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A DIMENSION OF THE TECHNOLOGY OF
EDUCATION: RETENTION OF COGNITIVE SKILLS

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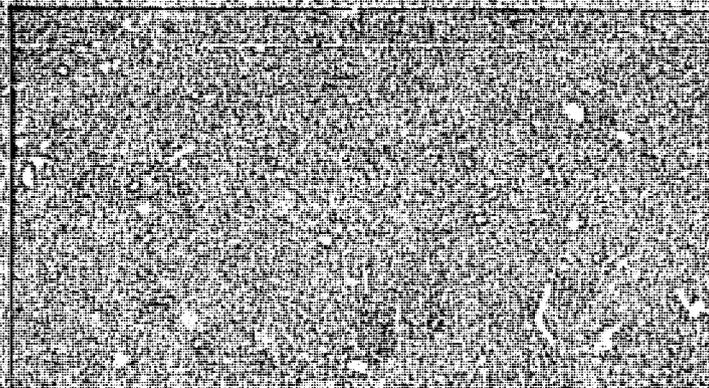
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RETENTION OF COGNITIVE SKILLS

by

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Abstract

To what extent do individuals retain or improve cognitive skills after they leave school? This is one dimension in the depreciation of human capital that has received little attention in the literature.

Using data from a survey of urban young men from Tunisia, I will argue that the loss of cognitive abilities is so serious that about half the primary school graduates can neither read nor calculate when tested after several years out of school. I will also argue that while the length of time they are out of school is significantly associated with loss of cognitive ability, it is not a significant predictor of their ability to retain what they learned. Rather, a number of background factors mainly relating to the home environment are significant in explaining the variance in retention of knowledge.

A DIMENSION OF THE TECHNOLOGY OF EDUCATION:

RETENTION OF COGNITIVE SKILLS

John Simmons¹

In the education process, the development of cognitive skills is emphasized with the idea that they will further economic and social progress. How far pupils manage to retain or improve these skills once they have been acquired is a question that is seldom mentioned or discussed. On the rare occasions when this subject does arise, one of two assumptions is commonly made. It will be argued either that once cognitive skills are learnt in school they will be retained without difficulty, or that, at the least, they will be retained by pupils who go on to secondary school. Any primary school pupils who subsequently lose their skills probably learnt little in the first place, or had no incentive to practice them later. But the assumption continues, even this last group received some benefits from their schooling through the socialization process. The purpose of this paper is not to speculate why the problem of maintenance or retention of cognitive skills has received so little attention from either researchers or policy makers.² Rather, we will attempt to explore the extent to which individuals with six years of schooling improve or decline in their cognitive abilities after being out of school for various lengths of time, and suggest several reasons for the changes.

Using data from a survey of urban young men from Tunisia, I will argue that the loss of cognitive abilities is so serious that about half the primary school graduates can neither read nor calculate when tested after several years out of school. I will also argue that while the length of time they are out of school is significantly associated with loss of cognitive ability, it is not a significant predictor of their ability to retain what they learned. Rather, a number of background factors mainly relating to the home environment are significant in explaining the variance in retention of knowledge.

In Part I of this paper, I will review the quantitative literature on retention in some detail since a review is not available in the literature and the studies relatively inaccessible. I will then discuss the design of the study, and the sample characteristics, and review the measures of retention in Part II, analyse the background variables in their relation to the retention of scores in Part III, and discuss the implications of the results in Part IV.

Part I

A View of the Literature

The empirical work on literacy retention is sparse. Limitations in the design of such studies as there are have further restricted their value as contributions to understanding the subject.

There are four major factors which might be usefully examined in studying the reasons for retention of literacy: the individual's education, personality, family characteristics, and post school environment. First, the quality, as well as the quantity of education is important. For participants in adult education programs, this means looking at the length and intensity of the program. Where primary schooling is concerned, it is particularly important to distinguish between years spent in school and grade levels completed, and thus to be able to separate the person whose six years' education got him only as far as grade three from the one who by the end of six years had finished the sixth grade. It cannot be assumed that reaching a particular grade level means a student is literate.³ Measurement of cognitive skill levels on the termination of literacy courses or primary school is essential for studying retention. To study retention it is essential to test the subject's level of skill immediately after he leaves primary school or completes a literacy course. This measurement will avoid confusing the man who has lost his literacy skills with the one who never mastered any in the first place. Consideration should also be given to quality of schooling including student/teacher ratios, teacher training, and the curriculum. Finally, aspects of the individual school experience such as attendance, academic achievement, and time out of school require attention.

The second factor relates to individual traits such as age, intelligence and non-cognitive personality characteristics like attitudes toward change, levels of motivation and aspirations. The third concerns family characteristics: socio-economic status, (as reflected in income and/or occupational status), living conditions, intra-family relationships, educational level of other family members and extent to which home atmosphere is "learning-conducive." The fourth factor is related to the circumstances in the home or on the job in which the "new literate" finds himself when he leaves primary school or literacy training.

The definition and measurement of literacy are poorly covered in the literature. Few studies provide realistic quantified estimates.⁴ Also one should note that an individual's cognitive abilities are only partially measured by the achievement tests commonly administered in schools. The tests of literacy often include the response to the census question of "have you been to school?" (or to the n grade of school), the reading aloud of a sentence or writing dictated phrases. With rare exceptions, they do not test reading comprehension.⁵

We now turn to a review of the five studies which seem to compose the literature on retention.

The earliest of the retention studies is reported by A. L. Tibawi in his historical assessment of education in Palestine under the British. In order to determine the extent to

which the minimum four years schooling was actually producing "permanent" literacy in an illiterate rural environment, the Mandatory Department of Education in 1932 tested skill retention in 902 men (who had been to primary school during the Mandate or the Ottoman period) in 54 villages generally served by schools of the "single-teacher-four-standards (grade levels) type." The measures employed are described simply as "standardized achievement tests" in arithmetic and Arabic language -- the language tests assessing "the ability to read both orally and silently the language commonly used in correspondence, to understand the material read and to convey it in writing and the arithmetic tests evaluating "facility in the four fundamental rules."

Among the 162 men who were oldest and longest cut of school who averaged 4.9 years⁶ of schooling, the Ottoman-educated men 53%⁷ failed in Arabic and 34% in arithmetic. For the younger group, educated during the Mandate, with a mean 5.1 years education the failure rate was less: 24% in Arabic and 18% in arithmetic. Note that for neither the younger nor the older group was baseline test data available.

Ten years later, Tibawi himself replicated the language portion of these same tests and collected post school data with two smaller samples: 300 men from 10 areas considered to represent differing stages of social development (nomad, rural

and urban) and 40 urban females. He did not retest the same men used for the earlier study. All 340 had spent at least four years in primary school.⁸ The test results (which he did not present) led Tibawi to the conclusion that permanence of literacy for this group was very much a function of the post-school social environment; where circumstances afforded no opportunities for using his skills, a man soon fell back into illiteracy. He concluded that achievement of literacy with any chance of keeping it required a minimum of five years schooling with "suitable" accommodations and equipment and competent teaching staff. For areas that did not have these advantages even five years was insufficient.

The entire group of girls (half of whom had four years and half five or more years education) had lost their literacy skills within five to eleven years after leaving school. This lapse occurred despite the fact that all of them were in occupations "expected to promote literacy" (dressmaking, home management, school or domestic service).

Contemporaneous with Tibawi's study is a considerably more extensive investigation (carried out in 1942-43 and reported by Gadgil, 1955) of the "durability of results" effected by the primary schools of the Satara district in India. This research attempted not only to discover the incidence of lapse into illiteracy but to identify possible causal factors as well. The

study group comprised 2678 men who had (1) been out of school five to thirty years and (2) reached at least Standard II⁹ before leaving primary school.

The study deliberately did not attempt "a refined gradation of ability, attainment or retention" and the tests (which dealt only with reading and writing and not arithmetic/computation skills) were accordingly set "at a very low level of attainment." Literacy was defined simply as the ability to "read printed matter with understanding and to write matter dictated so as to convey to a reader what had been dictated." The reading measure¹⁰ consisted of reading aloud to the investigating officer, any one, or parts of more than one, of three passages from a series of recent government publications specially designed for new adult literates. Reading ability "with understanding" was considered to have been retained if "while a person was reading loudly others could follow what he was reading, and if he was able to convey ... the purport of what he had read." Little attention was paid to either correct pronunciation or fluency. Also the grading of the reading comprehension was subjective, based on the tester's opinion of the reader's ability. For the writing tests, subjects were asked to take down two full lines dictated to them from the reading test passages. Incorrect spelling and usage were almost completely disregarded -- writing ability was rated passing if what had been dictated was

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captured at a very minimal level. Both the reading and writing tests were designed and graded to capture the slightest ability and define the person as literate.

The tendency to lapse into illiteracy proved to be inversely related to both years spent in school and grade level reached.¹¹ Thus, for example, the literacy rate among Primary II, Primary III and Primary IV leavers was 67%, 88%, and 97% respectively. Within each standard, loss of skills also became less likely as age at time of leaving school increased (at least up until age 15). With regard to indices of quality of education neither one-teacher schools nor lack of teacher training appeared to affect pupil retention importantly.

The data indicated that most of the lapse into illiteracy occurred within the first five years after leaving school. While retention did not show a linear relationship to either earnings or occupation, it was definitely weakest among very low income groups, including landless agricultural laborers. As for other aspects of post-school experience, occasional or periodic migration did not significantly inhibit or encourage literacy loss. Further education had been obtained by only a small percentage of the sample. The few who had had some adult education (chiefly in recently opened village courses) were all classified literate, regardless of the standard in which they had left primary school. The technical or craft training which was the most usual form of education appeared to have a "somewhat" positive effect on retention

The incidence of lapse was greatest in the larger villages of 2,000 or more people, and least in those of "middling size" (population 1,000 to 2,000). But maintenance or loss of literacy did not appear to have anything to do with village contact with the outside world as reflected in number of newspapers coming into village, presence or absence of a post office, distance from nearest railway station or road, etc.

A final discovery was that even among those who were literate, few used their reading and writing skills.

The third research study (Greenleigh, 1968) took place in the United States and, unlike the ones described above, was concerned primarily with retention of literacy from adult education courses. The main study group consisted of 1600 welfare recipients in three states who had participated during 1965-66 in specially designed adult basic education courses lasting seventeen weeks. The majority were black, female and over thirty years old. Sixty-eight per cent of them had completed at least five grades of school, yet the entire group scored below fifth grade level on the pre-course reading measure (Gray Oral Reading Paragraphs Test) and were hence considered functional illiterates at the start of the course.

Initially, the mean reading level of the group was 2.895 or almost the third grade; at the end of the course it had risen to a high of 4.665 (i.e. nearly fifth grade level). When

the gray test was re-administered six months after the course terminated, reading levels had begun to drop. The regression in skills was more pronounced at the twelve-month interval. At this point, the group as a whole still showed a net gain of one grade level over their beginning reading scores -- with, however, a wide range of achievement: 15% reading at 8th grade level or better and 19% still below level five. Retention after six and twelve months did not appear to differ significantly either by reading system used¹³ or by level of teacher preparation (high school graduate vs. college graduate vs. certified teacher).

Comparison of the main sample with a control group of non-course participants showed rather interestingly that the latter had made very similar reading skill gains over the study period. Also an examination of relationships between reading achievement and employment (vs. unemployment) showed that the greatest reading gains were made by those who had become employed -- regardless of whether they took part in the adult education classes. On the other hand, post-course involvement in further education or training programs did not significantly affect reading gains or losses.

The data indicated that adult education courses of the kind evaluated were "not of long-run educational value," and further that employment and the "moving out into the world" which it implies are important stimuli in literacy achievement.

The most recent reports (Smith, 1970) concern an experimental Rhodesian program carried out with a small rural group of "ordinary (and illiterate) cultivators practising unimproved farming methods." The experiment was designed to produce "simple"¹⁴ literacy at the "elementary" level by teaching these illiterate adults all eighty-five lessons of a first grade primer (ordinarily requiring a year of primary school to complete) in a full-time intensive course lasting four to five weeks, and concluding with ten days of special instruction on keeping farm and household accounts and records. At the end of the course, eighteen course participants were tested in arithmetic (simple addition and subtraction) and writing (test not described). Performance on these "post-tests" did not appear to be affected by either age or previous education (some members of the group had had one year of primary schooling).

Six months after the course terminated, literacy retention was assessed by re-administering to thirteen of these eighteen persons these same tests, plus additional measures: reading and comprehension tests based on a short passage from post-primer level two reader. These were rated on a three-point scale by adult literacy teachers.

The "general impression from these limited test results" was that the students who had got through the primer had managed to "maintain but not improve the reading and writing skills"

attained in the course. Arithmetic abilities showed a considerable loss, however. The bottom group who never completed the primer (and were thus considered to have remained illiterate) were unable to score on any of the tests.

Home interviews showed that the "follow-on" program (supposed to consist of record-keeping by course participants plus supportive visits from the local agricultural extension worker) had not provided the planned support. Only two out of eighteen persons reported frequent visits and help. The application of their new literacy skills in writing letters, reading books and leaflets and record keeping seemed to be "very variable" and did not allow any conclusions as to their utility in stimulating retention.

It was concluded that the overall skill loss was less than might have been expected in view of the weakness of the follow-on program and the heavy work commitments of the new literates.

While the inadequacy of the design and analysis of the Rhodesian study is sufficient to exclude it from this review, it does deal with the subject. The initial sample of 18 is small, and gets smaller as it is retested. No report is made on the 5 of the 18 subjects who were not retested. The levels of reading comprehension for a second grade primer could hardly be equal to understanding passages of a national newspaper.

The study by Simmons and Allman looked at men from a

Tunisian village who had had two years to three years of adult education. The only baseline measure was taken in 1965 at the end of the first year course and measured only the adult's ability to read aloud from a text before him. Forty per cent of the 757 who were tested passed this test. No assessment was made of comprehension. While most of the participants went on for one to two more years of the course after the baseline test, the test was not repeated. The authors assumed that the pass rate would have increased to 70 or 80% by the end of the second year -- had the group been retested.

In 1968 a 20% sample was taken from the group tested in 1965. These men were given two tests, one identical to the baseline exam, and the other a test of reading comprehension with multiple choice answers that they had to circle. The results were not encouraging. Only twenty-two per cent passed the reading retest -- a decline of 45% between test and retest. And if it was assumed that the baseline level seriously underestimated the level the adults reached a year or two later when they finished the course, then the decline was closer to 75%.

The second test was a measure of reading comprehension which defined three levels of literacy: illiterate, simple literate and full literate. A full literate could understand passages from the national newspaper. A simple literate could understand simple phrases and sentences, but nothing more. And illiterates were unable to reach this level although they might

be able to recognize isolated words. The results of this test showed 80% illiterate, 16% simple literates and 4% full literates.

The same reading test was administered to primary students in the sixth grade classes in a rural school. While the difference between weakest and strongest class was slight, the weakest of the classes had no illiteracy, 72% were simple literates and 28% full literates.

Replication of the 1965 baseline arithmetic test of simple calculation ability showed a small decline in ability. Because of the weakness of the original test instrument, an improved version was given in 1968 testing respondents in simple addition and subtraction, multiplication and several word problems. The results showed that 20% could not do simple subtraction. While the weakness of the baseline test did not permit a careful analysis of retention, the new improved measure suggested that the adults' present level of arithmetic ability was too weak to be of much utility.

Finally, the authors examined factors that might have accounted for either the high initial level of literacy attained, or the retention over time. They found that high test scores correlated with the amount of previous education, socio-economic status and use of literacy. Age was inversely related to test scores. Test performance was not affected by: the years spent

taking adult education, use of radio and TV, attendance at the movies, contact with urban areas and participation in the numerous organizations. Given the statistical nature of the zero-order correlation coefficient as well as deficiencies in design, the authors emphasize the tentative nature of the results.

In sum, what can we generalize about these studies? First of all, it may be reiterated that their number is amazingly small in view of the importance of the subject. Comparability is minimal; the studies reviewed above do not share the same definition or measure of literacy, let alone have in common independent variables other than amount of schooling. They also suffer from serious defects in design. With the exception of the Greenleigh study, they lacked control groups. Definition and measurement of independent variables tended to be so imprecise as to make evaluation of their role extremely difficult -- even with regard to previous education, grade level completed vs. years spent in school were not adequately distinguished from one another. The analytic procedures of cross tabulation and correlation did not permit controlling simultaneously for important background variables like age, socio-economic status and previous schooling. Another crucial weakness was the failure to clarify initial skill levels; only the Greenleigh study really obtained thorough baseline data against which retention over time could be compared.

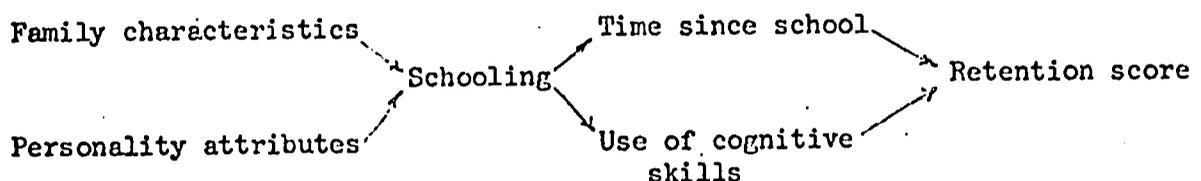
With these caveats in mind, we turn to the results. First, they consistently indicate a decline in literacy skills over time -- with the exception of the Rhodesian research, where the only loss was in arithmetic ability. Second, high levels of previous education are not a guarantee that some people will not lapse into illiteracy. Previous education levels ranged from some adult literacy training to complete primary. The lowest levels of schooling seem to impart very little that is retained. Third, the tests of comprehension show that even what is retained appears to have little practical value to the individual or the society.

Part II

The Approach

The purpose of the study was to make the empirical test of a model with factors that are theoretically significant in predicting individuals' loss or gain (retention) in cognitive skills after they had left school. The causal model of these factors takes the following form.

Diagram 1



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Each of the factors in the model will be represented by several dimensions when the model is tested. Family characteristics include an index of socio-economic status, as well as a measure of parents' exposure to mass media, religiosity dimensions. Personality attributes of the students include measures of their attitudes toward school, relations with their peers, etc. The oversimplified diagram hides many of the possible interrelationships.

Two basic approaches are possible when examining the retention of cognitive skills in a population that has been out of school for a period of time. They are the comparative cross sectional approach and the longitudinal. The longitudinal approach measures the individual's level of cognitive achievement when he leaves school, and then measures him after a passage of time on the same test. The results would be scored for his gain or loss. The comparative cross-sectional approach, which this study used, takes two samples at the same point in time, one finishing school, and the other out of school. Both are tested for cognitive levels and interviewed for background variables to control for possible variations in the populations. The mean score of the in-school group becomes the baseline for measuring a gain or a loss for the individuals who have been out of school. Two assumptions are basic to this method: that the quality of neither schooling nor students has changed over time.

We are unable to control for the first assumption -- no change in the quality of schooling -- although we can make some observations on possibilities. The second assumption -- no change in the quality of the students -- is also difficult to control for. If we consider student quality to be a bundle of dimensions including intelligence, motivation, attitudes, behavior, and family background, then we can only begin to control for these possible differences with some of the interview data on attitudes and family background. Given the lack of information on both of the assumptions, it is useful to speculate for a moment on what may have happened over time to the older population.

Throughout Tunisia there are more primary age children than there are places available for them in school. Five years ago, when the older of our two populations was in school, school places were even more scarce. How were children picked to get these places? Self selection probably played an important role, since some parents were not convinced of the importance of education, or lived too far away for their children to walk to school. More recently, additional schools have been built, and more families have moved closer to villages and cities to take advantage of the schools. The number of school places available per 100 primary age children is greater than it was ten years ago. The motivation a student requires to get to school, and then stay there, was probably greater ten years ago than it is today. Furthermore, as the proportion of low income families

with sons attending school increased, their children, as compared with children of higher income families, would tend to do less well at school. This would be true even after controlling for the genetically endowed, in contrast to the environmentally determined, component of intelligence among children of different social groups. The more education oriented attitudes and behavior of the higher income groups would tend to assure this result.

This speculation about the differences between our baseline population and the older population is important for interpreting the results. Both the above points about change in the quality of the schooling and the students indicate that the measured loss of cognitive skills will underestimate the true results. Specifically, assuming the points are correct, baseline scores would be higher if they had been taken ten years ago. Thus, if a worker shows a significant improvement in the score over the baseline measure, we should adjust it downward to correct for the quality bias. If a worker showed that he lost ground relative to the baseline measure, the correction for the quality bias means that his true score was even worse. Thus the estimates we will report are biased in favor of retention.

To test this model a purposive sample of young men aged 15-25 was drawn from a suburb of Tunis. The sampling goal was to assure a significant number of families in the low and middle income range. The sample included one group which was still in

the sixth grade -- the baseline group, and those who were out of school but who also had only reached the sixth grade. This criterion limited the out of school group to 24 and the baseline group to 13. Because the number for the baseline group was small, their scores were verified by sampling several classrooms of sixth graders in the same community, but not from the exact sample area. The resulting scores were similar to the scores for the baseline group. Thus years of schooling was not a variable for either the baseline or the worker group.

While small samples limit the extent to which the results can be generalized, this is a pilot study not a comprehensive survey. It is designed to explore a wide range of possible variables rather than more accurately specify a small number of variables by using a larger sample.

Several measures of retention were estimated, and the results are presented below. The French and Arabic achievement tests were scored 0-6, and math 0-5. First the mean scores for the tests are presented in Table 1. All three tests are consistent in suggesting a loss of retention of one group compared to the other.

Table 1

Test Scores

	<u>Baseline (n13)</u>	<u>Workers (n24)</u>
	<u>Mean</u>	<u>Mean</u>
Arabic	4.3	3.6
French	4.2	3.8
Math	3.8	3.3

Second, we wished to calculate the difference for each worker rather than the group, as he compared to the baseline scores in the three achievement tests. The differences or rates of retention were categorized three ways. First was the loss measure where workers whose scores were the same or improved were coded 0, and those whose scores showed a decline of 1-4 points were coded 1-4. Second, a similar measure was computed for gains in skill where those who scored the same or lost were coded. And third, a dichotomous variable was defined to include the workers who were unchanged or improved in one category, and the workers who had declined in another. Fourth, a final measure was computed from the sum of the dichotomous measures of retention for Arabic and French.

The measures in Table 2 show that about as many workers in each of the three cognitive skills measured improved as declined. They indicate that 42% of the workers did not suffer a loss of their Arabic ability, while 58% lost some, including 6% who suffered complete loss. For French achievement, 50% did not decline, while 25% regressed to no measured ability. Math loss, while similar in pattern to the other two, showed slightly less loss at each level. The sub table on gains examines the workers improved most in math with a gain of 54%, in Arabic 42% showed gains, and in French 50%. In the last sub table the dichotomized scores for the measures are summed. Thus 33% of the sample declined on both the Arabic and French tests, while 42% improved on one but not the other.

Table 2

Retention of Cognitive Achievement
(% of n24)

Loss	(none)				(High)
	0 ^a	1	2	3	4
Arabic	42	13	13	8	6
French	50	17	4	4	25
Math	54	17	17	8	4

Gain	(none)		(High)
	0 ^a	1	2
Arabic	58	21	21
French	50	42	8
Math	46	29	25

Retained	(Loss)	(Gain)
	0	1
Arabic	58	42
French	50	50
Math	46	54

Combined Retained	0	1	2	3
Arabic & French	33	42	25	-
Arabic, French & Math	25	25	29	21

a. Because the baseline scores were not integers, and the workers' scores were, it was possible to score only a gain or a loss.

Part III

Factors in Retention

What are the factors which cause some workers to enhance their cognitive abilities and others to lose them? A model of the theoretically important factors was given in diagram 1.

To represent each of these factors theoretically important dimensions were chosen. Each set of dimensions was entered into a stepwise regression predicting retention. A partial list of these dimensions by factor is presented in Table 3 with their beta and zero order correlation coefficients.

To simplify the interpretation of the results, we examined the possibility of combining the dichotomized variables of French and Arabic retention into one index of retention. The zero order correlation coefficient between the two was sufficiently high ($r = .80$) to suggest that they could be combined. The normal distribution of this combined variable, presented in Table 2, supports this decision.

The results of Table 3 show that each factor has several dimensions with beta coefficients which are significant at normal levels of probability in predicting retention.

The dimensions which are significant hold few surprises. SES, while positively correlated, is not significant. Better measures of those family attributes more closely related to cognitive achievement like religiosity and mother influence are

Table 3

Dimensions of Cognitive Retention
(n 24)

Dependent variable; Retention of Reading Comprehension.

<u>Family Background Factor</u>		<u>Beta</u>	<u>r</u>	<u>R²</u>
40	Socio economic index		.11	
31	Mother supervises education		.32	
29	Someone in family prays	-.58	-.48	
75	Son had assistance on homework		-.19	
68	Mother a major influence	.44	.30	
	(for significant Betas)			.42
 <u>Schooling Factor</u>				
164	Years Kuttab		-.13	
47	Primary grades repeated		.10	
60	Years since school		-.42	
48	Changed schools	.54	.54	
46	Age entered school		-.14	
	(for significant beta)			.30
 <u>Personality Factor</u>				
42	Age		.02	
85	Improve School facilities	.47	.54	
81	Improve aid to poorer students		.06	
73	Noise and problem for homework		.19	
92	High job aspirations		.37	
99	Advantages of job: personal		-.22	
83	Student to blame for own failure		.19	
133	Modernity scale		.19	
137	Need achievement scale		.33	
58	Left school because bad performance	-.37	-.46	
	(for significant Betas)			.42

Table 3
(continued)

<u>Use of cognitive skills</u>	<u>Beta</u>	<u>r</u>	<u>R²</u>
134 Mass media exposure	.51	.51	
109 Speaks French		.39	
125 Write French letter		.45	
136 Associated with French scale		.40	
124 Writes Arabic letter		.41	
93 School helps work		-.10	
114 Participation in organization		-.14	
94 Work requires reading & writing		-.26	
135 Use of education scale		.35	
(for significant Betas)			.26

Note: See the Appendix for the statistics of the significant variables and the coding.



significant. While the sample had only 6 years of primary, other schooling dimensions did have variance. The time since the worker had left school was one of them: the longer he was out, the lower his retention score. The variable "changed schools" and in the latter variable does not have a significant Beta. We describe this variable below. Most of the dimensions for the last two factors have a theoretical justification for their significance. The boys who replied to the question, What would you do to make your school better if you were the director that they would like to see an improvement in the school facilities, are highly correlated with reading retention. It is unclear what the attitude may suggest. Other replies included improvements in programs, communication and discipline.

The boys who left school because of bad performance, i.e. low cognitive achievement, would be expected to have lower reading retention than those who had higher performance. Note that the two scales measuring attitudes - need achievement and modernization - are not highly correlated to retention. Finally we would expect a reinforcing relationship between mass media exposure and retention.

The significant dimensions for each factor were then combined in one equation to test the full model of retention. The results in Table 4 suggest that three factors are represented (personality drops out), and only by a single dimension. The family background dimension suggests the importance of low

religiosity in the home, at least as characterized by the presence of some member praying, for high retention. The fact that some students changed primary school was significant. These are students of migrant families, most of whom started primary in the Sahel area on the Southern coast before moving to la Goulette soon after independence. Thus, this variable could be interpreted as a proxy showing that students had higher quality instruction before they moved, that miserable conditions forced them to leave, or that the move to the city demonstrated that the family had high motivation for success. The last may be the most plausible explanation. This dimension might have best been considered under the family background factor.

Table 4

Factors Related to Retention

Dependent Variable: Retention of Reading Comprehension

Independent Variables	Significant Variables.			Full equation			
	Beta	t	U.V	r	Beta	t	x'x
48 changed schools	.53	4.09	.29	.54	.40	2.56	1.00
134 Mass media	.38	2.77	.13	.51	.33	1.49	1.00
29 someone prays	-.36	-2.65	.12	-.48	-.30	-1.84	.90
85 improve school facilities				.54	.33	1.92	.65
31 Mother supervises ed.				-.32	-.23	-1.12	.27
58 left school				.46	.19	1.21	.15
constant	-0.05				.30		
R ²	.66				.74		
F for equation	12.7				6.79		
n observations	24				24		

Note: when $t = 2.80$ $P < .01$

when $t = 2.06$ $P < .05$

$|x'x|$ is a measure of multicollinearity.

Beta is the standardized regression coefficient.

U.V is the unique variance

r is the zero order correlation coefficient.

The final dimension, high mass media exposure, is not surprising. High exposure may awaken and maintain an interest in reading to gain more information. The reverse would also be true. More reading encourages higher exposure to mass media.

The R^2 for the significant variables is .66, thus the unexplained residual is .34. The residual suggests that important dimensions may be lacking. There are a number of possibilities. While we know that physical disabilities among students reduce learning potential, we did not test, for example, for dyslexia, eye sight, hearing, or subnormal brain size. Nor did we attempt to measure the relative genetic endowments which may have been significant for intelligence levels. A factor which is not shown in the diagram that undoubtedly had an influence on the individual cognitive retention was luck -- not randomly distributed across the sample. Other dimensions of the family background factor could have included the measure of the parents' verbal ability and measures of interaction with their children.

Part IV

Summary and Implications

The Conclusions of this study are tentative, since both the design of the study and the individuals who were sampled restrict the breadth of useful generalization. Specifically, using the comparative cross section method to measure change

in cognitive skills over time, is not as good as having observations on the same individual over time. Also, we controlled for the amount of primary schooling the sample had, which meant that we could not examine possible threshold amounts of schooling that might have been important for significant increases in retention. Finally the universe limited the sample to boys from low and middle income urban families. We can draw little inference about other groups such as girls, rural individuals or upper income people.

Given these qualifications about the design of the study, the results suggest two major conclusions. First, the loss in cognitive ability, as measured in tests of reading comprehension, is clear. For the sample 33% declined in both Arabic and French, 42% gained in one and declined in the other, and 25% gained in both. And for French, 25% incurred total loss. The sample all had six grades of primary, which for some, because of repeating, meant as many as ten years of schooling, excluding additional time in the Kuttab.

Second, ^{several of} the factors considered to be theoretically significant in explaining the gain or loss of cognitive abilities over time proved to be statistically significant. These factors included family background, and post school use of cognitive skills.

What are the implications of these results for further research and future policy? Clearly, an important area of research has been overlooked in the past. While the conclusions are consistent with the several studies we reviewed, the methods and results are far from comparable. Much needs to be done. Further research would explore the role of different amounts of education and kinds of teaching in limiting cognitive loss. The other independent variables, only crudely measured here, could be refined. Future samples should work closely with upper income groups as well as those in the lower range. Finally and perhaps most important from the perspective of economic and educational policy, what is the role of the individual's cognitive ability, as narrowly measured by reading achievement, in his work and for national development? Before massive resources are mobilized to reduce the loss of cognitive skills, this question needs better answers than we now have.

Appendix
Statistics
(n24)

<u>Var.</u>		<u>coded</u>	<u>mean</u>	<u>stdev.</u>
29	Someone prays	0,1	.36	.50
31	Mum supervised educ.	0,1	.42	.50
48	changed schools	0,1	.33	.48
58	Left school	0,1	.79	.42
85	Improved school facilities	0,1	.42	.50
134	Mass media	0-6	4.08	1.35
177	Retention of Reading	0,1	.92	.78

Note: The coding assigned the low value to a negative response, and a high value to a positive response. Mass media is the sum of several items.

Appendix

Zero order correlations coefficients
(n24)

<u>Var.</u>	<u>Var</u>						
29 Someone prays	(29)	(31)	(48)	(58)	(85)	(134)	(177)
31 Mom supervises		0.218	0.0	-0.026	-0.480	-0.310	-0.482
48 Changed schools			0.478	-0.191	-0.029	0.139	0.315
58 Left school				-0.290	0.120	0.022	0.543
85 Improved school					-0.191	-0.589	-0.462
134 Mass media						0.331	0.538
177 Retention of reading							.506

NOTES

1. The data are part of a larger study undertaken with Sumru Aksoy. The research assistance of Russel Beirn and Lewis Koppel was most helpful. The cooperation and assistance of numerous members of the Tunisian research community and government were essential for making the study. The study was financed by the Ford Foundation and the Agency for International Development through the Center for Middle Eastern Studies and the Center for Studies in Education and Development. The Development Research Group provided computational assistance under N.S.F. & U.S. A.I.D. grants.
2. Pursuing this concern could prove useful in understanding both the politics of, and the investment in, educational research and programs.
3. The UNESCO literature on literacy and primary education is replete with assertions equating 4 years of primary education to literacy.
4. For a review of these measures and an attempt to establish and apply a comprehensive definition, see Simmons & Allman (5).
5. For examples of the exceptions, see Simmons (4).
6. Since most of the schools had only four standards, or grades, the number of years schooling must be supposed to include some repetition.
7. No information given as to what constituted "passing" or "failing".

8. Whether this always meant completion of four standards is not entirely clear.
9. Standard II is the third level of the primary system which begins not with Standard I but with "infant class."
10. Scoring-persons "possessing" both reading and writing skills were rated "1", i.e. "literate". Non-possession of both skills was taken as lapse into illiteracy and scored "0". A rating of .2146 was assigned to "semi-literacy", i.e. retention of reading skill only.
11. Without, however, controlling for SES.
12. Gray Oral Reading Paragraphs Test.
13. The four alternative systems were: American Incentive to Read, Science Research Associates: Reading in High Gear, Mott Basic Language Skills Program, Follett: Systems for Success.
14. Report of the Workshop on Functional Literacy, UNESCO, Paris 1969.

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