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ABSTRACT

The International Association for the Evaluation of Educational Achievement (IEA) conducted cross-cultural surveys of educational achievement in six subject areas: reading, science, literature, civics, French as a foreign language, and English as a foreign language. Each of the surveys contained items which measured the extent to which parents interact with students on educational and related matters. This paper uses a variety of statistical techniques to assess the contributions of those home environment variables to students' attitudes and achievements, correlations being higher for 14-year-olds than for 10-year-olds. The analyses which indicate that the relationships among the variables change over time are discussed, and other pertinent data are examined. (Author)

A CROSS-CULTURAL STUDY OF THE IMPACT OF HOME ENVIRONMENT VARIABLES ON ACADEMIC ACHIEVEMENT AND AFFECTIVE TRAITS

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The data utilized in this paper were made available by IEA through the University of Kentucky Data Bank repository. The data were originally collected by IEA. Neither the original collectors of the data nor the University of Kentucky bears any responsibility for the analyses or interpretations presented here.

Introduction

Those who are familiar with the International Association for the Evaluation of Educational Achievement (IEA) know that there are striking similarities among the major findings from the Six-subject survey of cross-cultural educational achievement. Despite the range of subject matter achievement sampled (reading, science, mother tongue, French as a foreign language, English as a foreign language and civics education) the general findings indicate that levels of academic achievement are best predicted by the home background of students and less well predicted with the characteristics of schools that provide the setting for instruction. The major concomitants of variation in student achievements are typically measures of the home background from which the student emerges and not the unique characteristics of the school that is attended.

The finding that home background is a most powerful predictor of achievement is not unique to the IEA studies. Other large scale investigations (e.g., Coleman et. al., 1966; Jencks et.al., 1972) arrive at similar conclusions. Nor are the variables that are used in these studies unique. Typically, home background of students is conceived of as being reflected in the social status of parents, the father's occupation, or similar measures which indicate a family's potential to devote resources to a child's education. Although such status variables are very strong predictors

of achievement they are limited in that they indicate little about what parents do to provide educational experiences for their children. One can imagine, for example, two homes of the same social class or headed by similarly educated parents which differ substantially in the manner in which parents and children interact in educational and school-related tasks.

Contrasted to such status variables are those variables which indicate what parents do and how they interact with their children to encourage and stimulate the child's educational development. Such variables, which may be called "process" variables, also produce strong predictions of academic achievement (Dave, 1963; Kifer, 1975). If we distinguish between these two types of variables - those which reflect the status of parents and those which seek to describe how parents interact with their children - it can be argued that the latter, because they are potentially manipulable and describe what kinds of interactions foster educational development, are the variables which are of prime interest educationally. Teachers, parents, educators, or researchers can do little to change the social status of students. They can, however, change the milieus in which education takes place and interact with students in ways which produce desirable educational outcomes.

The Study

The Variables

In addition to the home background variables that reflect the social status from which students emerge, the IEA surveys

include items which attempt to measure or are proxies for interactions which occur in the home. There are 10 such variables (see Table 1) which I have labelled home process variables. The focus of the study is to describe how those 10 variables are related to science and reading achievement test scores, word knowledge (a proxy for IQ) and affective measures of Liking for School and Expectations for further education.

The Sample

There are samples of students at two different age levels (10 years old and 14 years old) in 7 different countries (Chile, Germany, India, Netherlands, Scotland, Sweden, and the United States). Table 2 gives the sample sizes for each country.

The Analyses

Since the IEA data is survey data the prime purpose of the data analysis is to describe with various statistical techniques how the home environment variables, the affective variables, and the achievement variables are related. To that end a series of simple correlations, multiple correlations and canonical correlations have been computed. The question of interpreting the results rests on finding patterns across countries in the ways the variables are related and then speculating about what such patterns may mean. Without having benefited from the manipulation of experimental conditions it remains impossible to confirm any of the speculations so the study must be construed as primarily exploratory.

Conceptual Framework

Despite the fact that the study is exploratory, the explor-

ations were done within a framework that suggests that certain environmental dimensions of the home when focused on the preschool child are antecedent to successful academic achievement and positive attitude, and when operating during the school years are concomitants of those variables. Those dimensions subsume processes and interactions within the home setting which produce successful achievement and positive affective views regardless of the status characteristics of the house. As such, they provide indications of how interactions can be modified if it is considered desirable for the child to be successful in school and have positive attitudes toward school and education.

Identifying and defining the important process variables is, of course, no easy task. In the first place, the effects of the home begin early in the life of the infant, accumulate over time and many facets of it are almost certainly very subtle. Second, important process variables may include not only what parents do with children but also how they do it. The climate in which the crucial interaction between parent and child occurs may be just as important as the interaction itself.

Despite such obvious difficulties of defining, identifying, and measuring process facets of the home educational environment, previous studies (Dave, 1963; Wolf, 1964) have reported stronger relationships between process variables and students' aptitude and achievements than are found with measures of home status characteristics. In addition, studies (Kifer, 1975) have reported strong relationships between process variables and measures of

students' affective characteristics.

I prefer to think of the process variables in the home as facets of three main conceptual dimensions of the home environment. A first dimension can be labelled the verbal environment. Facets of the verbal environment include such things as bathing the infant in language, reading books to children and encouraging children to express themselves precisely both in speech and writing. In those homes where accurate communication is encouraged children apparently develop abilities which give them increased power to comprehend what is expected of them in the school setting. One assumes that success in school tasks is a function of the child's ability to penetrate a verbal curtain which surrounds the tasks. Those children with verbal facility tend therefore to be more successful in academic tasks.

A second dimension of a home environment includes activities in the home which are congruent with the expectations and demands of the school. Examples of facets of this dimension include providing a time and place for students to complete homework, working with the student when and if he or she is faced with a difficult school task, and taking an interest in what the child is doing in school. Through a variety of interactions, the child learns not only that what happens in school is important but also is given active support, if needed, so that tasks in the school can be completed successfully.

A third dimention of the home environment is the general cultural level of the home. Homes which emphasize reading

discussions, attending cultural activities, museums and zoos, provide a milieu in which students develop both competencies and attitudes which increase the probability that as students they will be successful in the school setting. One can conceive of an environmental press within the "educating" home which encourages and stimulates intellectual and social development and provides simultaneously a set of experiences which gives the child skills, knowledges, and attitudes which are prerequisites of success in the school setting.

Limitations of the Study

As is apparent from Table 1 the "slice" of the home environment which was measured in the IEA surveys is not a big one. One can contrast the fact that the science cognitive test has 80 items while the number of items measuring facets of the home environment, a more complex and certainly a less well-known measurement area, has only 10 items. Suffice it to say, the measurements of the home environment represent but a very small sample of the domain which could be measured.

A second caveat is necessary. Much previous research on process variables has been done by actually observing what occurs in the home and then, based on the observations, differentiating among home educational environments. The IEA variables are not the results of home observations but instead reflect the child's perceptions of the home environment. One would hope that what happens in the home and what the child perceives as happening do

not differ appreciably. It is conceivable, however, that the correspondence between the two is not exact.

Findings

Despite the above limitations it is possible to ask whether the home environment measures in the IEA surveys produce results similar to those which have been found in previous research. Based on a compilation of existing IEA analyses and a new set of analyses which link the home process variables of Table 1 to science achievement, reading achievement, word knowledge, expectations for further education and liking for school variables, the general answer to these questions is yes. Tables 3 and 4, give the multiple correlations and canonical correlations which describe the relationships among the variables.

When one views the process variables in the IEA surveys as a set, then they are linked positively to both cognitive and affective student outcomes. That is, those students who come from homes which provide more powerful verbal environments, more support and concern for what is accomplished in school and milieus which emphasize cultural activities have both higher scores on the cognitive measures and more positive scores on the affective measures. The multiple r's for the cognitive test scores range from .09 to .46 with a median of .25; for the affective scores the range is from .14 to .48 with a median value of .29. The first canonical correlations, the correlations between the process variables and the five outcome

variables, range from .31 to .60 with a median value of .40. Though the strength of these positive relationships varies from country to country they are, given the limited number of process items, ra[illegible] substantial in each case. It is interesting to note, in addition, that the process variables predict equally well in the developed and developing countries; such is not the case for home status characteristics which in general are more powerful predictors in the developed countries.

These positive relationships between the process variables and the students' cognitive achievements and affective traits tend to increase slightly with age. In most countries the relationships are stronger for 14 year olds than for 10 year olds, particularly when affective levels are predicted. Whether this finding suggests a cumulative effect for the process variables or whether it is a function of analyses which are not strictly parallel is not clear. It is interesting to note that it reflects a general finding of the IEA surveys that predictions are better in the population of 14 year olds than in the 10 year olds.

The final general finding of the analysis is that the home process variables in all countries predict the affective measures as well or better than they predict cognitive scores. This is particularly notable since the status characteristics of the home tend in the IEA volumes to predict achievement more effectively than they predict variables in the affective domain. Since the correlations between the cognitive and affective measures are positive and substantial,

this finding suggests the obvious: the home is not only the locus for activities which increase the probability of successful achievements but also a milieu in which positive school-related attitudes are fostered.

Although the pattern of relationships among the process variables and outcome variables are different from country to country (there is no one set of process variables which is equally powerful in all contexts) there are particular variables which stand out in the analyses. For 10 year olds, the more important variables appear to be the amount of reading for pleasure the child does and the students' perceptions of the parents interest in school. For the 14 year olds, amount of reading for pleasure, the amount of homework and a fixed time for homework tend to have the largest weights. If one takes the reading for pleasure variable as a proxy for the verbal environment, then an extremely strong generalization about these "important" variables would be that verbal environment is important for both populations of students but the specific school related behaviors seem to be more important for the 14 year olds. There is, of course, no way to confirm this speculation.

A Speculation About the Direction of the Effects

Although the descriptive analyses presented earlier substantiate the notion that the home environment variables are reasonably good predictors of both achievement and affective levels, such correlational information tells little about the directions of the effects of the variables. Do the home variables influence simutaneously the student's

achievement and affective levels? Do they influence the achievement scores only indirectly as they operate directly on the attitude levels?

There is, of course, no way to answer such questions conclusively. It is possible, though, to analyze the data so that one estimates the influence of the home process variables when different statistical models are entertained as the proper ones. Tables 5 and 6 show the results of regression analyses in four different countries when different statistical models are used to describe the data. For Population I, the 10 year olds, the initial model is one where the process variables are separated into two groups, Reading for Pleasure (the strongest variable in the set) and the remaining variables. Components of variance are then estimated assuming that simple model. For example, in the U.S.A. the process variables "explain" about 9% of the variance in reading achievement with Reading for Pleasure accounting for almost 2/3 of that. The second model in Table 5 is a regression model where the attitude measures have been added to the model and the home variables have been ordered last in the regression. Again in the U.S.A. for reading achievement the total amount of variance explained is about 9 1/2% with the attitude scales accounting for about 2% and the home-process variables accounting for almost 8%. If, for example, in the second model the attitude scales accounted for all of the explained variance, one would be in the position to say (in the language of vanishing partials of path analysis) that the home variables influenced achievement only indirectly since the direct influence can be attributed to the attitude scales. For the third

model, the Word Knowledge test (the proxy for IQ) is added and the variables are ordered in the model from front to back as follows: Word Knowledge, attitude scales, home process variables. In this case for the U.S.A. in reading achievement one can apparently infer that the influence of attitudes and home process variables on reading achievement are mainly indirect since they now account for a small proportion of the explained variance. In this particular case one might entertain the notion that the home variables and the attitude variables operate through their influence on Word Knowledge attainment to influence reading achievement.

In Table 6, Population II or the 14 year olds, a similar statistical process has been used. A simple model is generated first, then additional variables are added to the regression equation. One change has been made in the analysis: The home process variables have been separated into different components. The first component contains both Reading for Pleasure and Amount of Homework (the two strongest variables for 14 year olds) and the second component contains the remaining process variables. Otherwise the analyses for Population I and II are parallel.

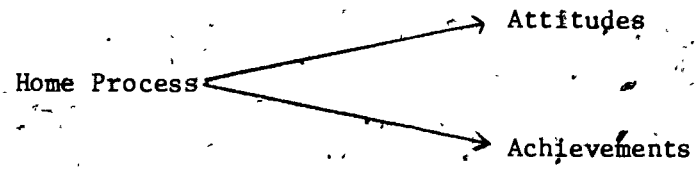
When one compares the Population I and Population II analysis, two rather striking results appear. The first is the power of the Word Knowledge variable. Its addition to the regression equation improves substantially the prediction of both reading and science achievement in all countries. At the same time it minimizes the influence of the attitude scales and the home process variables. It appears that the influence on achievement of both the attitude scales and the home process variables are mediated by verbal facility (Word Knowledge), of students. Despite the power of the Word Knowledge variable, however, it should be noted that the home process variables

remain important in the regression equation. Ordered last in the largest model, they still account for 2 to 3% of the variance in achievement.

The second finding of note concerns the influence of the attitude scales. With the exception of India, the addition of the attitude scales to the model in Population I which includes only the home variables adds very little to the prediction of achievement and subtracts little if any from the explained variance due to the home process variables. And when considered in the model with Word Knowledge the attitude scales contribute very little to the prediction of achievement. When one looks at Population II a very different picture emerges. In this case adding the attitude variables increase substantially the prediction of achievement although it again has little influence on the home process variables. Also in Population II the attitude variables are more resilient when the model with Word Knowledge is entertained. In sum the attitude variables seem to be much more important for the prediction of 14 year olds achievement than they are for the achievements of 10 year olds.

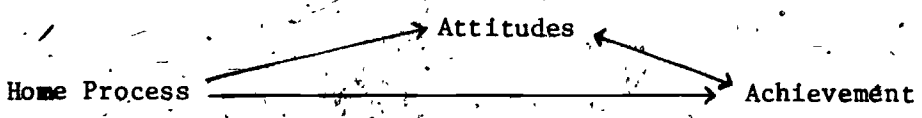
Before attempting to interpret the results of these regression analyses an important caveat is in order. None of these regression models can be considered the proper one. The measured variables in the model are measures of some things but proxies for many others. The models are limited since they depend not only (as indicted earlier) on a very limited sample of home process variables but also they do not contain <u>all</u> of the important attitudinal or affective variables.

With that warning in mind, it seems reasonable to speculate about what may be the relationships among these variables as they are reflected in the regression analyses. When one looks at the results of the regression analyses, especially those models which include only attitudes and the home process variables, it appears that there are different kinds of relationships among those variables at the different age levels. For example, when one looks at the 10 year old regressions, the addition of the attitudes scales does little to increase the prediction of achievement and leaves the influence of the home variables virtually intact. Given that the affective variables and the home process variables are correlated (as indicated in Table 3) the model which describes the relationships among variables for 10 year olds appears to be the following:



That is, the home process variables predict both achievement and attitudes but the attitudes do not influence achievement when the home variables are included in the regression.

On the other hand, when one looks at the 14 year olds a different picture emerges. That is, the attitudes increase the predictability of achievement but not at the expense of the home variables. A picture to describe those relationships may be as follows:



For the 14-year olds the attitudes have a direct influence on the achievement levels. The question of how the attitudes and the achievement scores are related cannot be answered. When one compares the two models, it appears that a kind of reciprocal relationship between attitude and achievement exists at age 14 which is not apparent at age 10.

One way to explain the different models is to suggest that they reflect the experience of schooling. Ten year olds have had 4 years of experiencing the school setting while the 14 year olds have had about twice that amount. It is possible that early in a child's career the home is the locus of both positive attitudes and academic achievement and that the student does little to separate feelings about the school from accomplishments in the school. By age 14 the students have had an opportunity to experience more of schooling and that experience has served to differentiate among them in terms of their accomplishments. Those who have been successful in the school setting are those with the positive attitudes. Those with positive attitudes are those who have accomplished much. Whether the positive attitudes are the source of the accomplishments or whether the accomplishments are the source of the attitudes is not clear. The reciprocal relationship between the two types of variables, however, is unambiguous.

The school, however, has operated to differentiate among students on both ability and attitude. The home, by age 14, has been placed in the back seat. Although the home can still influence the attitudes and the achievement the major locus for that influence has become the school.

Summary and Conclusions

The IEA volumes which report the findings for the Six-Subject Survey emphasize the influence of the home background in the prediction of students' achievements. In those studies the home background variables were measures such as Father's Occupation and Father's Education. In this paper such variables are labelled "status" variables and it is argued that such variables are of limited usefulness to educators. They tell us virtually nothing about how effective educational environments can be created in the home.

The variables of interest to educators are those which can be called "process" variables, ones which reflect what parents do and how they interact with their children to facilitate educational development. Within the IEA surveys there are a very limited sample of the process variables that have been ignored generally in the IEA reports. As reported in this paper these variables, which are conceived of as facets of verbal environment of the home, of the support mechanisms provided by the home to aid the child with school work, and of the cultural milieu that serves to guide the child's

social and cultural development, are strong predictors of both student achievements and student attitude levels. Even with the small number of items (10) which attempt to measure some of the processes in the home, the findings support unambiguously the results of other studies of the impact of the home environment.

The main findings of the study can be summarized easily. First, the process variables, despite their small number, predict both student achievements and attitudes in all countries for both 10 year olds and 14 year olds. Although the relationships between the individual variables and student achievements and attitudes vary slightly from country to country, the patterns of the relationships are strikingly similar. Second, the predictions of both achievement and affective levels are better in the 14 year old group than in the 10 year old group. One can not say whether the effects of the home environment accumulate but it appears that the items which measure the verbal environment of the home are important predictors at both ages while the items which measure the home's support for activities encountered in the school are stronger for the 14 year olds. Third, the relationships between the process variables, the attitude scales and cognitive achievements differ between the 10 year old group and the 14 year olds. What exactly are the effects or the directionality of the effects are a matter for speculation.

One speculative interpretation of the relationships among the home, affective levels and achievements is to suggest that the home operates in the early school years to affect directly both the

student's attitude toward schooling and the cognitive achievements. That is, the attitudes play little if any part in the prediction of achievement if one controls for the influence of the home variables. For the older group, the 14 year olds, the attitude variables appear to have a relationship with the achievement variables which is independent of the home process variables. Not only does the home have an influence on the attitudes and achievements of the student, but also the attitudes play an independent role in predicting achievement. This suggests that the ways that attitudes and achievements are intertwined are much more complex for older children than for those who have had less experience in the school setting. The exact nature of the relationships between the affective and cognitive variables, though a subject of extensive previous research, is no further explicated by this set of findings.

Since we know that the home has a powerful influence on how well a student will do in school and how positive that student's attitudes will be, one is faced with the obvious question of what should be done about it. Such questions are important ones but fortunately beyond the scope of this paper. The effects of home intervention programs have been documented by Gordon (1969) and some possibilities for such programs have been discussed by Kifer (1975). How the school can respond to these student differences is the crux of Bloom's (1976) arguments concerning the effectiveness of quality on instruction. It is obvious that both the home and the school have a stake in providing optimal environments for the development of the young.

Table 1

HOME PROCESS VARIABLES IN IEA STUDIES

Item	Dimension: Verbal Environment	Support for Academic Activity	Cultural Milieu
1. Do you usually have a fixed time for homework?		X	
2. How often does your mother or father help you with your homework?		X	
3. When you talk at home do your parents insist on correct speech?	X		
4. When you show your parents anything you have written do they check your spelling?	X		
5. How often is a dictionary used in your home?	X		
6. Do your parents encourage you to read in your spare time?			X
7. When you get home from school do your parents want to know about your school work?		X	
8. How many hours did you spend reading for pleasure last week?			X
9. How many hours did you spend doing your homework (in all subjects) last week?		X	
10. Do your parents encourage you to go to museums?		X	

Table 2

SAMPLE SIZES

	Chile	Germany	India	Netherlands	Scotland	Sweden	USA
Population I	783	1417	1656	1019	1808	1554	3933
Population II	832	1646	1680	947	1782	1907	2067

Table 3

MULTIPLE CORRELATIONS BETWEEN PROCESS VARIABLES AND OUTCOME VARIABLES

Country	Population I (10 years old)	Population II (14 years old)
Chile		
Science	R = .13	R = .17
Reading	.09	.26
Word Knowledge	.13	.23
Like School	.27	.20
Expected Education	.21	.18
Germany		
Science	R = .23	R = .20
Reading		
Word Knowledge	.24	.25
Like School	.27	.33
Expected Education	.22	.32
India		
Science	R = .21	R = .20
Reading	.22	.24
Word Knowledge	.21	.25
Like School	.25	.33
Expected Education	.25	.24
Netherlands		
Science	R = .26	R = .30
Reading	.32	.38
Word Knowledge	.30	.33
Like School	.22	.33
Expected Education	.14	.34
Scotland		
Science	R = .28	R = .40
Reading	.30	.46
Word Knowledge	.29	.38
Like School	.35	.46
Expected Education	.21	.48
Sweden		
Science	R = .16	R = .15
Reading	.20	.22
Word Knowledge	.18	.17
Like School	.27	.44
Expected Education	.18	.32

Table 3 continued

U.S.A.		
Science	R = .23	R_c =
Reading	.27	.34
Word Knowledge	.24	.30
Like School	.32	.43
Expected Education	.18	.29

Table 4

FIRST CANONICAL CORRELATIONS AND IMPORTANT PROCESS VARIABLES

Country	Population I (10 years old)	Population II (14 years old)
Chile	r = .32 amount of reading for pleasure parental interest in school use dictionary correct speech	r = .33 amount of reading for pleasure parental interest in school correct spelling
Germany	r = .34 amount of reading for pleasure parental interest in school	r = .42 fixed time for homework encourage museum visits
India	r = .33 encourage reading amount of reading for pleasure parental interest in school	r = . 42 encourage reading fixed time for homework
Netherlands	r = .38 amount of reading for pleasure use dictionary	r = .48 amount of homework amount of reading for pleasure fixed time for homework
Scotland	r = .41 amount of reading for pleasure encourage reading parental interest in school	r = .60 amount of homework amount of reading for pleasure encourage reading parental interest in school fixed time for homework
Sweden	r = .31 amount of reading for pleasure parental interest in school	r = .47 amount of homework fixed time for homework use dictionary parental interest in school amount of reading for pleasure
U.S.A.	r = .38 amount of reading for pleasure encourage reading parental interest in school	r = .49 amount of homework amount of reading for pleasure fixed time for homework encourge reading

TABLE 5 Regression Analysis - Population I

		U.S.A.	NETHERLANDS	INDIA	SWEDEN
Home Process with					
1) Reading	Multiple R	.29	.34	.22	.27
Reading for Pleasure	% Variance	5.7	8.1	1.0	4.9
Remainder	accounted for	2.9	3.7	3.8	2.6
2) Science	Multiple R	.26	.27	.22	.24
Reading for Pleasure	% Variance	4.6	3.1	1.0	3.2
Remainder	accounted for	2.3	4.1	3.7	2.7
Adding Attitude Scales					
1) Reading	Multiple R	.31	.38	.43	.29
Attitudes	% Variance	1.7	3.0	16.71	1.5
Reading for Pleasure	accounted for	6.4	9.2	.04	3.4
Remainder		1.5	2.0	2.0	3.5
Science	Multiple R	.27	.29	.37	.25
Attitudes	% Variance	1.1	1.8	10.9	1.1
Reading for Pleasure	accounted for	4.9	3.4	.25	2.2
Remainder		1.5	3.2	2.7	2.9
Adding Word Knowledge					
1) Reading	Multiple R	.65	.56	.58	.50
Word Knowledge	% Variance	40.2	25.9	25.4	21.9
Attitudes	accounted for	.2	1.2	7.3	.47
Reading for Pleasure		1.4	3.0	0	1.2
Remainder		.3	1.0	.9	2.1
2) Science	Multiple R	.64	.51	.60	.50
Word Knowledge	% Variance	38.9	22.8	31.6	22.1
Attitudes	accounted for	.2	.8	3.3	.27
Reading for Pleasure		.8	.9	0	.49
Remainder		.4	1.4	1.2	1.9

TABLE 6 Regression Analysis - Population II

		U.S.A.	NETHERLANDS	INDIA	SWEDEN
Home Process with					
1) Reading.	Multiple R	.35	.41	.28	.29
Reading for Pleasure & Homework	% Variance accounted for	8.6	11.1	5.8	8.3
Remainder		3.5	5.6	2.1	.1
2) Science	Multiple R	.31	.34	.25	.22
Reading for Pleasure & Homework	% Variance accounted for	6.2	7.6	3.9	2.4
Remainder		3.1	3.8	2.1	2.4
Adding Attitude Scale					
1) Reading	Multiple R	.44	.47	.35	.43
Attitudes	% Variance	9.6	11.4	8.0	13.1
Reading for Pleasure & Homework	accounted for	7.4	7.3	2.4	3.6
Remainder		2.1	3.5	1.8	2.0
2) Science	Multiple R		.40	.31	.36
Attitudes	% Variance		8.7	6.1	9.9
Reading for Pleasure & Homework	accounted for		4.5	1.3	2.1
Remainder			2.8	2.1	.9
Adding Word Knowledge					
1) Reading	Multiple R	.64	0.62	.44	.59
Word Knowledge	% Variance	34.6	36.9	14.0	26.9
Attitudes	accounted for	3.2	4.1	3.3	5.5
Reading for Pleasure & Homework		2.2	1.9	1.3	.8
Remainder		.7	1.9	1.0	1.6
2) Science	Multiple R		.52	.47	.52
Word Knowledge	% Variance		21.2	18.9	21.1
Attitudes	accounted for		3.4	1.5	4.1
Reading for Pleasure & Homework			1.3	.5	0
Remainder			1.6	.8	1.5

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