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By-Barritt, Loren S.

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Studies (2) of auditory memory performance are reported. Children were asked to recall material which permitted different language habits to be used (structural, and meaningful). Lower socio-economic status (LSES) Negro children performed more like their middle socio-economic status white (MSES) counterparts on non-contingent strings. When structure could be used to aid in recall, MSES performed better than LSES children. LSES children in the first and second grades gained more during the year between studies than did the MSES first and second grade children. Third grade LSES children did not show the same performance gains. (Author)

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A COMPARISON OF THE AUDITORY MEMORY PERFORMANCE OF NEGRO AND WHITE CHILDREN FROM DIFFERENT SOCIO-ECONOMIC BACKGROUNDS[1]

Loren S. Barritt

Center for Research on Language and Language Behavior
and
School of Education
The University of Michigan

2 studies of auditory memory performance are reported. Children were asked to recall material which permitted different language habits to be used (structural, and meaningful).

Lower socio-economic status (LSES) Negro children performed more like their middle socio-economic status white (MSES) counterparts on non-contingent strings. When structure could be used to aid in recall MSES performed better than LSES children.

LSES children in the first and second grades gained more during the year between studies than did the MSES first and second grade children. Third grade LSES children did not show the same performance gains.

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It has been demonstrated that the performance of children from different racial and socio-economic backgrounds who differ on several language measures is not different on a Binet type auditory memory test (Barritt, Weener, & Semmel, 1966; 1967). Since short term memory capacity is similar across socio-economic groups of children and since there are well established differences in language performance between socio-economic groups then one might use this task with different kinds of language materials to identify specific language skills that differentiate socio-economic groups. For example, the auditory memory of lower and middle class children for a random string of digits is similar (Barritt, Semmel, & Weener, 1967) and it is also similar for nonsense syllables but it may not be similar when language habits can be used to aid in recall.

Miller (1956) has pointed out that human memory capacity is fixed and that one increases the amount recallable by expanding the amount of information contained in each remembered unit by chunking. A sentence is chunkable because of the rules which we have for processing it. A string of nonsense syllables

is relatively unchunkable. The meaning and structure of language permits chunking and therefore increases the number of units which can be recalled.

The use of the auditory memory procedure with different kinds of material should be a useful tool for evaluating the nature of the difference between middle class and lower class children's language performance. The material can be varied by adding meaning and/or structure while increasing length. If meaning or structure or both are more helpful to the middle class than the lower class child then it should be apparent when the performance of the groups are compared with different kinds of material.

In an earlier study this prediction was not substantiated (Barritt, Semmel, & Weener, 1967). However, the children used as Ss in that study lived in the same community and the socio-economic distinctions were not stark. The present study sought to remedy these problems.

It was therefore expected that the children from lower socio-economic backgrounds would do as well as their middle class peers when asked to remember non-contingent strings of either nonsense words or meaningful words but that the groups would be dissimilar in capacity for structured strings.

It was further expected that a cumulative deficit would be observed in comparing these two groups. Older children from lower socio-economic status backgrounds (LSES) would be farther behind their older middle socio-economic status (MSES) peers than would the younger children.

Hypotheses

It was predicted that:

Hypothesis 1

Children would recall more information as lists permit the use of semantic and/or syntactic language habits. Thus it should be possible for children to recall more units when the material is presented in sentence form than when there are no contextual constraints between items in the list.

Hypothesis 2

Older children would recall more units of information than younger children.

Hypothesis 3

The disparity between older and younger children would become greater as tasks permit the use of language skills to aid in recall.

Thus older and younger children should be more alike in recall ability for nonsense words than for meaningful sentences.

Hypothesis 4

Children from different socio-economic backgrounds would be increasingly dissimilar in auditory memory capacity as previously learned language habits could be used to aid in recall. Thus children from the MSES group would remember more of the sentence material than their LSES counterparts, but that these groups would be more similar in recall for unstructured material.

Hypothesis 5

The predicted interaction between task levels and SES backgrounds would be greater for older than younger children. In other words a cumulative deficit is predicted between SES groups with increases in age. This deficit should manifest itself most clearly in older children at Levels 3 and 4 where language habits can be most helpful.

This paper reports the results of two investigations made one year apart with the same children. The materials used were similar in form but varied slightly in content. The groups of children were in the kindergarten, first and second grades when first tested. One year later they were first, second, and third graders.

Method

Sample. Children were selected from two schools in Michigan. Lower socio-economic status (LSES) children were Negro and came from a school community that was lower middle class in composition. None of the parents of these children were reported to have had college training. The children attended an all-Negro school.

Middle socio-economic status (MSES) children were white and were chosen from the University Elementary School at the University of Michigan. The average father of these children had attended school beyond high school for over six years. Most were engaged in professional work.

The children were tested initially in early 1967 and again at about the same time one year later. Kindergarten, first, and second grade levels were tested initially. These same children were tested again in the first, second, and third grades after one year.

In 1967 the LSES plus the MSES groups contained 102 Ss. In 1968 some children in the original sample were no longer present. A reduction in the sample sizes was necessitated. The 1968 sample contained 72 Ss. The sample reduction in 1968 was equated for both groups at each grade level by the random deletion of Ss.

There were 17 Ss at each grade level in each group in 1969 and 12 per grade in each group in 1968. A separate analysis of the 1967 data with the diminished 1968 sample revealed the same results obtained with the entire 1967 group. It is therefore assumed that results for 1968 are comparable with results that would have been observed had the samples remained intact.

Procedure

Each child was seen individually by a white female who conducted all of the experimental sessions in a small private room. Instructions were read after E was confident that the child was at ease. The instructions included several test tasks to insure the child's understanding of the procedure.

The instrument used was developed earlier for comparing similar groups of young children (Barritt, Semmel, & Weener, 1967). It consisted of an auditory memory test for four different kinds of material. Items in the first task level consisted of CVC trigrams selected at random from the Underwood and Shultz lists (1960) with meaningfulness ratings in the 30-70 range. The second task level contained nouns selected randomly without replacement from the 500 most frequent words in the original Thorndike count, excluding common homonyms (Thorndike & Lorge, 1944).

The third and fourth task levels contained sentences with respective items at each level having the same grammatical structure. Level 3 were meaningless (anomalous) and Level 4 meaningful sentences. The anomalous (Level 3) sentences were generated by stratifying the word pool from Level 4 on form class and then selecting words randomly to fit the appropriate frames at Level 3.

The entire auditory memory test was recorded and presented to Ss on a tape recorder. The words in Levels 1 and 2 were read as a list at the rate of 1

unit per second. The sentences of Levels 3 and 4 were read with normal sentence inflection at the rate of three words per second. Lists were presented in four different orders based on a balanced 4 x 4 Latin square. Each S was asked to recall the words in proper order. Only one trial was given for each item and the ceiling was established at two incorrect items in each list. The S's responses were recorded and scored later as an immediate memory span test. A S's score for each level was the number of words in the last item correctly recalled.

Children from the two school samples were seen on alternate days until testing was completed. Each child was assigned by order of appearance in the test situation to one of the four orders of level presentation.

Specific stimulus items at Levels 2, 3, and 4 were changed slightly for the second year's testing. This was done to reduce the complexity and irregularity fo the structures for Level 3 and 4 sentences as they became longer. Words were deleted from Level 2 strings that could be nouns as well as some other part of speech. No changes were made in Level 1 items. The intent of these changes was to control more carefully the nature of the tasks presented to Ss. The 1967 and 1968 versions of the test are presented in the appendix.

Results

Study I (1967). The raw score means and standard deviations for each of the groups at the four task levels are presented in Table 1. It should be noted that the standard deviations are markedly different across the four task levels. The largest variance is 36 times the smallest. Further these means and variances are correlated. A log transformation was performed upon the raw scores which reduced this correlation and also the heterogeneity. All of the statistical analyses were performed with transformed scores. Tables and figures display raw score values.

Insert Table 1 about here

A three way ANOVA was performed upon the transformed data with the two levels of socio-economic status, the three grades and four task levels serving as factors (Edwards, 1960, p. 224). All of the main effects were significant while none of the interactions were significant. The F ratios were 21.89 $p < .01$ for

socio-economic status, 4.08 $p < .05$ for grade level, and 371.20 $p < .01$ for task levels.

Confirmation of Hypothesis 1 that children remember more units as language habits can be utilized was supported by the large F ratio for task levels. Examination of the means at each task level reveals that striking increases are achieved from one level to the next as language skill supplements memory capacity to increase the number of units recalled.

The second hypothesis was confirmed by the significant main effect observed for grade levels. Figure 1 displays the means for this analysis at each of the task levels. Older children remember more units than younger children.

Insert Figure 1 about here

The third prediction that older children will do better, relatively speaking, at task Levels 3 and 4 when compared to 1 and 2 calls for the observation of an interaction between task levels and grades. This prediction was not confirmed even though the graph of the trends in Figure 1 seems to support the prediction.

Hypothesis 4 requires that an interaction between socio-economic status and task levels be observed. This hypothesis was not confirmed. There is no significant difference in the slope of the trends across task levels for LSES and MSES children. Figure 2 is a graph of the trends for this analysis. The significant main effect for socio-economic status coupled with the lack of a significant interaction with task levels suggests that the differences between LSES and MSES children in memory capacity remains relatively constant as the nature of the material to be recalled changes.

Insert Figure 2 about here

The absence of a significant three-way interaction between SES, grades, and task levels indicates that the trends of increase from Levels 1 to 4 is not different for the three grade groups from different SES backgrounds. Hypothesis 5 must be rejected.

Figures 3, 4, and 5 are plots of the two SES groups at each of the four task levels. Examination of the figures suggests that even if the three-way interaction had reached a level of statistical significance, it would have been

due to the greater deficits at Levels 3 and 4 for younger low SES children rather than older. This is the opposite trend from that which was predicted. Like findings have been reported in studies of similar groups but using PA learning tasks (Semler & Iscoe, 1963; Rohwrer, 1967).

Insert Figures 3, 4, and 5 about here

It is difficult to know whether this trend, opposite to that predicted, was a function of a difference in the samples at the three ages or was a trend occurring as a function of the experience children were having at these different ages. To obtain more information about these alternatives the study was replicated after one-year with the same group of children.

If the observed trend was a function of age related experiences, then the two younger groups of children should become more similar when retested after one year. Certainly any inference about the observations presented here would have to rest on a closing of the gap between socio-economic status groups during the second grade. If sampling error was involved, then one might expect to find the younger groups becoming more dissimilar as the cumulative deficit hypothesis suggests.

Study II (1968). The raw score means and standard deviations for each of the groups at the four task levels are presented in Table 2. Again there was a correlation between the means and variances. To reduce the correlation a log $x + 2$ tranformation was performed upon the raw scores. All statistical analyses were performed upon the transformed scores. Tables and figures, however, display raw scores to facilitate interpretation of the data.

Insert Table 2 about here

A three-way ANOVA was performed upon the scores with two levels of socio-economic status, the three grades, and four task levels serving as factors (Edwards, 1960, p. 224). All main effects were significant as was the case in Study I.

These children from MSES and LSES backgrounds differed in their ability to recall the information presented to them ($F = 7.64$; df 1, 66; $p < .01$). The MSES children recalled more than the LSES children. Older children recalled more than younger children ($F = 3.480$; df 2, 66; $p < .05$). There was an increase in the number of units remembered as structure and meaning could be used

to aid recall ($F = 411.89$; df 3, 198; $p < .01$). The interaction between socio-economic status groups and task levels was significant ($F = 2.72$; df = 3, 198; $p < .05$). A test of the difference between the means for LSES and MSES groups at each of the four levels was performed (Winer, 1962, p. 344). The LSES and MSES were not significantly different from one another in their memory for nonsense or nouns. The groups were, however, significantly different from one another at Levels 3 and 4. In each case the MSES children exceeded their LSES counterparts. The difference between groups at Level 3 ($F = 15.34$; df 1, 198; $p < .01$) was larger then the difference at Level 4 ($F = 5.26$; df 1, 198; $p < .05$).

Hypothesis 1 is confirmed. Children recall more items as structure and meaning are introduced into the task. The significant main effect for task level supports this prediction. Hypothesis 2 that older children recall more than younger children is supported by the significant main effect for grades. Hypothesis 3 that older children would make better use of structure and meaning than younger children requires the observation of an interaction between grades and task levels. This prediction was not confirmed ($F < 1$). The shape of the curves for grades across the four task levels was not different.

The interaction between socio-economic status and task levels confirms Hypothesis 4. In Figure 6 it can be seen that children from the SES groups are more similar to MSES children in memory for nouns and nonsense than they are for anomalous or meaningful sentences.

Insert Figure 6 about here

Confirmation of Hypothesis 5 requires the observation of a significant three-way interaction with the older children from different socio-economic groups being more dissimilar than the younger on Levels 3 and 4 than on Levels 1 and 2. No such interaction was observed. The curves for grade 1, 2, and 3 can be seen respectively in Figures 7, 8, and 9.

Insert Figures 7, 8 and 9 about here

In Study I it was observed that children from different socio-economic groups became more similar with age rather than less so. A major reason for replicating the first study derived from the finding. Do children from markedly different backgrounds become more alike as they progress through school?

The present study sought an answer to this question. An affirmative response could be supported by a significant interaction between grade and socio-economic status. This effect was not significant in Study II. The trend observed in the first study was also not significant. However, it was the observation of a trend opposite to expectation along with similar findings by others that raised the question about the interaction.

Examination of Figure 10 shows that the trend observed in the first study was partially replicated. There was again a coming together of first and second grade LSES and MSES groups. However, the third grade LSES and MSES groups diverged from one another. These effects were due to the marked increase in performance for LSES children who were second graders, coupled with the absence of growth for third grade LSES children.

Insert Figure 10 about here

If Figures 7, 8, and 9 are compared with Figures 2, 3, and 4 it can be seen that the curves for second grade groups from different SES groups are most similar. A striking drop off for third grade LSES children, when compared to MSES children, is clearly seen. These are the same children who were second graders last year and who showed the greatest similarity to these same MSES children. In 1968 the LSES children in the third grade received lower scores than the second grade LSES children at each task level while the MSES third grade children scored higher than the second grade MSES children at every task level.

The third grade LSES children improved the least during the year between testings. Support for this assertion can be seen in Figure 11 which is a plot of the gain scores for the two socio-economic groups at each of the grade levels.

Insert Figure 11 about here

An analysis of variance performed upon the gain scores using socio-economic status, grade and task levels as factors revealed significant effects for grades ($F = 4.57$; df 2, 66; $p < .05$), for task levels ($F = 6.36$; df 3, 198; $p < .01$) and for the grade by socio-economic status interaction ($F = 3.54$; df = 2, 66; $p < .05$). A test of the mean gain scores revealed that the LSES first and second grade children gained significantly more than their MSES counterparts. There was no significant difference between gain scores for third grade groups (Winer, 1962, p.3

Discussion

The trends in both of these studies support the conclusion that MSES white children are able to utilize the structure of language as an aid to memory more effectively than LSES children. In Study I this conclusion can only be supported by inspecting the curves. In the 1968 study the interaction between socioeconomic status groups and task levels is also in the predicted direction but this time the effect is significant. The discrepancies between SES groups in performance when the items in a string to be recalled are not related to one another is smaller than when structure is present. LSES children are not deficient in memory capacity. They seem to lack a strategy or set to use structure as efficiently as MSES children. The greatest discrepancy between LSES and MSES performance exists in memory for structured strings. Further, to the extent that anomaly represents a control for meaning when comparison is made with sentences, then one can suggest from these data that meaning is relatively more developed as a tool than is structure as a tool for LSES children.

The most hopeful and satisfying result obtained here was the larger gains for young LSES children than for young MSES children. It is difficult to refrain from concluding that the early school years, particularly first grade, are more helpful to LSES children than MSES children. In two separate testings the second grade LSES children were found to be most similar to their MSES counterparts. First grade children both times seem to be moving toward their MSES counterparts. Gain scores show significantly greater growth for LSES first and second graders when compared to similar MSES children. The conclusion that school helps seems warranted.

On the other hand the lack of growth in LSES third grade children is the most disturbing and puzzling result found here. These children were most like the MSES group one year ago. What happened? It is perhaps best to leave this question unanswered. These data were collected from children in less than 20 minutes with a one year lapse between testings. It would be unwise to seek closure on a point which involves generalization about an entire year from such a limited sample of data. This caution should not be construed as a rejection of the reliability of these results but rather merely as reluctance to offer an explanation in the absence of corroborative evidence from other studies.

One interesting conjecture about the poor performance of the LSES third grade children does deserve mention. The examiner in this study was, of necessity,

Caucasion. There were no trained Negro examiners available. She reported feeling that several of the all-Negro staff members were hostile to her. One teacher even told her that children whom she wished to test were not present in the classroom. It was obvious to the examiner that this was not the case.

The understandable hostility felt and expressed by some of these teachers toward a white examiner may have been communicated to the children in subtle ways (e.g., Rosenthal, 1968) or it may have even been overt. In either case it seems pertinent to point out that times have changed. White experimenters were not welcomed into this black school. Perhaps those of us who are white will have to turn to other groups with learning problems for our studies. Or maybe we have an obligation to train Negroes to aid us in our work.

Footnote

[1]The research reported herein performed in part pursuant to Contract OEC-3-6-061784-0508 with the U. S. Department of Health, Education, and Welfare, Office of Education, under the provisions of P. L. 83-531, Cooperative Research, and the provisions of Title VI, P. L. 85-864, as amended. This research report is one of several which have been submitted to the Office of Education as Studies in Language and Language Behavior, Progress Report VIII, February 1, 1969.

Figure Captions

Fig. 1. Average raw scores for kindergarten, first, and second grade children at four task levels-1967.

Fig. 2. Average raw scores for high and low socio-economic status groups at four task levels for grades kindergarten, first, and second combined-1967.

Fig. 3. Average raw scores for kindergarten children from high and low SES groups-1967.

Fig. 4. Average raw scores for first-grade children from high and low SES groups-1967.

Fig. 5. Average raw scores for second-grade children from high and low SES groups-1967.

Fig. 6. Average raw scores for MSES and LSES groups at four task levels for grades 1, 2, and 3 combined-1968.

Fig. 7. Average raw scores for first-grade children from MSES and LSES groups-1968.

Fig. 8. Average raw scores for second-grade children from MSES and LSES groups-1968.

Fig. 9. Average raw scores for third-grade children from MSES and LSES groups-1968.

Fig. 10. Average raw scores for MSES and LSES groups at Grades 1, 2, and 3-1968.

Fig. 11. Average raw score gains for MSES and LSES groups at Grades 1, 2, and 3.

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Table 1

Raw Score Means and Standard Deviations at Four Task Levels for MSES and LSES Groups at Grade Levels K, 1 and 2

		L-1		L-2		L-3		L-4	
		$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
MSES	Grade K n = 17	2.82	.71	3.88	.58	8.59	1.50	10.12	2.61
	Grade 1 n = 17	2.29	.71	3.82	.58	7.77	1.50	10.94	2.61
	Grade 2 n = 17	3.06	.80	4.35	.76	9.06	1.55	11.77	1.93
LSES	Grade K n = 17	1.82	1.15	3.18	.98	5.88	2.78	7.88	2.42
	Grade 1 n = 17	1.77	1.31	3.53	.70	6.94	2.75	8.35	3.51
	Grade 2 n = 17	2.06	1.43	3.47	.61	7.65	2.59	11.18	1.20

L-1 Level one - nonsense words
L-2 Level two - common nouns
L-3 Level three - anomalous sentences
L-4 Level four - meaningful sentences

Table 2

Raw Score Means and Standard Deviation at Four Task Levels for MSES and LSES Groups at Grade Levels 1, 2, and 3

		L-1		L-2		L-3		L-4	
		$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
MSES	Grade 1 N = 12	3.08	1.24	4.08	.29	9.33	2.87	11.83	.58
	Grade 2 N = 12	3.00	.60	4.00	.60	9.67	2.38	11.83	3.13
	Grade 3 N = 12	3.88	.57	4.58	.52	11.17	1.03	12.33	1.16
LSES	Grade 1 N = 12	3.08	.67	3.67	.65	6.67	2.87	10.00	3.72
	Grade 2 N = 12	3.33	1.37	4.08	.52	9.17	2.89	11.50	1.73
	Grade 3 N = 12	3.17	.84	3.92	.90	8.33	1.88	11.00	2.00

APPENDIX

Immediate Memory Test - 1967

Level 1

Nonsense Syllables

Item 1:	cax	zab				
Item 2:	dup	mav	tuz			
Item 3:	kuv	rof	fup	nid		
Item 4:	mub	fip	gak	bem	sib	
Item 5:	yod	tud	wib	paf	nus	mef

Pronunciation key: a as in bat, e as in bet, u as in but, o as in go, i as in bit.

Level 2

Item 1:	watch	hill					
Item 2:	gold	church	land				
Item 3:	night	king	men	school			
Item 4:	hand	wind	house	corn	bed		
Item 5:	ball	rain	world	street	year	arm	
Item 6:	wall	mild	word	stone	tree	friend	food
Item 7:	man	air	light	sound	bud	box	death place

Level 3

Item 1: A truck opened today.

Item 2: Today his man has black fire.

Item 3: The little curly trees ran at a door.

Item 4: A path for new black tails looked down the hand.

Item 5: On the girls she ran over the big friend with some umbrella.

Item 6: The snowman and garden lady, a teacher went in and down as they flew.

Item 7: Old cow and his street slowly jumped up a red kitten to a black, new book.

Level 4

Item 1: The door opened slowly.

Item 2: Today all pigs have curly tails.

Item 3: A little old lady ran down the street.

Item 4: A man on his red truck looked at the fire.

Item 5: Over the trees she flew with a black umbrella in her hand.

Item 6: The snowman and his friend, the cow, jumped up and down as they sang.

Item 7: His kitten and my turtle slowly walked down the garden path to the big red, barn.

Item 8: The boys and girls went with their teacher to buy some books about pets for their new school.

Immediate Memory Test - 1968

Level 1

Nonsense Syllables

Item 1:	cax	zab				
Item 2:	dup	mav	tuz			
Item 3:	kuv	rof	fup	nid		
Item 4:	mub	fip	gak	bem	sib	
Item 5:	yod	tud	wib	paf	nus	mef

Pronunciation key: a as in bat, e as in bet, u as in but, o as in go, i as in bit.

Level 2

Item 1:	boy	hill					
Item 2:	heart	church	land				
Item 3:	night	king	men	school			
Item 4:	hand	wind	house	corn	bed		
Item 5:	ball	rain	world	street	year	arm	
Item 6:	wall	day	word	stone	tree	friend	food
Item 7:	man	air	light	sound	bud	box	death place

Level 3

Item 1: The man went together.

Item 2: Slowly some mouth drove small trees.

Item 3: A new green nut had at the road.

Item 4: The large fence of the leaves walked into the barn.

Item 5: It ran with the car in a little horse up my school.

Item 6: A cow and their all dog went fast less often as girls grew brown.

Item 7: His cornfield and their house looked yesterday to the pet rabbit with the red older boys.

Item 8: The animals and they ran down its pictures to buy black cat in hill for his long mother.

Level 4

Item 1: The car drove fast.

Item 2: Yesterday all trees had green leaves.

Item 3: A large brown cow went into the barn.

Item 4: A little horse in the cornfield looked at the fence.

Item 5: It ran up the hill with a black nut in its mouth.

Item 6: The man and his pet dog walked together less often as they grew older.

Item 7: My rabbit and his cat ran slowly down the long road to the small red school.

Item 8: The boys and girls went with their mother to buy some pictures of animals for their new house.

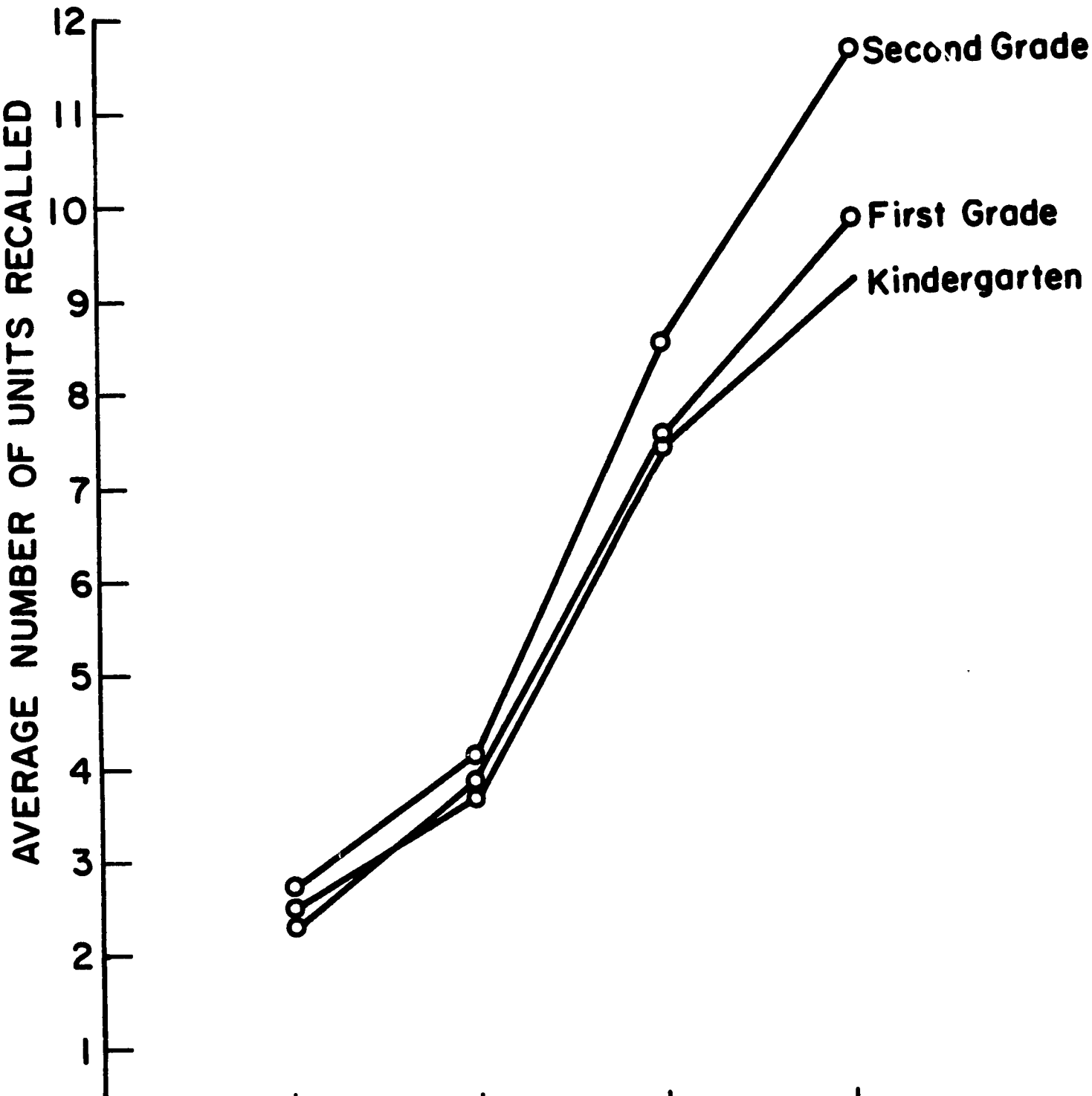
AVERAGE NUMBER OF UNITS RECALLED
0
1
2
3
4
5
6
7
8
9
10
11
12
L-1
L-2
L-3
L-4
Second Grade
First Grade
Kindergarten

Figure 1

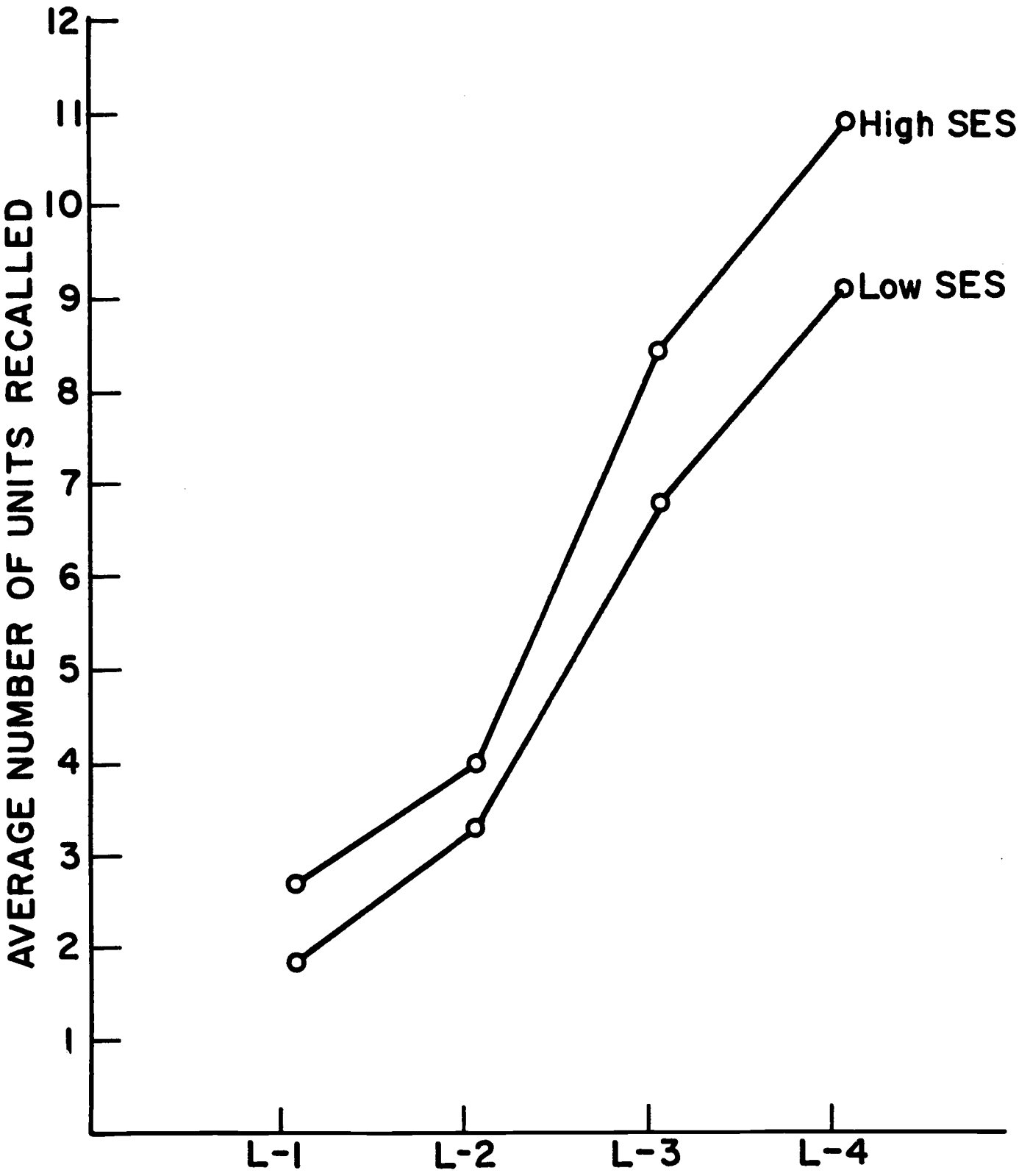
AVERAGE NUMBER OF UNITS RECALLED
12
11
10
9
8
7
6
5
4
3
2
1
High SES
Low SES
L-1
L-2
L-3
L-4

Figure 2

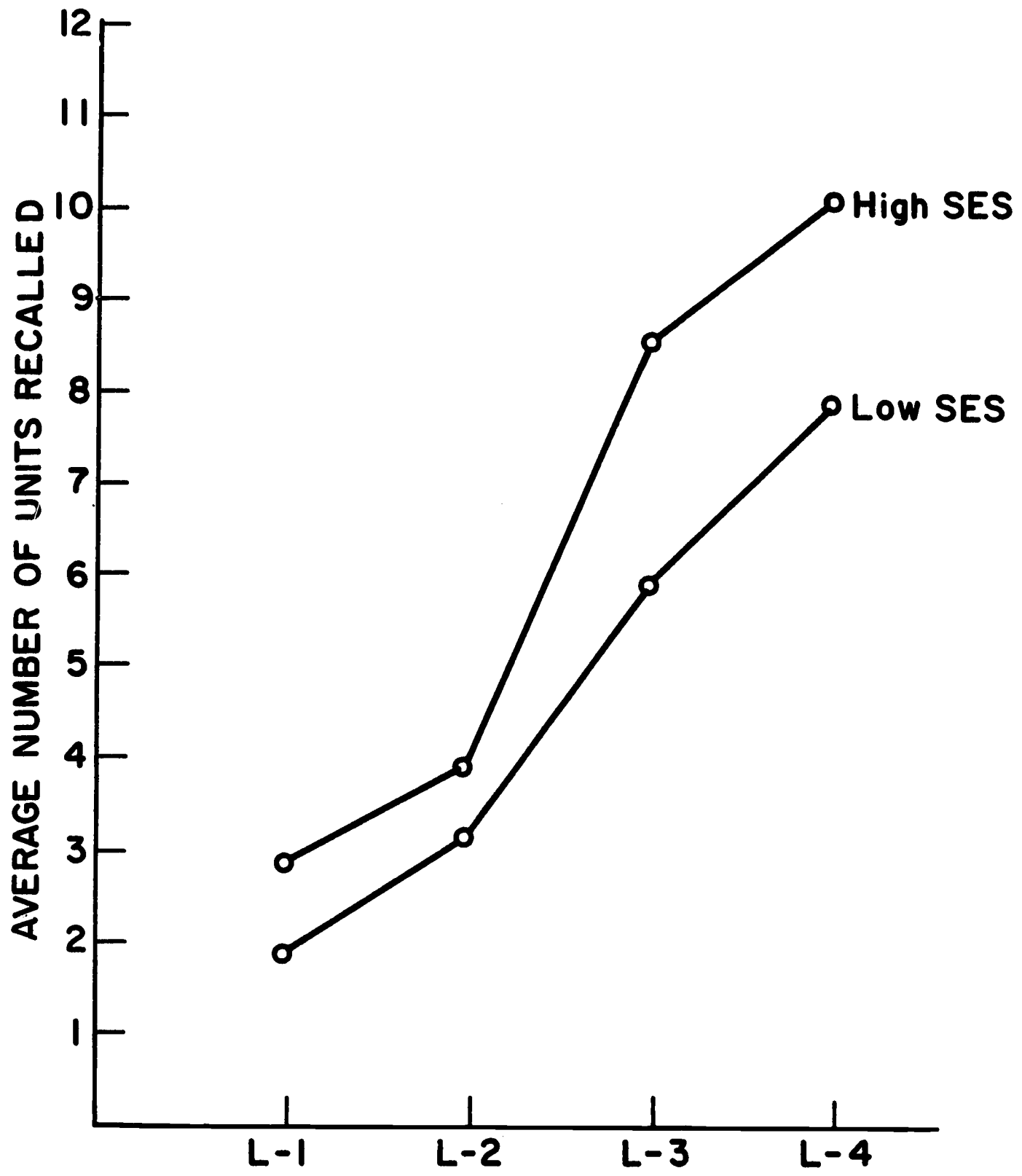
AVERAGE NUMBER OF UNITS RECALLED
12
11
10
9
8
7
6
5
4
3
2
1
High SES
Low SES
L-1
L-2
L-3
L-4

Figure 3

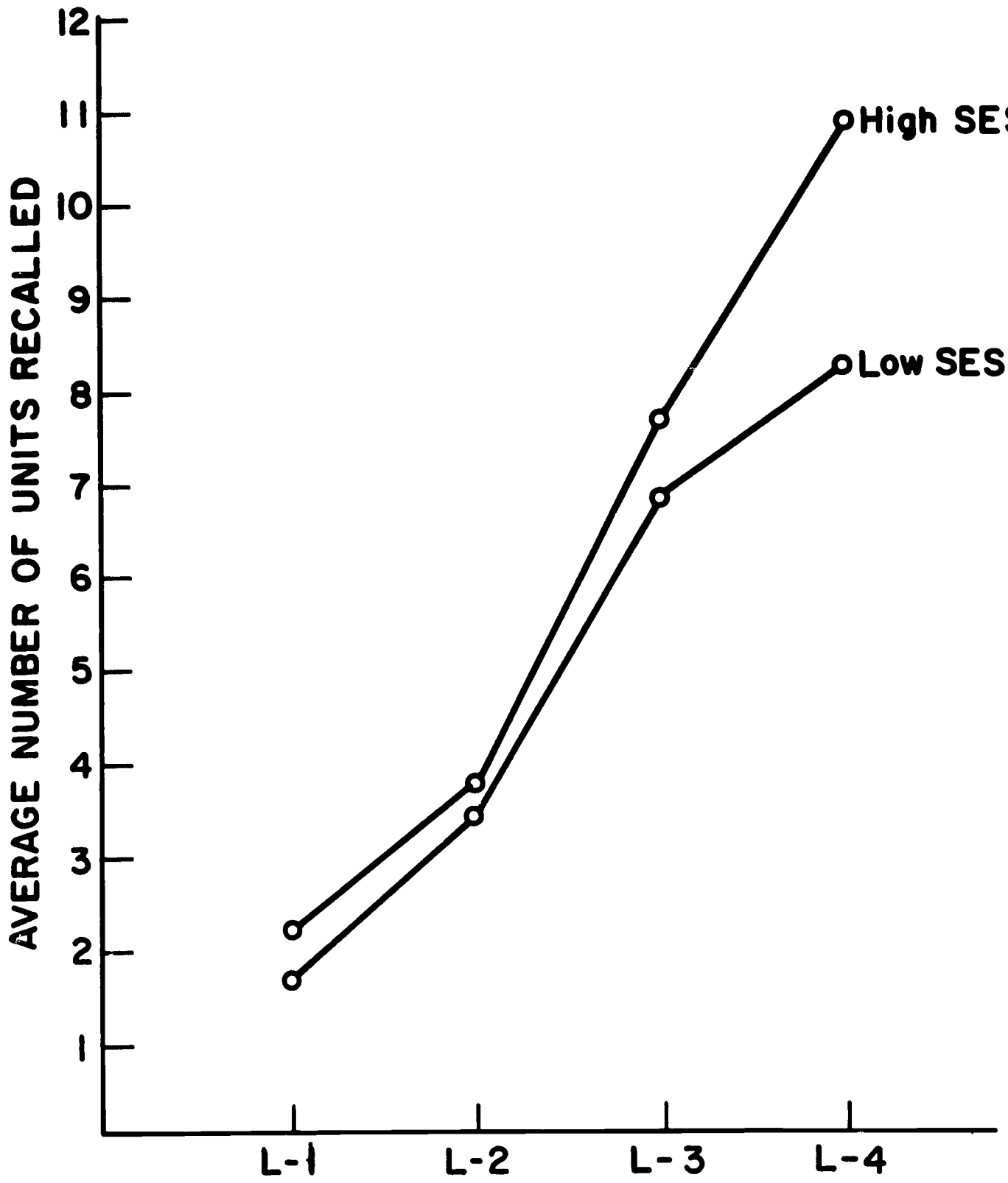
AVERAGE NUMBER OF UNITS RECALLED
12
11
10
9
8
7
6
5
4
3
2
1
High SES
Low SES
L-1
L-2
L-3
L-4

Figure 4

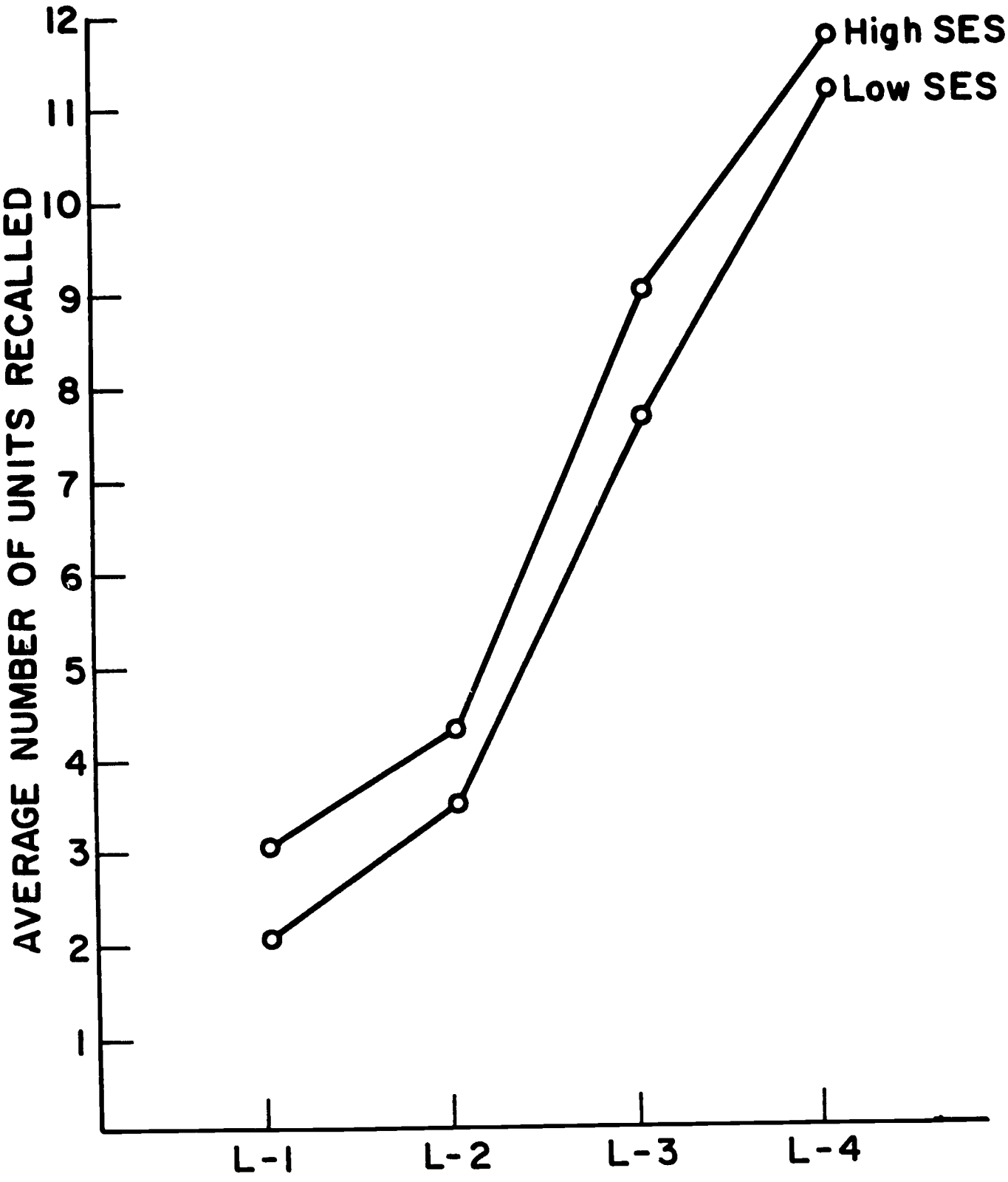
AVERAGE NUMBER OF UNITS RECALLED
12
11
10
9
8
7
6
5
4
3
2
1
High SES
Low SES
L-1
L-2
L-3
L-4

Figure 5

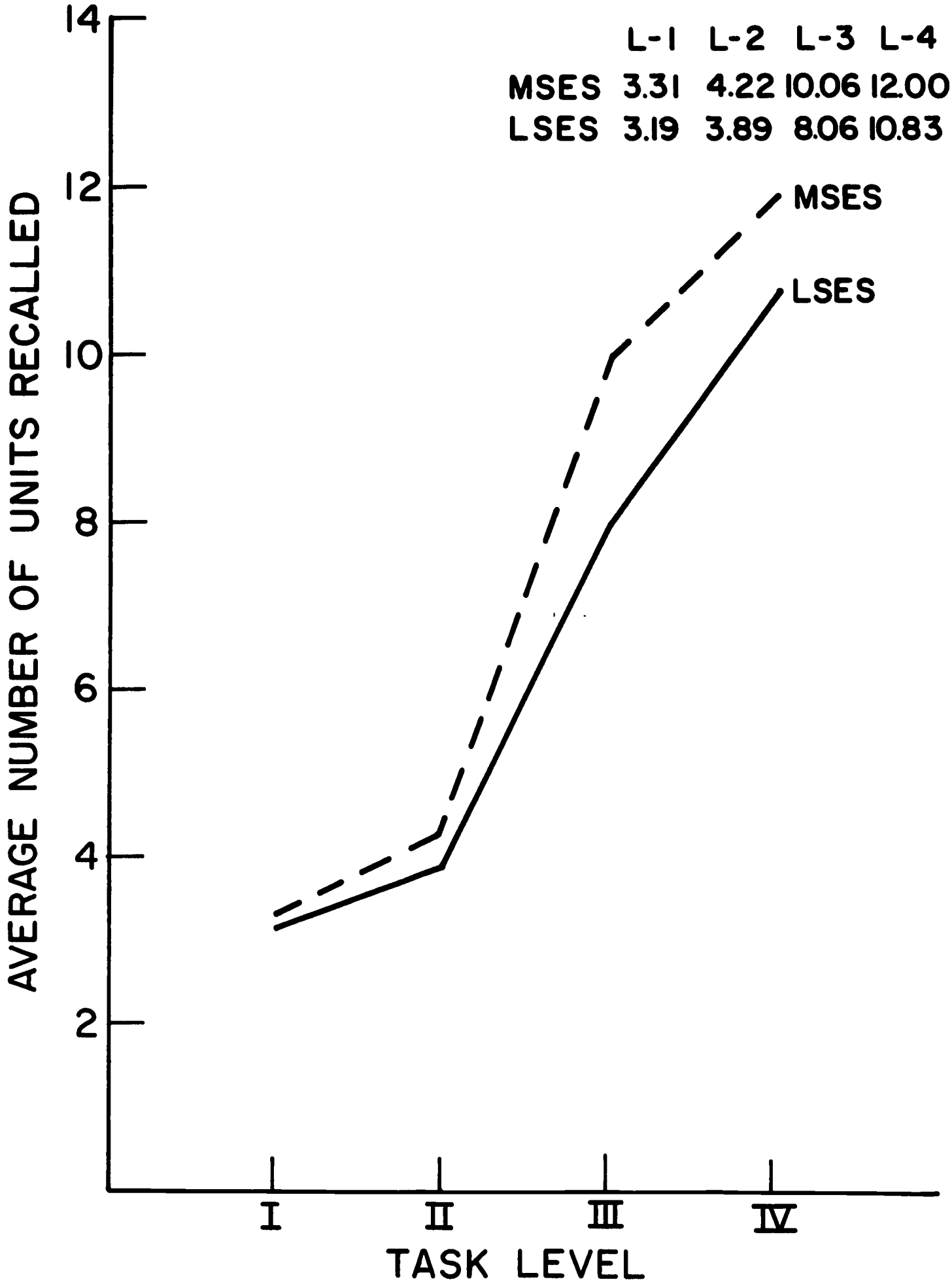
L-1 L-2 L-3 L-4
MSES 3.31 4.22 10.06 12.00
LSES 3.19 3.89 8.06 10.83
MSES
LSES
AVERAGE NUMBER OF UNITS RECALLED
14
12
10
8
6
4
2
I
II
III
IV
TASK LEVEL

Figure 6

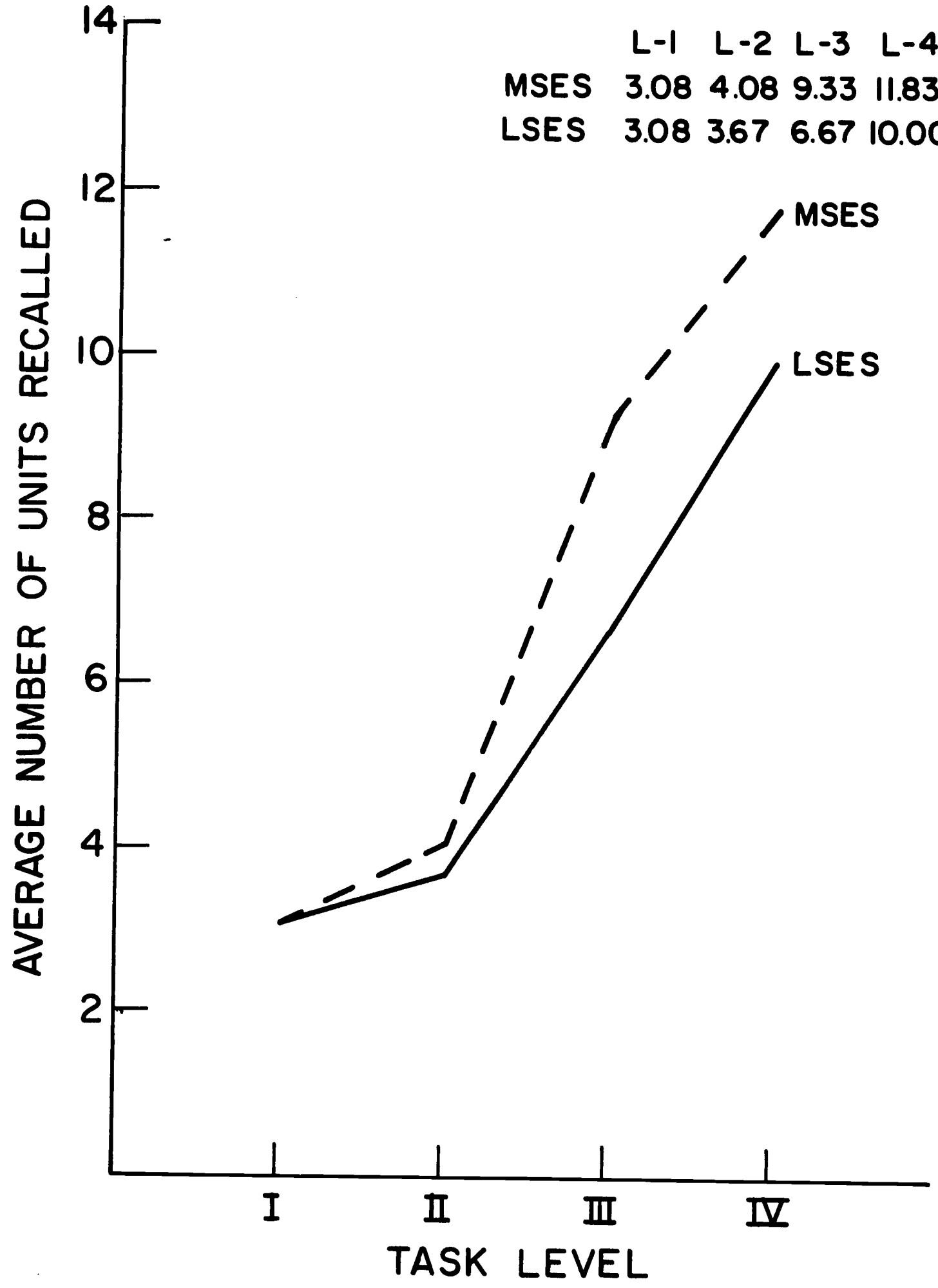
L-1 L-2 L-3 L-4
MSES 3.08 4.08 9.33 11.83
LSES 3.08 3.67 6.67 10.00
MSES
LSES
AVERAGE NUMBER OF UNITS RECALLED
14
12
10
8
6
4
2
1
I
II
III
IV
TASK LEVEL

Figure 7

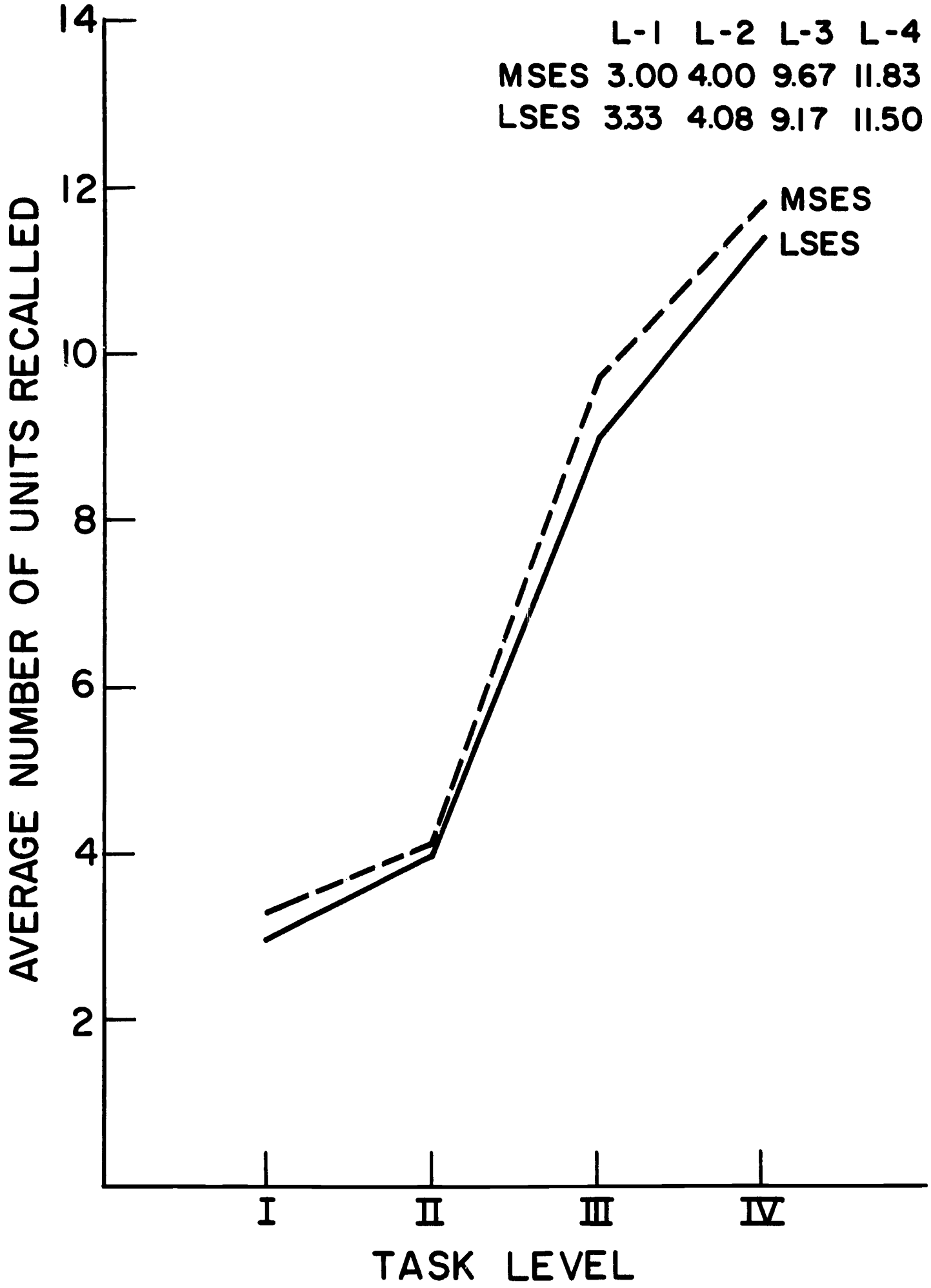
L-1 L-2 L-3 L-4
MSES 3.00 4.00 9.67 11.83
LSES 3.33 4.08 9.17 11.50
MSES
LSES
AVERAGE NUMBER OF UNITS RECALLED
14
12
10
8
6
4
2
I
II
III
IV
TASK LEVEL

Figure 8

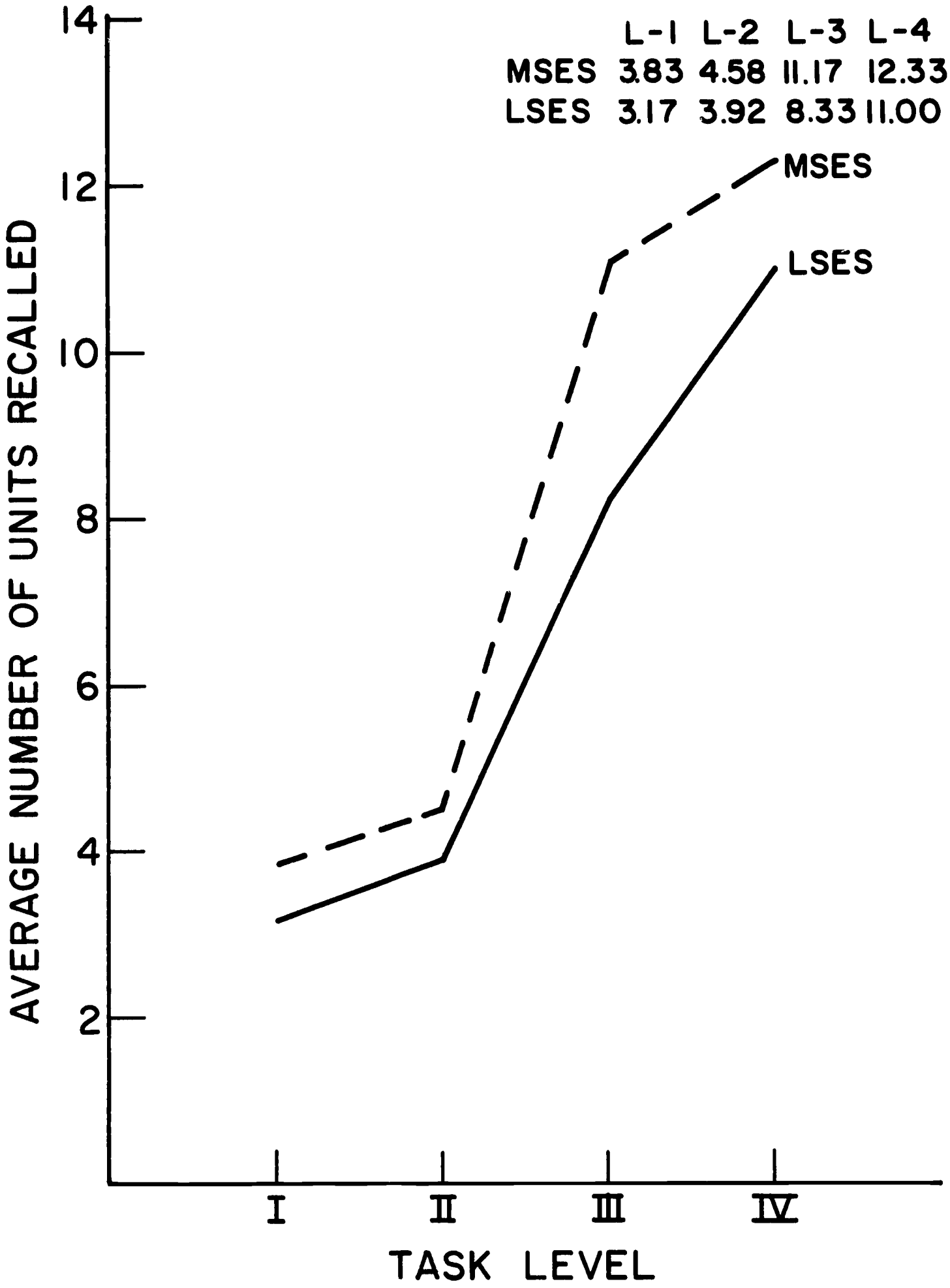
L-1 L-2 L-3 L-4
MSES 3.83 4.58 11.17 12.33
LSES 3.17 3.92 8.33 11.00
MSES
LSES
AVERAGE NUMBER OF UNITS RECALLED
14
12
10
8
6
4
2
I
II
III
IV
TASK LEVEL

Figure 9

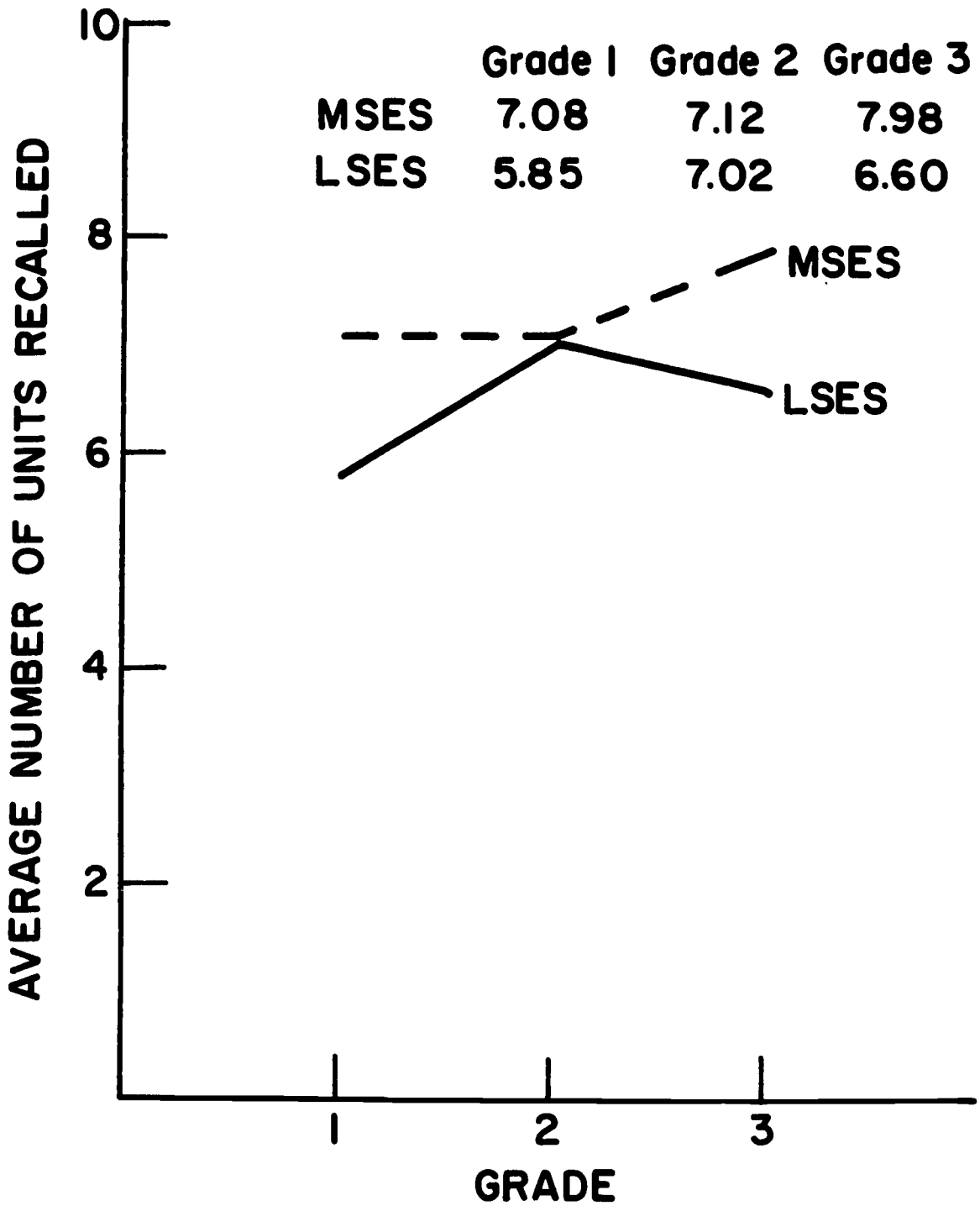
Grade 1 Grade 2 Grade 3
MSES 7.08 7.12 7.98
LSES 5.85 7.02 6.60
MSES
LSES
AVERAGE NUMBER OF UNITS RECALLED
10
8
6
4
2
1
2
3
GRADE

Figure 10

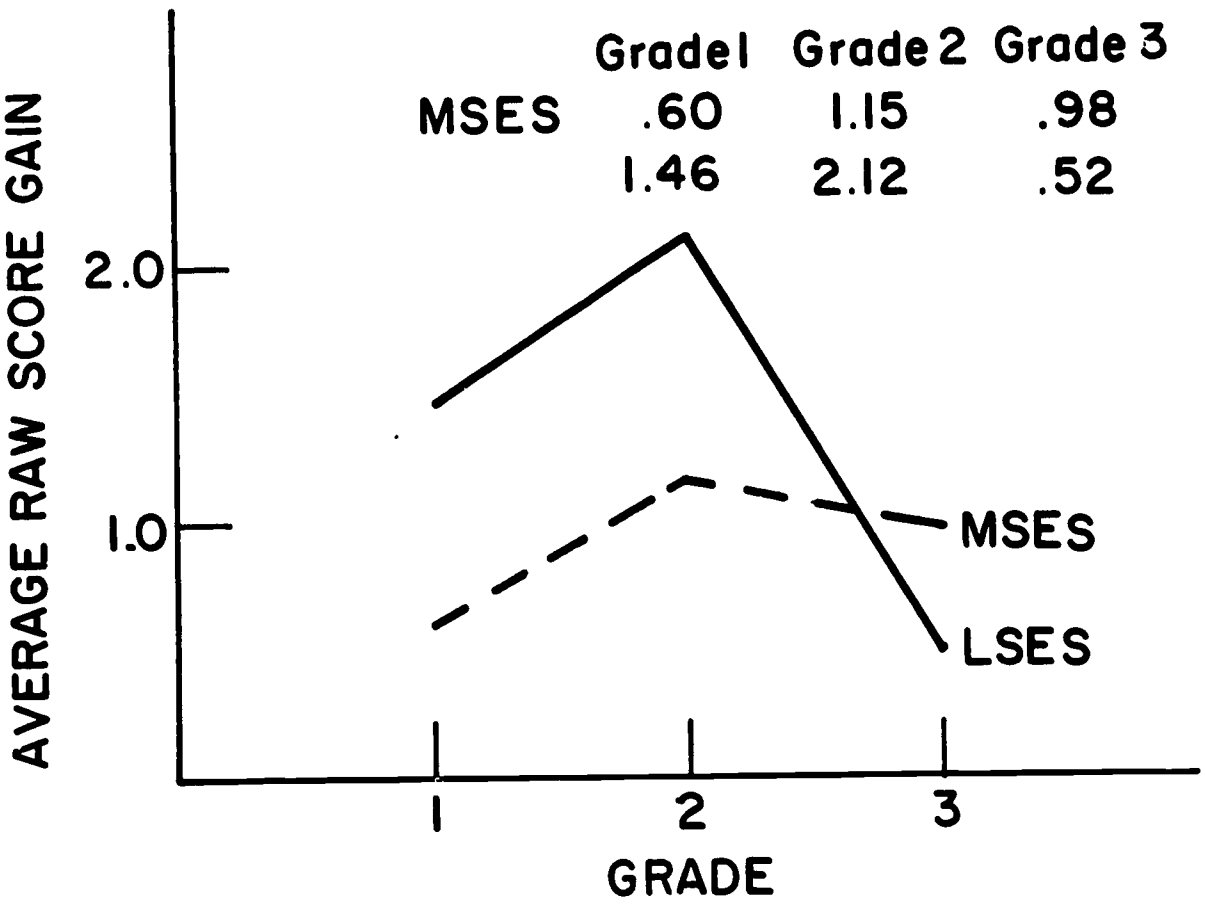
Grade1 Grade2 Grade3
MSES .60 1.15 .98
1.46 2.12 .52
AVERAGE RAW SCORE GAIN
2.0
1.0
MSES
LSES
1
2
3
GRADE

Figure 11