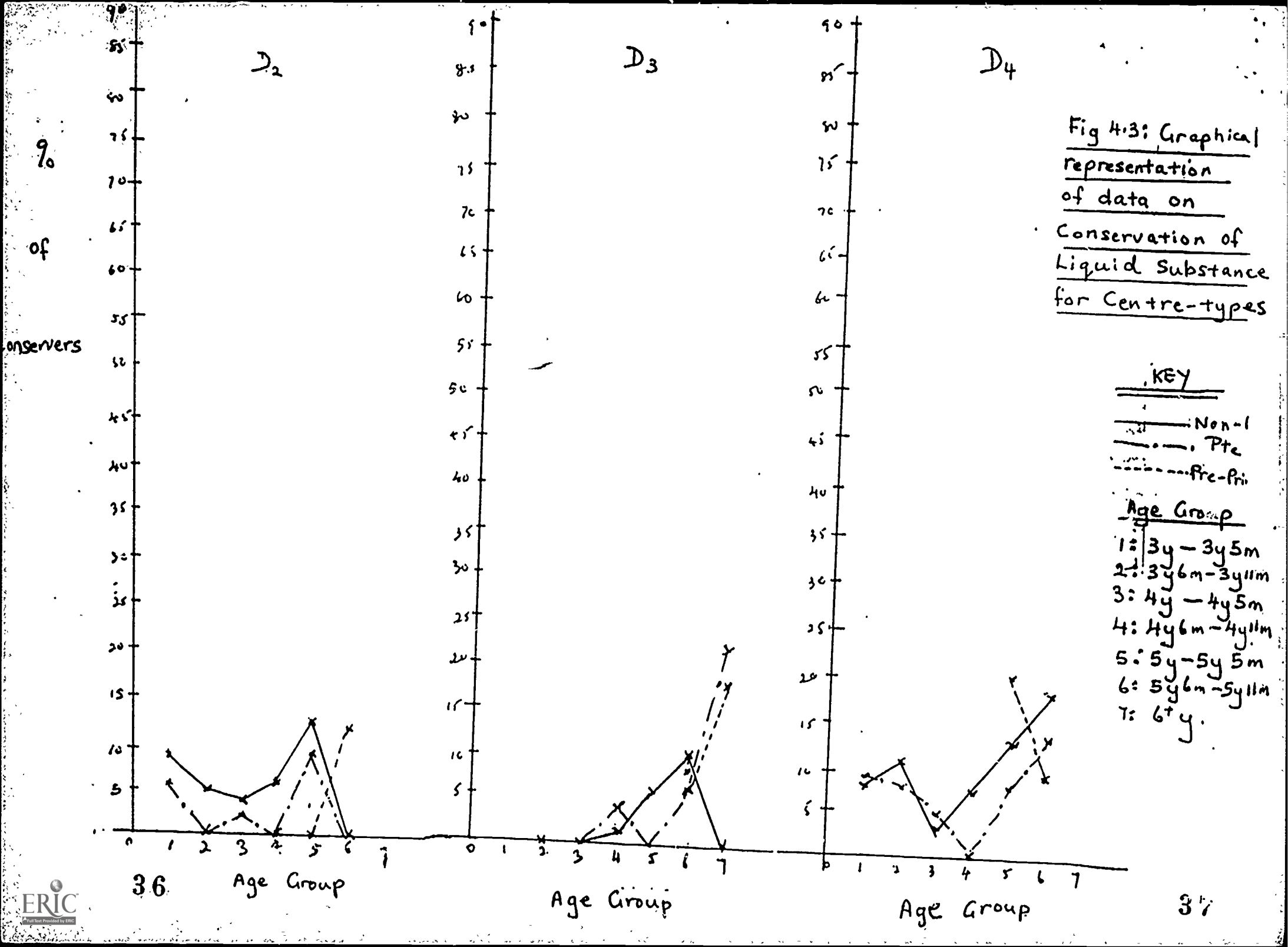

Fig 4.3: Graphical representation of data on Conservation of Liquid Substance for Centre-types

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