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# PHILIPPINE JOURNAL OF EDUCATIONAL MEASUREMENT

**ASSESSMENT IN THE PRIVATE SCHOOL SECTOR**

*Esperanza C. Buen*

**The Filipino Child As A LEARNER**

*Elizabeth R. Ventura*

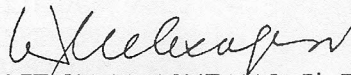
**LANGUAGE USE AND TRANSFER IN  
MATHEMATICAL PROBLEM SOLVING**

*Allan B. I. Bernardo*



## FOREWORD

The Center for Educational Measurement has always recognized the need for research on the learner and the learning process. It is the intent of the Journal to support this research by providing a venue for discussions of issues, reviews, and empirical studies bearing on these topics. Educators, psychologists, and those in other related disciplines who have a common interest in these topics are invited to share their work through this Journal.



LETICIA M. ASUZANO, Ph.D.  
President





Center for Educational Measurement

# PHILIPPINE JOURNAL of EDUCATIONAL MEASUREMENT

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The Philippine Journal of Educational Measurement publishes empirical papers and nonempirical reports such as theoretical notes, specialized reviews, and commentary on issues related to educational testing, measurement, assessment, evaluation, and research in all of its many aspects.

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## ASSESSMENT IN THE PRIVATE SCHOOL SECTOR: THE CEM EXPERIENCE

Esperanza C. Buen  
*Center for Educational Measurement*

*The private education sector in the Philippines is a major field of action, making up a large proportion of the schooling population. It was on account of their need for measurement and related services that the Center for Educational Measurement was established. The CEM has for its mission that of helping schools improve their programs through the use of assessment and research. It has sought to attain this through the development of indigenous measures for scholastic achievement, career guidance and admissions to various training programs. The management and monitoring of its testing services through a centralized testing program in which schools become members, utilize the tests and actively work for the improvement of their programs. To make data meaningful and useful to schools has been a major concern of the CEM. It therefore continues to provide assistance to its members by way of instructional and advisory services for data interpretation, teaching interventions and research.*

In every society education is an instrument for development. In the Philippines, the private education system is seen as a uniquely Filipino contribution to the ways by which man fashions this instrument. Many other pressing priorities, however, limit what the government can do in the field of education. This has compelled it to regard the private sector as an additional resource needed for responding to society's educational needs. In spite of deficiencies, private education in the Philippines is an achievement of the Filipino. As such, it must be strengthened so that it may be more efficient and relevant in its contribution towards improving the quality of life in this country.

Indeed, while private education accounts for less than 10 percent of total enrollment in the elementary level, it does account for 36 and 80 percent of total enrollment in secondary and tertiary levels, respectively. It is therefore a vital domain of action. With this in view, the problems of private education are not to be seen as problems of the sector alone. Government has a significant role in enhancing the status, welfare, and capacity of private schools to perform the part it has assigned to them (FAPE, 1986).

On its part, then, private education must be committed to the ideals of excellence and relevance to the imperatives of development, within the limits of available resources. Deficiencies can be remedied, however, by responding to the strong impetus and abundant inspiration among the private schools to improve themselves. The practice of self-evaluation has been undertaken by many of these schools in order to assess the quality of



their services. Often, such efforts are couched within the system of voluntary accreditation where the schools can demonstrate the excellence of their programs, whether in terms of student achievement, the significance of their research efforts, or the value of the educational service that they provide.

It is within this context that our organization finds itself. The Center for Educational Measurement or CEM is a privately managed organization committed to assist member schools in improving the quality of their educational programs through measurement and research.

## **CEM HISTORY**

The early beginnings of the CEM can be traced back to a cooperative testing program launched by a group of private sectarian colleges and universities in 1968. The Fund for Assistance to Private Education (FAPE), at the representation of private educational institutions, embarked on a comprehensive guidance and testing program to help schools in scholarship selection, curricular placement, psychological testing and career guidance. The program gave priority to the development of indigenous tests, the first of which was the College Entrance Test (CET) used nationally for the first time in 1971, followed by the DECS commissioned National College Entrance Examination (NCEE) in 1973. Two years after, FAPE turned over the management of the NCEE Program to the government and proceeded to develop other tests for academic and career guidance.

The enthusiastic response of both government and private schools to these tests as well as the clamor for technical assistance in their development planning set the course for FAPE to immediately consider a plan to set up a separate and independent entity which will provide measurement and related services to schools. Following consultations with individuals and groups, with schools and school associations, a consensus was reached: an independent testing agency was in order. Thus, on September 1, 1978, the CEM was born.

## **CEM MISSION**

CEM regards education as a development process that involves change both in the individual and the school. This change in individual and institutional behavior can be susceptible to measurement and study, and can thus serve as basis for planning and directing the growth of students and schools. Given this view, CEM considers as its principal mission that of helping schools improve the quality of their educational programs through measurement and research. A complementary goal is increasing the fit between the characteristics of the program and those of the students who participate in them.

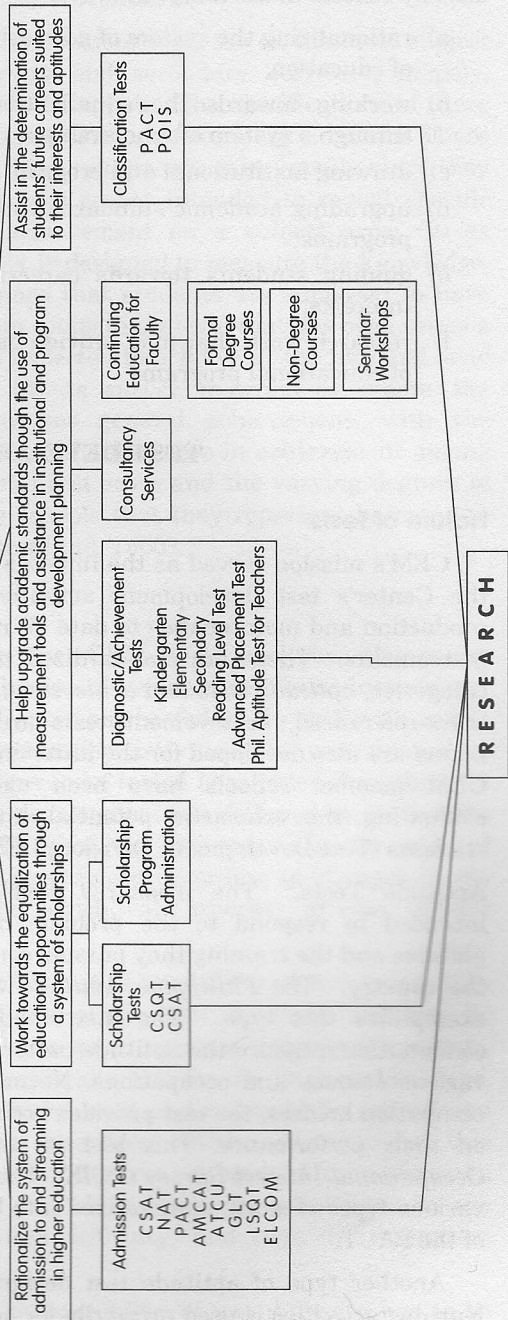
Figure 1  
CEM Mission



## CENTER FOR EDUCATIONAL MEASUREMENT

### MISSION

#### HELP IMPROVE THE QUALITY OF EDUCATIONAL PROGRAMS THROUGH MEASUREMENT & RESEARCH





Under this concept, CEM provides its clients test measures at all levels of the educational ladder. Data generated by these tests may be used by schools in the following ways:

- a) rationalizing the system of admission to and streaming in all levels of education;
- b) working towards the equalization of educational opportunities through a system of scholarships;
- c) drawing institutional and program development plans;
- d) upgrading academic standards through instructional and advisory programs;
- e) guiding students towards careers suited to their abilities and interests;
- f) research work that may provide basis for planning and evaluation of educational programs.

## TEST DEVELOPMENT

### Nature of Tests

CEM's mission served as the impetus during the last fifteen years for the Center's test development activities which have resulted in the production and maintenance to date of, more or less, 50 educational test instruments. These are standardized tests classified into two general categories, *aptitude tests* and *achievement tests*. While aptitude tests are norm-referenced, achievement tests are criterion-referenced, although norms are also developed for the latter in order to maximize their utility. CEM member schools have been using these tests primarily for evaluating the scholastic potential and learning outcomes of their students (Test Development Division, CEM, 1993).

**Aptitude Tests.** The measures developed under this category are intended to respond to the problem of mismatch between students' abilities and the training they pursue, considering the manpower needs of the country. The *Philippine Aptitude Classification Test (PACT)* best exemplifies this type. The instrument consists of subtests that in combination measure the aptitude patterns which are deemed relevant to various courses and occupations. Normed on successful graduates and occupation holders, the test provides probability scores for students based on their performance. This test is complemented by the *Philippine Occupational Interest Survey (POIS)*. The POIS measures preferences for various types of work, summarized into broad categories matching those of the PACT.

Another type of aptitude test designed to predict success in future learning activities is used primarily for admission and selection purposes. The contents of the test usually consist of mental ability and subject-matter measures. The *College Scholastic Aptitude Test (CSAT)*,

the DECS-commissioned *National Medical Admission Test (NMAT)*, and admission tests for allied health sciences, graduate courses and scholarship programs are examples of such tests.

**Achievement Tests.** The CEM achievement tests are on the basic subject areas specified in the elementary and secondary curricula, namely, Mathematics, Science, Pilipino, and English. The specifications of these tests are based on the revised elementary and secondary curricula. These tests may serve three purposes: (1) as *diagnostic* instruments since they have been constructed to yield part scores intended to reveal specific weaknesses and strengths in achievement on a subject area; (2) as measures of *mastery* since the test is designed to measure the knowledge, skills, and other learning outcomes that students are supposed to have acquired, compared to a minimum competency level that has been set as a standard which all students are expected to achieve at the national level or at the school level; and (3) as *survey* instruments where the interpretation of scores emphasizes general achievement, with the intention of ascertaining the extent of differences in achievement among pupils or among schools. The total test score and the varying degrees of success among pupils or among schools that they represent become the focal points of the test results (Gronlund, 1965).

### Process of Test Development

The process of developing the CEM tests includes the major components required in the production of standardized forms intended for defined populations. While the Center has beefed up its staff with people trained in skills required for evaluation activities, the participation of experts as consultants in the areas to be tested is solicited from the very start. The various steps in test development are followed to ensure the qualitative and statistical validity of the measures. In the case of subject-related tests, the forms are revised according to changes in the nationally prescribed curricula which, at present, private schools generally follow.

In addition, where a particular test is used from year to year, it is desirable to assemble parallel forms of the test. A single form may be invalidated prematurely through constant exposure, copying of contents, or loss of test booklets. This is especially true for the "high-stakes" type, such as admissions tests. Test forms used earlier would be retired and new forms parallel to them are assembled. Although expensive, this procedure safeguards the integrity of the test. A bank of items comes in handy and new forms can be assembled ensuring parallelism in the distribution of item content, item difficulty, and item discrimination (Angoff & Dyer, 1971).

In this task, the problem of comparability of test difficulty has to be resolved. Differences among sample groups do exist and are likely to affect the statistical characteristics of the items. Item analysis yields





group statistics which are not sample-free. The CEM therefore employs the process of item equating, also called delta equating, which puts both old and new items in an item pool on the same standard scale established according to specifications of the first form of family of tests. This equating of forms also renders the measure capable of yielding comparable results that are useful in trends analysis.

### **CENTRALIZED TESTING PROGRAM**

The CEM believes that its mission of helping schools improve their educational programs can best be achieved through a "self- help" concept. Many schools in our country have set up or intend to set up their own testing programs, presumably, to gather valid and reliable information about their students' scholastic behavior. However, an effective testing program needs not only qualified people to handle the development, administration, and interpretation of data but physical facilities, equipment, research expertise, and access to indigenous test instruments as well. All these entail a substantial budget. These constraints and the merit of answering the concerns of a large number of schools led to the conceptualization of a centralized mechanism that can offer all the services of a good testing program at the smallest budget possible (Asuzano, 1976). Such is the concept behind CEM's Centralized Testing Program (CTP).

Through the CTP concept, schools that feel the need for assistance may enlist themselves as members, and in consultation with CEM , they further clarify their needs and identify the services available that would best fit these needs. The schools are also enjoined to commit themselves to the development of their programs, with the assistance of the Center. Akin to a civic club membership and relationship, the schools begin to extend their developed resources and professional expertise to other schools that may be needing them.

The Test Service office of CEM undertakes the promotion activities and monitors test administration on the national level. It serves as the liaison between the Center's main office and the test service centers located in all regions of the country. As shown in Table 1 , its nationwide scope of operation is established through a network of 23 test service centers. All regions of the country have at least one CEM test service center although there may be two or more test service centers in a particular region depending on the school membership potentials of the area. (It is interesting to note that about six percent of the member schools come from the public sector.) At present, the CTP of CEM services more than 400 member schools all over the country. This translates to nearly half a million students tested with CEM instruments, as shown in Table 2. The volume of examinees tested from 1978-79 until 1992-93 is presented in Figure 3.



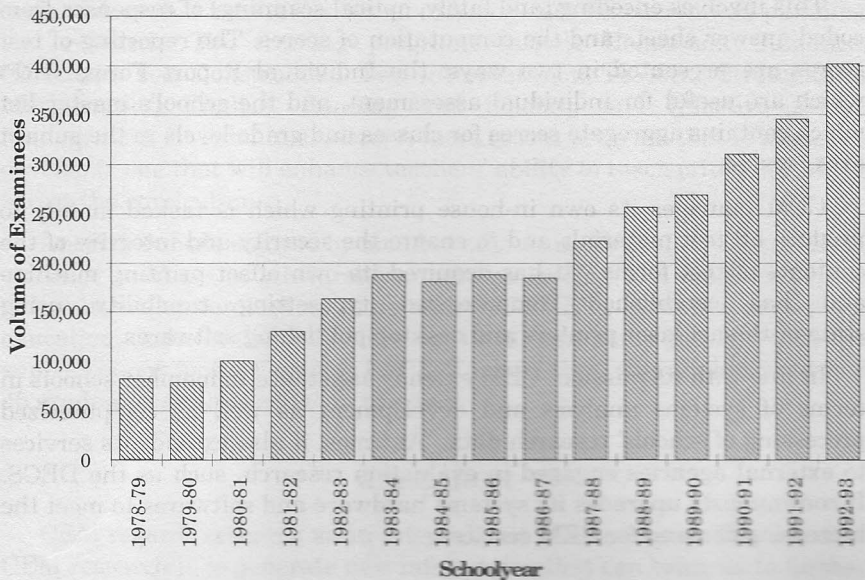
Table 1  
Distribution of CEM Centers and Member Schools By Region  
As of Schoolyear 1993-94

Region	CEM Test Center	Number of Member Schools		
		Private	Public	Total
NCR	CEM-Metro Manila	80		80
CAR	University of Baguio, Baguio City	2		2
I	University of Pangasinan, Dagupan	13		13
	Divine Word College of Laoag, Laoag City	2		2
II	La Salette of Santiago, Isabela	13		13
III	Wesleyan University of the Philippines	1		1
	Columban College	15		15
IV	CEM-Lucena, Lucena City	9	1	10
	St. Francis de Sales Minor Seminary, Lipa City	22		22
	Holy Trinity College, Palawan	4	4	8
	CEM-Mindoro, Calapan	9	2	11
V	Aquinas University, Legaspi City	13		13
VI	CEM-Iloilo, Iloilo City	17		17
	University of St. La Salle, Bacolod City	17		17
VII	CEM-Cebu	27		27
VIII	Divine Word University, Tacloban City	8	1	9
IX	Ateneo de Zamboanga	5	1	6
X	Xavier University, Cagayan de Oro City	20		20
	San Nicolas College, Surigao City	5		5
	Urios College, Butuan City	9	5	14
XI	CEM-Davao	51	6	57
	Notre Dame of Dadiangas Coll., Gen. Santos City	24	2	26
XII	University of Southern Mindanao, Kabacan	12	3	15
T O T A L		378	25	403

Table 2  
Regional Distribution of CEM Test Centers,  
Member Schools and Volume of Examinees

Region	No. of CEM Test Centers	No. of Member Schools	Volume of Examinees			
			Elementary	Secondary	Tertiary	TOTAL
Ilocos Region	2	15	4,117	10,605	648	15,370
Cagayan Valley	1	13	1,531	7,453		8,984
Central Luzon	2	16	779	3,798	486	5,063
Southern Luzon	4	51	7,249	17,038	490	24,777
Bicol Region	1	13	6,902	6,991	239	14,132
Western Visayas	2	34	7,044	8,440	2,892	18,376
Central Visayas	1	27	9,299	7,978	411	17,688
Eastern Visayas	1	9	1,085	2,835	158	4,078
Western Mindanao	1	6	4,860	2,560	51	7,471
Northeastern Mindanao	3	39	4,558	20,303	991	25,852
Southern Mindanao	2	83	18,609	39,033	582	58,224
Central Mindanao	1	15	2,401	7,634	175	10,210
Cordillera	1	2	2,041	7,710		9,751
National Capital Region	1	80	80,416	93,667	7,698	181,781
NATIONAL TOTAL	23	403	150,891	236,045	14,821	401,757

Figure 3  
CEM Volume of Examinees (SY 1978-79 to SY 1992-93)



A major role is played by the test center coordinators who perform in behalf of CEM the functions of planning, administration, and evaluation of CEM-assisted programs to schools in their respective areas of responsibility. They are chosen on the basis of a strong professional background and personal qualities important for management of testing, a task that requires security, standard conditions, and confidentiality of measures and results. In turn, the coordinators are tasked to train and maintain a pool of examiners and proctors who are also selected according to the prescribed qualifications.

The management of a centralized testing program is not an easy task. In the process of test distribution, administration and retrieval of materials, errors can creep in. The loss of a single test booklet can be considered the loss of a whole set. A well-designed manual is therefore issued to the central staff, the local staff and examiners. Extra precautions are instituted for the "high-stake" exams. In our experience, faithful conformity with the guidelines has insured us from any major setback in test administration.

### PROCESSING OF TEST DATA

After servicing the testing needs of schools through appointed examiners, the CEM retrieves test materials and does the centralized scoring of accomplished answer sheets. Through the years, it has acquired



a modest degree of advancement in terms of its capacity to process test data through a computerized system.

This involves encoding (and lately, optical scanning) of responses from coded answer sheets and the computation of scores. The reporting of test scores are presented in two ways: the Individual Report Forms (IRF) which are useful for individual assessment, and the school's master list which contains aggregate scores for classes and grade levels in the subject areas tested.

CEM manages its own in-house printing which is tasked mainly to produce all test materials and to ensure the security and integrity of the contents of test forms. It has acquired its own offset printing machine and has established computerized typesetting capability using state-of-the-art laser printers and desktop publishing softwares.

In line with its mission, CEM extends assistance to member schools in terms of systems analysis and development as well as computerized processing of schools' research data. At times, it also extends its services to external agencies engaged in evaluation research, such as the DECS. It continuously upgrades its systems hardware and softwares to meet the increasing demand for CEM services.

## **INSTRUCTIONAL AND ADVISORY PROGRAMS**

Beyond the testing exercise, the CEM provides professional assistance and services in data utilization and instruction. CEM member schools are taught how to interpret test results and use test data in relation with other information in order to help students understand themselves, and to aid teachers in improving their teaching methodology. Through its instructional and advisory programs, CEM adheres to its mission of assisting schools in upgrading their academic programs and in promoting quality education. The services range from continuing education through training and scholarships to consultative efforts in teaching strategies and information technology.

### **Data Utilization Program (DUP)**

The DUP is a concerted effort of the CEM and its member schools to assess the immediate uses of data obtained from CEM tests. In addition to enhancing the capabilities of counselors and teachers in dealing with individual test results, the school develops the expertise in applying aggregate information to particular sections or classes in a subject area and grade level. In a DUP conference-workshop, classroom teachers, administrators, academic heads and guidance coordinators carefully analyze the test results in the light of other relevant information and prepare plans of action for the improvement of programs for instruction, guidance and admission.

## **Short-term Training Programs and Degree Programs**

The CEM conducts training programs to improve teaching methodology and help test users in utilizing data for curriculum planning and research. The training programs include Homeroom Guidance, Classroom Test Construction, Test Interpretation, Teaching Strategies in Mathematics, English, Reading and Science, and Effective School Management for Administrators. A more recent program that it wishes to develop is one that will enhance teachers' ability to teach critical thinking across the curriculum.

Another benefit enjoyed by member schools is the participation of their qualified teachers in scholarship programs leading to a master's degree either in evaluation and measurement (MSEMEV), guidance, or reading education. Some of these scholarships have been made possible with the support of our mother agency, FAPE. To date, this program has produced 45 graduates already active in the field.

## **RESEARCH**

CEM regards research as an integral part of assessment. The thrust of CEM research is to generate new information that can bring us to further refinement of our assessment schemes, identify the factors that affect the output of programs and evaluate the effectiveness of interventions, in short, to contribute to the science and technology of measurement as well as its usefulness to the schools that we serve.

### **Institutional, Regional, and National Profiles**

Individual test scores constitute the bulk of assessment data compiled by CEM. This readily accessible data bank gives CEM the capability to function beyond the assessment of individual scholastic achievements and aptitudes. Profile reports have been used to identify particular strengths and weaknesses in school learning as they describe the current ability levels of an institutional, a regional, or a national sample of students. These have become the bases for the design and implementation of intervention programs for various aspects of the learning situation.

### **Comparative Profiles**

Comparative profiles of test performance have also been generated to detect areas of improvement or decline of student competencies. These were in the form of comparisons of school, regional, or national test performance across specific school years or comparisons of diagnostic pretest-posttest performance within a schoolyear for an institution that avails of the scheme. Examples can be seen in Figures 4 and 5.

In these types of comparative studies, focus of interest shifts from individual student characteristics to institutional factors which may

Figure 4  
Mean Performance of the Western Visayas Sample in the Four (4) CSAT Subtests  
(School Year 1985-86 to 1991-92)

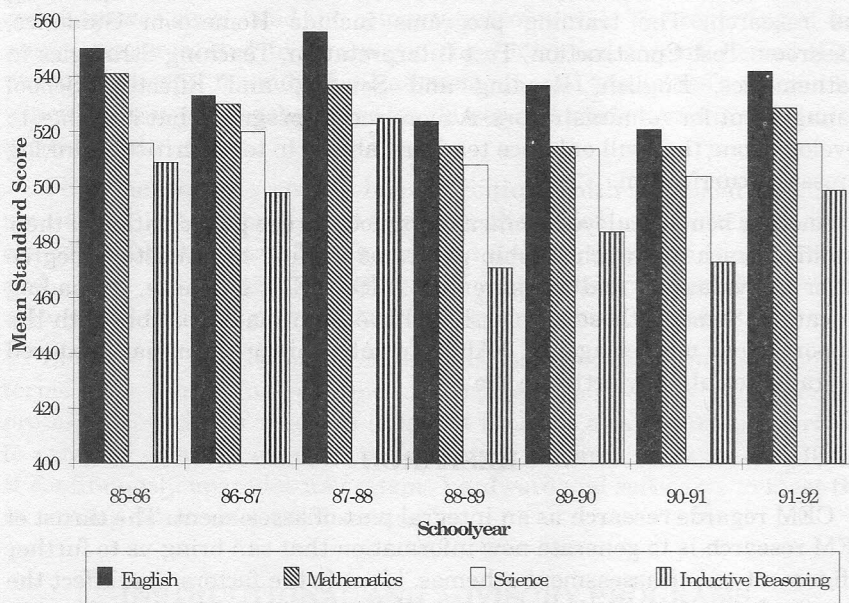
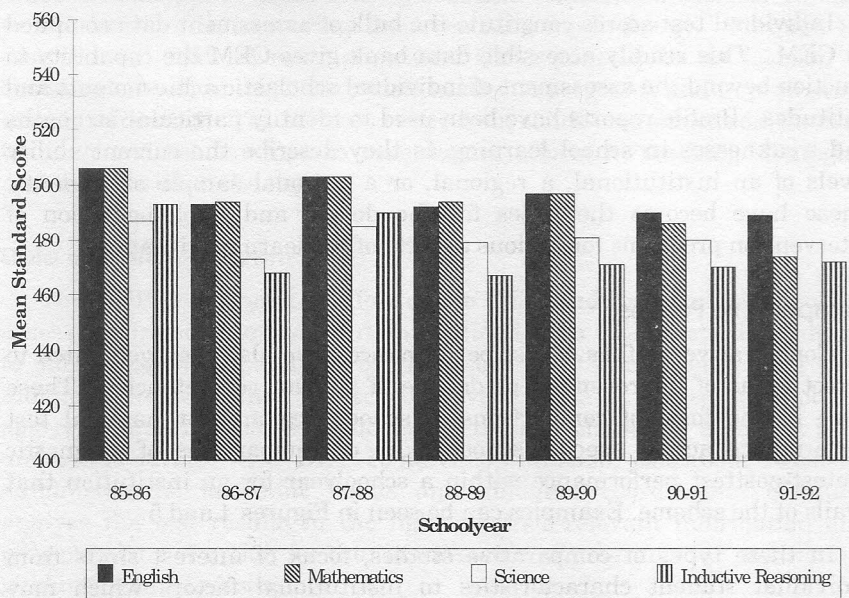


Figure 5  
Mean Performance of the National Sample in the Four (4) CSAT Subtests





account for the significant increase or decrease in test performance (e.g., teacher competence, instructional program, school environment, etc.). Further studies may then be recommended or initiated to verify the effects of these factors.

CEM prepares school profile reports upon request by member schools, particularly those which do not have a fully functioning guidance or research section. They feel the need to understand their own results in a systematic manner and often need this information for the accreditation process. CEM envisions a policy of transferring this assessment capability to individual schools through a series of data utilization seminars.

### Validity Studies on CEM Test Instruments

Acknowledging the fact that the accuracy of research findings and inferences depends on the proper research methodology and on the validity and reliability of an appropriate research instrument, the CEM

Table 3  
Coefficients Obtained in the Prediction of First Year College  
Average Using HSAVE, CSAT and NCEE as Predictors.

Degree Programs	Criterion	Predictor	r	R	Beta Wt.
Total	FYCG	HSAVE	0.56	0.67	.56**
		CSAT	0.41		.34**
		NCEE	0.44		.20**
Engineering	FYCG	HSAVE	0.69	0.83	.69**
		CSAT	0.58		.44*
		NCEE	0.55		.22
BS Biology	FYCG	HSAVE	0.63	0.75	.63**
		CSAT	0.34		.40**
		NCEE	0.36		.03
AB	FYCG	HSAVE	0.47	0.65	.48**
		CSAT	0.53		.37**
		NCEE	0.37		.32**
LIA-COM	FYCG	HSAVE	0.63	0.79	.63**
		CSAT	0.36		.41**
		NCEE	0.57		.38**
BS Nursing	FYCG	HSAVE	0.36	0.52	.36**
		CSAT	0.32		.32**
		NCEE	0.39		.23**
Commerce	FYCG	HSAVE	0.63	0.69	.63**
		CSAT	0.34		.26**
		NCEE	0.41		.12

\* significant at .05

\*\* significant at .01

note: FYCG is First Year College Grade; HSAVE is High School Average

undertakes studies that monitors the psychometric integrity of its assessment instruments. This entails research studies on the validity of test results as used by the member schools.

Concurrent validity of diagnostic test scores in relation to the final grades of the examinee and predictive validity of CSAT scores in predicting college performance are examples of these studies.

The correlation of DT scores with final grades also establishes the congruence of the school's curricular and instructional program with that of an instructional strategy, designed by curriculum and subject area experts, which served as the basis for drawing up the test specifications of CEM test instruments. It may likewise serve as a basis for evaluating the validity of the grading system adopted by the teacher or by the school in relation to a standardized measure of subject area achievement.

Validity studies on other CEM instruments used for selection and classification purposes are also inherent concerns. The NMAT instrument, for instance, has undergone a series of research studies which dealt on the following areas: (1) the validity of NMAT scores to predict the first and second year performance in medical school, (2) the correlation of NMAT scores with "Passing All" or "Failing At Least One" medical subject during three years of academic training, and (3) the relationship of NMAT scores to success rate in the Physician Licensure Examination.

In the area of career guidance, a number of CEM member schools have already initiated their own research studies based on CEM test results. One Metro Manila school recently presented a tracer study of a sample of its high school graduates who went through the school's Career Streaming Program four years ago and recently graduated from different college courses. Based on the results of the PACT-POIS given during their junior year, high school seniors were streamed into different career groups and trained under a specific career-based curriculum. A major part of the research problem deals with a discriminant analysis of the test results which in effect, established the validity of the measures in discriminating the appropriate college course where an examinee's aptitudes and interests could be classified.

## **Evaluation Studies**

CEM has also undertaken evaluation studies that sought to determine effectiveness of programs and/or policies for purposes of making decisions on whether or not a program should be changed, continued, or terminated. It has assisted DECS in the evaluation of academic achievement under the New Elementary School Curriculum (NESC) program. It is currently working with the Bureau of Secondary Education in the ongoing evaluation of the new curriculum, the Secondary Education Development Program.

The prospective thrust of CEM is to undertake further studies on its existing instruments, do surveys on the school and classroom environments, case studies on effectiveness of instructional interventions, and perhaps other ideas that may present themselves along the way. It is in the nature of this exercise that with the arrival at a few answers to research questions, further questions arise. The Center also wants to activate its role as a clearing house for educational research studies being done by its member schools. It can build up a research grid which, together with university-based studies, can serve as a valuable reference or information bank for researchers, students, faculty, and policy makers in regard to measurement and evaluation.

The CEM perceives its role in the private education sector as an assessment body that lends support in the improvement of school programs and outputs. While our major action is in servicing them with systematic, test-based information about themselves, and even extend further assistance in instruction and research, they assume the responsibility for the actual implementation and further evaluation to sustain improved outputs. In some limited fashion, our sphere of influence has extended into the public sector, but always in the form of a cooperative venture with our counterpart in the government service.

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## THE FILIPINO CHILD AS A LEARNER: A REVIEW OF RESEARCH AND PROSPECTS

Elizabeth R. Ventura\*  
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*This paper reviews relevant empirical research in the discipline of child psychology in the Philippines, relates their findings to the educational process and identifies possible areas for further research which can lead to a better understanding of the Filipino Child as a learner.*

What do we know about the Filipino Child as a learner?

Each of us will surely feel that we have some answer to this question. And rightly so, because we recall our own learning experiences as children, or have ourselves taught something to a child. Beyond the experiential and personal, however, it can be a formidable task to integrate the existing empirical literature and attempt to describe the Filipino Child as a learner. As the following review will show for example, research is sometimes sporadic, and rarely systematic, thus making it difficult to be assertive about generalizations. Nevertheless the question posed is a valid one and the attempt to answer it will at least provide clues to what needs to be done.

Central to the understanding of the Filipino Child as a learner is an appreciation of his intellectual, emotional, and personality development. These facets of his life are recognized as vital inputs in his learning experiences. Thus, with the end-in-view of achieving a psychological perspective of the Filipino Child in the context of the educational process, this paper will focus on the following objectives: first, to describe the results of relevant empirical research; second, to see how these findings may be related to the educational process; third, to identify research problems and suggest some solutions.

### PSYCHOLOGICAL RESEARCH ON THE FILIPINO CHILD AS A LEARNER

A review of the literature in child psychology by Ventura (1988) shows some clear trends on the Filipino Child as a learner. The themes which have emerged include correlates of achievement, causal attribution of success and failure, the effects of language of instruction, the relationship between self-concept or self-esteem and learning, studies on Piaget's theory of cognitive development, the use of behavior modification in

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\*Professor of Psychology and presently Director of Admissions, University of the Philippines..

schools, school environments, textbooks, and the acquisition of selected concepts.

### **Studies on School Achievement**

Several researchers have looked into child rearing styles which are correlated with high or low achievement. For example, Macaranas (1968), found that low achievers consistently perceived their parents as protective, controlling and authority-oriented whereas low achievers saw their fathers as approving of self-sufficiency and initiative. Another finding consistently found in studies is a positive relationship between maternal discipline, home environment and academic performance. Umali-Razon (1981) showed that the mothers who are most successful in promoting cognitive development among 5-year old urban children are those who encourage autonomy and are loving. These mothers also provided their children with varied activities for their cognitive growth. Mabal (1978) and Castillo (1978) likewise stated that compared to the parents of low need achievers, parents of high need achievers demanded that their children learn independence and care-taking tasks at an earlier age. Working mothers and those coming from the middle class were also found to set higher independence and achievement goals compared to mothers in the lower socioeconomic group. Rao (1981) reported contrasting child-rearing practices for parents of fast and slow learners. Parents of fast learners, were characterized as encouraging verbalization, fearful of harming the child. On the other hand, the parents of slow learners had the following traits: martyrdom, ascendancy of the mother, irritability, and intrusiveness. It is clear from the foregoing studies that child-rearing practices as well as personality attributes of parents can influence academic achievement. The utilization of these findings in the educational process will be discussed in a later section.

Looking into another aspect of the problem, Watkins (1982a) studied 237 children (mean age, 15 years) to search for antecedents of academic achievement. He concluded that the best predictors are intelligence, socio-economic status and locus of control. A subsequent study of Watkins, Hattie and Astilla (1983) compared children from "privileged" and "depressed" backgrounds on antecedents of affective and cognitive learning outcomes. In contrast with the "depressed" children, the "privileged" group were younger, had lower academic self-esteem but showed more positive attitudes towards school. They also had better educated parents. Overall they found IQ to be the best predictor of academic success followed by academic self-concept.

For children in the rural areas, what were the causal attributions for achievement? Watkins (1982b), utilizing Weiner's attributional theory of achievement reported that Filipino barrio children utilized all four types of explanations for success or failure at an academic task. Thus, academic performance was perceived as due to ability, effort, difficulty of task, and

luck. Interestingly, all four were seen as important with luck as the least important. Unsuccessful students were found to be least likely to attribute poor performance to ability or effort. In the group as a whole, the authors reported that they held reasonably adaptive patterns of attribution and optimistic views of life, and worked hard for educational qualifications.

In investigating the cognitive outcomes of elementary education, Coronel (1990) found that generally, the participants in the study showed poor performance (correct answers were less than 50% of the total number of items) in verbal proficiency in Pilipino as well as in English, numerical proficiency, word problem-solving, arithmetic computation, and diagram/figure interpretation. However, variation in achievement was found to be largely due to differences among pupils in a school rather than the school's location. This was also evident in the finding that mental ability was the best predictor of academic achievement in the subject areas mentioned above.

Other predictors of achievement were the availability of a phone in a barangay and understanding of Tagalog for community variables. For school variables, the use of textbooks and games predicted academic achievement. Aside from mental ability, average annual income was also found to be a significant individual variable in assessing cognitive outcomes. This detailed listing of factors influencing academic achievement point out the importance of learning environments and suggest the need to undertake studies focusing on the dynamics between home, school, and the community.

The foregoing studies indicated that academic achievement as a research area in child psychology revolved around 1) a characterization of parenting styles of high and low achievers, 2) a search for antecedents, 3) a description of causal attribution.

### **The Learner's Self-Concept and Self-Esteem**

Another area which has attracted researchers in child psychology is the learner's self-concept and self-esteem. Rao (1981) reported that academic performance levels were significantly correlated with self-concept scores, especially with older children (Grade 5). Contrary to expectations, slow learners were found to have higher self-concepts. On the other hand, Cano, et. al. (1983) reported a positive correlation between self-concept and IQ. Rao's finding might be explained by the individualized instruction utilized in the school where she conducted her study. The individualized would certainly have implications in the handling of slow learners.

In an intervention study for institutionalized adolescents, Fajardo (1980) showed that participation in a Theater Arts program increased self-esteem. This particular study demonstrated the importance of



non-academic or extracurricular aspects of the educational process. The series of studies of Watkins and his colleagues reported several relevant findings on self-esteem and learning. In the 1982 study, they confirmed an earlier finding that self-esteem is positively correlated with academic achievement. They also identified as antecedents of personal adequacy, factors such as sex, socio-economic status, quality of family relationship and parental and self-academic aspirations. In particular, all children with higher IQ's and those who reported satisfactory family relationships felt more personally adequate. Generally, males were found to have higher self-esteem than females.

Watkins and Astilla (1981) further reported that low self-esteem subjects failed to internalize success to the same extent as their high self-esteem peers. Both groups tended to internalize failure almost to the same extent. The results of this study have implications for handling success and improving on failures. In an earlier study (Watkins & Astilla, 1980) these two authors reported that self-esteem and school achievement were significantly correlated - a confirmation of a study reviewed in the article. (Youngblood, 1976).

### **Studies on Language**

Among the variables explored for their relation with language development were SES, age, IQ, motivation and parental attitudes. In a study of 566 urban preschoolers, Andaya (1978) demonstrated that with the use of the Denver Developmental Screening Test, children from higher socioeconomic levels were more advanced on the following language tasks: (1) having three words other than "mama," "dad" or their equivalent, (2) combining two words, (3) naming one picture, (4) using plurals and (5) recognizing three colors.

On the other hand, Lopez (1971) found age (but not sex and IQ) as a significant factor in the internalization of Tagalog grammar rules in a study involving 3- to 7-year old children. She observed that the imperfective form of verbs are internalized as early as 3 years of age but the contemplative aspect is achieved only at 4 years and above. With respect to adjectives, their singular formation was internalized only at age 7. For this group of 3- to 7-year olds, she also found out that *mag* verbs were used more often than *um* verbs.

In another study on the Tagalog language, Tucker (1971) gave imitation and completion tasks to 10-year old children using real and invented verbs to study focus acquisition. He found out that of the 6 types of focuses investigated, the easiest and the most difficult to learn was the object focus sentence and causative focus, respectively. In between were referential, locative, directional and actor, in that order. Compared to imitation tasks, completion tasks yielded more errors. This was interpreted by the author as supportive of earlier findings in other settings that the control of imitation preceded comprehension.

The two studies, which may be called motivational, explored the areas of verbal learning and verbal fluency. Task difficulty ["mahirap na layunin" (ML); "madaling layunin" (DL); "di-tiyak na layunin (DTL) and gawin sa abot ng makakaya (GML)] was manipulated in a study by Carag and Acayan, (1974) involving Grade 6 pupils in a memorization task of thirty 3-letter nonsense syllables. The results showed that the DL group had the greatest proportion of correct recall, followed by HL, GML, then DTL. IQ was not a significant factor.

Ilan (1972), in a study of verbal fluency found that motivated rural preschoolers (i.e., challenged to do well) had a lower speech rate and more disfluencies and hesitations than children who were not similarly challenged (a neutral speaking condition). She also reports that intelligence, indices of psychological states and parental attitudes are positively correlated with verbal fluency. Subjects who had parents favoring severe punishment for misbehavior tended to incur more hesitations and disfluencies.

The word association of Filipino children were explored in three studies (Tiglaio, et. al., 1971, Ilagan, 1974, Paredes & Silva, 1976) utilizing words chosen at random from a Pilipino translation of the Kent-Rosanoff list. Results indicated that older subjects, low socioeconomic status children and children from urban areas gave more paradigmatic rather than syntactic responses. Paradigmatic responses were seen as indicators of higher semantic development. These findings appeared in need of further validation, interesting as they are, to help us understand better the context of the development of word associations.

Filipino children oftentimes master not just two but three or more languages. Exploring this observation, Danganan (1974) studied the trilingual vocabulary skills of Grade 6 pupils in Angeles, Pampanga. She reported that pupils who performed well or poorly in English performed just as well or as poorly in Pilipino and in Pampango.

Focusing now on speech difficulties, three studies utilizing behavior modification techniques were done with children having articulatory defects. All three report marked improvement in their subjects with the use of positive reinforcement, auditory discrimination and imitation but lament the lack of time for continued sessions outside the experimental setting (Bunyi, 1974; Arespacochaga, 1974 and Piczon, 1974). In two concept papers, the language development of educable mentally retarded children (Socrates, 1975) and the "batang ngo-ngo" (Lao, 1976) were described. Specific techniques and the impact of the social environment were likewise discussed in both papers.

In a study of public school children, Tuazon (1981) reported higher scores in a test for comprehension for a group exposed to a reading material in Filipino compared to a group using an English text.

Using response latency, retelling time, and pauses within each retelling condition, De la Llana-Decentecio (1991) examined language switching (defined as the alternate use of English and Pilipino at the word, phrase, clause or sentence boundaries) in a story retelling task among 44 sixth-grade students of a laboratory school. The subjects were assigned to two groups, high or low, depending on their proficiency in both English and Pilipino as measured by cloze tests which were developed for the study. They then read a story which was in either English or Pilipino which, upon instruction, they had to retell in either English or Pilipino. The results showed that response latency was longer and retelling was most difficult when the subjects had to retell the story in the language other than in the one in which they read it; and that regardless of level of bilingual proficiency, the subjects had more pauses when they had to retell the Pilipino story in English. However, for the high proficiency group (that is, equally proficient in both languages) retelling in either English or Pilipino were tasks of equal difficulty or ease. On the other hand, longer mean pauses among the low proficiency group seemed to indicate difficulties in English.

Where switches occur in sentences was also examined. Categories were generated from the nature of these switches (e.g., lexical, intrasentential, or intersentential). Its implications for bilingual processing was also discussed. The study clearly pointed to the need for more studies in the area. Standardized process and outcome measures of bilingual competencies of Filipino school children and how these measures relate to academic achievement in the various subject areas can provide a critical base for evaluating the soundness of a single or a dual language curriculum policy in education.

### **Studies on Piaget's Theory of Cognitive Development**

The development of Piagetian constructs such as logical multiplication (multiple classes, seriation, spatial and time relations), class inclusion concepts and object grouping abilities, substance conservation and reversibility, discrimination and reference systems have received wide attention from researchers. The results consistently confirm Piaget's theory that there is a specific sequence in the emergence of these cognitive structures (Miao, 1971, 1972, 1974; Punsalan, 1976; Beltran, 1977; de Leon, 1978).

With respect to sex differences on the Piagetian tasks, sex was consistently found to be a non-significant variable except in two out of six tasks involving spatial concepts where boys did better than girls (Punsalan, 1976). Dolores (1970) also reported that boys used nine perceptible bases for classifying objects while girls used nominal and super-ordinate bases. Making comparisons across socioeconomic groups, Miao (1974) noted that cultural deprivation as measured by SES appeared to be related to low performance in tasks involving space and



time concepts. Other researchers discussed the influence of IQ and report that high IQ was associated with better performance on space concepts (Punsalan, 1976) and left-right discrimination (de Leon, 1978) but not on conservation. IQ also appeared to correlate positively with functional and super-ordinate groupings but negatively with nominal, mixed and complexive classifications (Dolores, 1970). In comparing rural and urban children, Beltran (1977) reported significantly more conservers among urban subjects.

However, when comparisons were made with Piaget's Swiss sample, it was noted that for older subjects, Filipino children were behind their Swiss counterparts. (Punsalan, 1976). This was true for both spatial concept development and substance conservation. For the latter, Beltran (1977) noted a 4- to 5- year lag. In addition, Miao claimed in two studies (1971, 1974) that preschoolers are still in a transition state to a true substance conservation and true class inclusion.

In an attempt at exploring the effects of a curricular program and experimental training sessions emphasizing class inclusion concepts and substance conservation, Miao (1971-74) asserts a significant gain in experimental over control groups who were exposed to logico-mathematical experiences.

### **Studies Related to Behavior Modification in the Classroom**

Three studies (Gavino, 1974; Enerio, 1971; Barral, 1974) looked into specific abilities such as reading and writing. They demonstrated how conditions, imitation procedures and reinforcement can successfully facilitate and increase learning in both normal and mentally retarded children.

Nepomuceno (1981) evolved a well-thought-out behavior modification program for teachers' use in the classroom. The author has also trained some public school teachers on the use of this manual and the response has been quite encouraging (Nepomuceno, 1985). The teachers have found behavior modification principles especially relevant in dealing with behavior modification problems.

### **Studies on Perception**

The five studies reviewed in this section were all done by students and involved 7-12 year old children in urban areas. Most were single session experiments. In the study done by Chan and Magiba (1978) for instance, the effect of color and complexity of stimuli on curiosity (operationally defined as the length of time a subject looks at a stimulus card) was investigated. They reported a positive relationship between these two sets of variables and explained their results using behavior theory, information theory and physiological concepts.

Interested in children's performance on a visual search task, Solis (1978) examined the effects of familiarity, reinforcement and sex. Of these three, only familiarity was found to be a significant variable. The novelty of the task was used as an explanation for the equal performance of reinforced and non-reinforced children. Still in another area of perception, Gobenson and Palileo (1978) reported that familiarity at the social level appeared to be a significant factor in children's perception of social distance. Thus, according to this study, the friendlier the atmosphere, the closer was the perceived distance in social interactions. Ethnicity was not found to be a significant factor.

Judgments of time duration of selections among children was investigated by Elevado, et. al. (1978). They found out that the kind of music significantly affected the children's perception of similar time durations and conclude that Piaget was right in pointing out that younger children have a more subjective conception of time than older children.

In a study that could be cross-referenced to the area of language development, Sollee (1974) explored the phenomenon of perceptual defense among bilingual children. Using recognition thresholds for anxiety-producing and neutral words as her basis for comparison, her findings revealed that the relative amount of defense in a primary language was significantly greater than that observed in a secondary language. Differential learning histories and susceptibility to emotional influences at an earlier age when the primary language was being learned, were used as possible explanations for her findings.

### **Studies on Creativity**

From her extensive experience in teaching art, Pañares (1979) discussed the characteristics of the Filipino child's art. She stated that like the art of other children in the world, it was spontaneous, natural, and distinctively creative. Secondly, the natural sequence of artistic stages described by Lowenfeld may also be observed - Scribbling, Preschematic, Schematic, Dawning realism, Pseudonaturalistic and Crisis of Adolescence.

With the same objective of determining developmental characteristics of art expressions of Filipino children, the CYRC (1970) undertook a nationwide survey involving 3,413 subjects who were asked to draw their parents and their houses. Analysis of the data revealed the following: unrealistic X-ray drawings and stick figures dominated the drawings of children between 5 to 10 years of age. Their productions also showed an absence of proportion, balance and spatial relationships.

As expected, the older child (11 to 13 years old) was observed to have some critical awareness about his creative efforts. Partly because the child's fine motor skills stabilized during this period and he began to put more significance on the final art product, a naturalistic or realistic

representation emerged and a sense of proportion was achieved. For the 13- to 19-year old group, drawings showed realism, a sense of balance, proportion and a consideration for spatial relationships.

Concerned with a different problem - the establishment of criteria for "creative" drawings - Arriola, et al (1980) proposed that creative work should attract attention and maintain interest. According to these researchers, this implied that emphasis was given to color harmony, proportion, composition of figures, presence of details and completeness of work. Using these variables, they devised a rating scale from 1 to 5 to be used by four independent judges. Faced with a similar concern, the CYRC (1970) attempted to develop an Art Creativity Test. They attempted to validate this scale by administering it together with the Barron-Welsh Art scale to a group of subjects and correlating the obtained scores. Results showed a correlation in flexibility and fluency between the two tests. Scores on originality and elaboration appeared not to be significantly correlated on the two measures.

Both the CYRC and the Arriola et al studies were also interested in discovering differences associated with gender, socio-economic status or rural-urban residence. For all three variables, both studies reported no significant differences in creative ability. Arriola et al noted, however, that pupils who came from schools with rigid classroom policies and regulations even in art classes, had lower creativity ratings.

Focusing on the content or themes of the drawings, differences were found between rural-urban and high vs. low SES subjects (Pañares, 1979). The art of the urban child primarily reflected western influences (Superman, fairy tales) while the rural child showed more elements of Filipino culture (rice fields, nipa huts, farmers, fiestas, processions). Similarly, drawings of 2,041 Muslim children in Tawi-Tawi, expressed the immediate environment and cultural life of the Muslims (Mahmud, 1972). On the other hand, Arriola et al (1980) noted that the low SES children had productions which were reality-oriented while high SES children's drawings expressed ideas from mass media. Pañares (1979) and Jimenez and Ventura (1980) also noted the same trend, especially among male subjects who made very detailed drawings of robots which were the main TV fare of this period.

In a study exploring object play of preschool children, Garcia (1993) compared manipulations in play with open-ended and realistic toys. She utilized Trostle and Yawkey's Four Uses of Objects to Serve Creativity to analyze video-taped observations of responses which include exploration, replication, or transformation. Her findings showed that there were more transformations with open-ended toys (e. g., blocks, play dough) while replications appeared more often with realistic toys (e. g., dolls, car). With respect to age differences, she observed that younger children (2- and 3-year olds) showed more replications and older children (4- and 5-year olds) revealed more transformations in their object-play. Her findings on



open-ended toys have implications for encouraging the development of creativity among preschool children.

### **The Effects of Sociocultural, School, and Home Environments**

In her study entitled *Influence of Acculturation on Cognitive Development* Acuña (1981) specified aspects of the socio-cultural environment which influenced the development of skill and concept. Her findings indicated that acculturation and grade level were significantly related to cognitive development and that children's replies to questions on natural phenomena were as developed in the rural as in the urban areas. She also pointed out that the ability to infer emotional and internal states in other persons was greater for traditional and least acculturated communities. These aspects of her findings have strong implications for the development of relevant and culture-fair items in ability tests.

On cognitive style, she noted that middle class membership, more years in school and being male were related to a more analytical, impersonalistic, task-oriented (field-independent behavior. Girls were observed to develop the same cognitive style as they acquire more education, but their development is more gradual than the boys! This gender difference in cognitive style should help the classroom teacher in planning her teaching as well as her remedial instruction.

The effects of socioeconomic status were further seen in the results on abstract reasoning. Rural lower class adolescents were reported as not being able to attain abstract reasoning even in the fourth year while the middle class (both rural and urban) were able to do so after the first year. As the author concluded, "the combined effort of being poor and living in a rural environment is related to an inability to develop abstract reasoning even with secondary schooling."

Furthermore, the rural poor in her study also showed "lower acquisition of scientific processes that are essential for science and mathematics achievement." She noted that inferring and experimenting processes were not achieved even by fourth year students and in comparing the rural poor and urban middle class adolescents, she observed that the gap between them widens through years in the secondary school.

However, the rural poor adolescent showed a good grasp of natural phenomena processes and as a general rule regardless of social class membership and place of residence, the subjects in the Acuña study scored high on inferential reasoning - a skill she interpreted as being related to social awareness and social sensitivity. To sum up her findings, the author stressed that "the cognitive difference of the rural poor students entails a commitment on the part of educators to utilize the existing cognitive skills in these students to effectively transfer these skills to school learning situations. The commitment of the educator to

develop these students will require innovative teaching strategies and more relevant examples to bring the school learning experience in touch with the students' socio-cultural environment."

Looking into different approaches to pre-school education, Bangsal et al (1983) noted the differences in the cognitive and social behavior of middle class children. A holistic approach emphasizing total development (spiritual, physical, moral and intellectual) was associated with higher scores in social and cognitive development while a Montessori approach resulted in higher scores for classroom interaction and cognitive performance.

Studies on the relationship of sociocultural and school environments with the learner are few. However, the Acuña study was noteworthy for its careful design and rich data on cognitive processes - a topic which other researchers have not adequately dealt with.

In a study of pre-school children, Pado (1990) identified learner, family, and home environment variables which predict literacy behaviors. Consistent with previous findings on the effects of socioeconomic status, she found that children from higher income homes showed higher interest before story reading, participated more during story reading, and named more upper case letters. The presence of other adults, language spoken at home, and number of siblings were not predictive of literacy behaviors. However, the following home environment variables were related to book orientation behaviors: parent/adult reading, verbal interaction with adults, family outings, educational aspirations, emotional security, and protectiveness. It is significant to note that this study is one of the few which tries to relate social and emotional variables to an aspect of cognitive development and emphasizes the importance of paying attention to the context of learning.

In addition to the variables mentioned, Pado's findings confirmed earlier reports in Western literature that early reading behavior was associated with parental interest in reading and availability of print and media materials in the home.

## **PSYCHOLOGICAL RESEARCH AND THE EDUCATIONAL PROCESS**

### **Problems and Recommendations**

The last two objectives of this paper will be treated together in this section. As the foregoing review shows, much of the work that has been done in child psychology is not directly related to the educational process. However, if an effort is made to sift the data for its relevance to education, several trends may be seen.

Among the research areas identified, the studies on school achievement are the most directly related to the psychology of the child as

a learner. Achievement has been related to parenting styles and its antecedents and causal attributions have been explored. The findings in these areas are useful in terms of describing the context of achievement and the factors which impede or encourage its development. However, a more dynamic approach to this problem is needed. More work on learning or cognitive processes is needed - a closer and more intensive look at how children think and learn. It is not enough to define what they have learned and search for the correlates. If educational intervention must come in, then the study of processes is imperative. But before appropriate educational intervention can come in, a shift in testing and test development must likewise take place. This would be in the direction of examining the processes required to solve items in a test rather than concentrating alone on the level of ability which the test measures. Certainly, much work still needs to be done in identifying the cause or cultural antecedents of ability in terms of ecological and cognitive processes, but there is a need to examine how awareness, coding, planning and decision-making (the higher cognitive processes) are acquired by children.

Similarly, the studies on self-concept and self-esteem provide some data which can generate one or two generalizations, but related and seemingly more important variable - that of self-control is absent from the literature. The ability to plan, think for oneself and decide are cognitive functions which are central to the adjustments that man must make in his daily life. These functions which are all related to self-control can be partly acquired from classroom experiences of problem-solving. This is one personality variable which has profound implications for personal as well as academic adjustment. Its importance as an area of research cannot be over-emphasized. To find out how our schools can teach our children to plan, create and make decisions deserves a lifetime commitment.

Several studies on language development point to differentials in cognitive performance as a function of language used. This emphasizes the need for more systematic studies in this area as input for formulating policy on the language of instruction. Psychology can contribute substantially in this area.

While parenting styles have been studied in the context of academic achievement, psychologists have failed to study the environment of learning including the teacher himself (e.g. effects of personality traits or teaching styles). The studies on perception could likewise be systematized to serve as inputs for planning a conducive environment for learning and presenting materials for the child. In this connection, a general comment can be made on studies done by psychologists. The practical implications of the findings are seldom realized. Mostly done to fulfill academic requirements, they usually meet the strictest standards of research but unfortunately remain in the shelves of university libraries. These bodies



of literature must be brought together to clarify what has been, and needs, to be done.

Another area of research which deserves more attention is creativity. Again, the need is for more information on the creative process rather than a labeling of who is or is not creative. Both scientific and artistic creativity among children needs to be further examined. Research is also needed on how teachers should handle children who are creative or high on original thinking. Western literature indicates that the ordinary classroom teacher generally reacts negatively to a child with unusual and original ideas.

While Piaget's theory continues to attract researchers, it must be stated that there is a need to explore other theories of cognition. Researchers should also learn to take the Filipino Child's responses within the context of his own culture and cease to use Western standards in asserting the existence of "lags." Before such comparisons are made, control for IQ and socioeconomic status across cultures should be observed. Work should also be done to develop strategies to enhance relevant cognitive processes. This implies that a lot of basic observation about how Filipino children think needs to be done.

So far, all of the observations and recommendations have been on the content areas of research. Looking at the types of subjects involved in the studies the same observations as those made earlier (Ventura, 1988) still hold - the urban middle class child from 6 to 12 years of age remains the most popular respondent. Therefore, the same recommendations need to be given - that the rural poor of all ages (0 to 18) deserve more of our attention.

As to the choice of methodology - there is a strong need to develop local measures of cognitive and creative processes. Organizations and individual researchers in the universities are fortunately moving towards this direction. A related recommendation would be for educators, psychologists and community workers to work together in developing a screening form so that early identification of giftedness, learning disabilities and other neurological dysfunctions are made possible.

In trying to integrate the above observations and recommendations, there is the basic problem of utilizing relevant research data in the classroom or in policy information. Individual researchers may work on some of the suggested problems but the impact should be on long-range programs of research and research utilization. We should therefore address ourselves to the task of coordinating research efforts for maximum dissemination and utilization. A listing of experts and researchers as well as the establishment of some kind of a clearing house are therefore strongly recommended. A Newsletter can also quickly inform researchers about work that is being done by others. All these of course requires voluntary participation which should be a high frequency behavior among serious-minded researchers. After all, Vygotsky, an

eminent cognitive psychologist, has said that more than intelligence, voluntary activity distinguishes man from apes. As we make a plea for the growth of playful behavior in the child, nurture and facilitate his sense of control and self-worth, we must do the same for ourselves.

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# LANGUAGE USE AND TRANSFER IN MATHEMATICAL PROBLEM-SOLVING: REVISITING THE WHORFIAN HYPOTHESIS AND APPRISING THE MEDIUM OF INSTRUCTION ISSUE\*

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*A research approach is suggested to investigate the medium of instruction issue. The approach is based on the weak version of Whorf's linguistic determinism which states that variations in lexical, semantic, syntactic, and pragmatic aspects of language influence thought. The approach is used to study the observation that people have a difficult time expressing in Filipino material that they have learned in English. This paper looks into the role of language use in the transfer of information in problem solving in math. Earlier studies have shown that language-based representations of problems affect performance in math word problems and that problem-specific information plays an important function in transfer. Based on these studies, it was predicted that transfer of information would be better when the language used to study the problems is the same as that used in the transfer test. The results of one experiment support the hypothesis and are discussed in terms of the Whorfian hypothesis and the medium of instruction issue.*

It would be an understatement to say that there is currently a disagreement about which language to use as the medium of instruction in our country. Del Pilar (1990) pointed out that this disagreement is readily seen in the divergent language policies of two important educational institutions--the DECS and the University of the Philippines. While the DECS maintains a National Bilingual Policy (English as medium for Science and Math), the U.P. is now deep in the implementation of its Filipino Language Policy (Filipino as medium for all subjects at all levels of education). Pascasio (1992), however, observed that while there has been a lot of opinion and debate on the issue, these are often not supported by data. She pressed for the need for more research that will bear on the issue.

This paper is one attempt to present data that will hopefully bear on one aspect of the issue. The study reported in this paper addresses the phenomenon of transfer of problem solving information in mathematics within and across languages. The cognitive psychological approach to the Whorfian hypothesis is used as the general theoretical frame, and a

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"representational" model of transfer in math word problem-solving is used as the specific frame.

### **The Whorfian Hypothesis: Linguistic Determinism**

Based on anthropological and cross-linguistic studies in the 1920s and 1930s, Benjamin Whorf (1956) proposed the hypothesis that the language we use exerts some amount of control over our thoughts. Whorf proposed that the way we perceive the world and the way we think about it are largely dependent on the structures of the language we use. For example, the Japanese language does not have distinct words for the colors green and blue. According to Whorf, a speaker of the Japanese language would not see or experience the rainbow in the same way that speakers of Filipino or English would. In this sense, he claimed that language determines thought. The view that language structures control the structures of thought has been labelled the "strong version" of Whorf's hypothesis. The strong version has long been abandoned. But recently, a "weak version" of Whorf's hypothesis has been revived on the basis of experimental studies of cognition. The weaker hypothesis states that specific cognitive functions can be influenced by variations in the lexical, syntactical, semantic, and pragmatic aspects of language. Hunt and Agnoli (1991) recently reviewed the experimental data that strongly support this hypothesis.

### **Linguistic Determinism and Language of Instruction**

Research on the medium of instruction issue in the Philippines has been largely based on studies on the relative effectiveness of Filipino (or a vernacular) and of English as media for instruction (see e.g., del Pilar, 1990; Gonzales & Sibayan, 1988). While affirming the value of such studies, I suggest a complementary approach to addressing the medium of instruction issue based on the assumption of linguistic determinism. I propose that another track that can be used to inform the medium of instruction issue is to study the effects of language use on specific aspects of the different cognitive skills that we expect students to learn. This approach involves several components. First, in the spirit of the Whorfian Hypothesis, we have to ascertain whether language use has any role in the operation of specific cognitive skills. Second, if language use has a role, we have to specify that role and demonstrate its function in the operation of the cognitive skill. Third, we have to determine the effects of varying the particular language used (e.g., first or second language of bilinguals) in order to know whether the use of one language will have predictable costs or benefits relative to the operation of the skill.

### **The Problem of Transfer**

A common observation among Filipino bilinguals who were schooled in English is that they have a difficult time expressing in Filipino things

that they have learned in English. This is particularly true when it comes to concepts related to science and math. From this observation, people have often incorrectly concluded that science and math is only possible in English.

One aspect of this problem that is readily identifiable is the lack of corresponding terminologies in the Filipino language. But aside from this surmountable problem (Miranda, 1991), there is still a general difficulty of transfer from English to Filipino. Others have proposed that this difficulty is mainly due to attitudinal and socio-cultural factors (Acuña, 1993). I propose that another factor that leads to this difficulty is related to the role of language in the transfer of information. In this research, I study the process of transfer of information between analogous word problems in math. There was a *learning phase* in which the subjects were given *study problems*, and there was a *test phase* in which the subjects were given *transfer test problems* that were analogous to the *study problems*. The language used for the *study problem* and the *transfer test problem* was varied in order to test a specific hypothesis about the role of language in transfer.

### **The Role of Linguistic Input in Transfer**

The model I propose in this study is based on two separate but related bodies of psychological findings. First, several studies have shown that analogical transfer is greatly dependent on similarities in the superficial, problem-specific features (i.e., as opposed to the abstract, structural features) of the analogous problems (e.g., Gick & Holyoak, 1980; Holyoak & Koh, 1987), even in the highly abstract problem domain of math (e.g., Bassok, 1990; Bernardo, 1994; Ross, 1987, 1989). It could be argued that the language used in the problem text is one of the superficial elements of the problem that is important in transfer.

This argument is related to the second body of findings that show the importance of semantic representations of the text of word problems in solving these problems. Several studies have shown that variations in the wording, ordering of sentences, and so on, result to variations in performance on such problems (e.g., Bernardo & Okagaki, 1994; Cummins, 1991; De Corte & Verschaffel, 1987; Riley & Greeno, 1988). These studies show that some semantic representations allow for easier inferences needed to answer the questions in the problem. These findings suggest that, to a great extent, linguistic input in word problems affects the understanding of the problem texts and also, therefore, the solutions.

Based on these two sets of findings, I propose that (1) in solving word problems, people construct a semantic representation of the information in the text; (2) these semantic representations are couched in terms of the language used; (3) in analogical transfer, people create mappings between semantic representations of the problems; and (4) mapping between semantic representations should be easier if the representations are in



the same language. Points (1) and (3) have already been supported by earlier studies. Point (2) will be indirectly tested in the attempt to explicitly test point (4).

## Overview of Experiment and Hypotheses

In this study, subjects were given problems in basic probability. As stated earlier, the subjects were first given *study problems* then *transfer test problems*. The *study problems* included a statement of the problem, a description of the quantitative relations in the problem and of the relevant principles, concepts, and equations, and a worked out solution for the problem. After the set of *study problems* the subjects were given the *transfer test problems*, which consisted of a set of analogous problems that were very similar in surface content to the corresponding *study problems*. The subjects were tasked to solve these *transfer test problems* without directly referring to the *study problems*.

Subjects were given *study problems* in Filipino or in English. For the test phase, all subjects were given half of the *transfer test problems* in Filipino and the other half in English. Subjects' performance in the *transfer test problems* were coded in terms of whether there was transfer of information from the corresponding *study problem*. It was predicted that transfer would be better if the *transfer test problem* was in the same language as the *study problem*, whatever the language of the *study problem* was.

## METHOD

### Subjects

Fifty-three Introductory Psychology students at the University of the Philippines at Diliman participated in this experiment as part of a class requirement. Data from 5 subjects were not analyzed because their first language was not Filipino (Bicolano, Bisaya, Pampango, English). Data from another 4 subjects were not included because they either did not transfer in any of the problems ( $N=3$ , they just scribbled numbers) or they solved all the test problems correctly ( $N=1$ , suggesting prior experience in the domain). Therefore, data from 44 subjects were analyzed (22 were randomly given Filipino study problems, 22 were given English study problems). All subjects were bilingual in Filipino and English. They reported Filipino as the language used at home and English as the main language used in math education. The subjects were asked to rate in a scale of 1 to 7 (1=not at all proficient; 7=very proficient) their proficiency in speaking and reading in Filipino and in English. The scores for both subject groups show no reliable difference in subjects' proficiency in either language. For the Filipino study condition, mean proficiency in Filipino was 5.20, and in English, 5.80 ( $t(22)=1.91$ ,  $stderr=.31$ , n.s.). For the

English study condition the means were 5.11 and 5.30 ( $t(22)=0.62$ ,  $\text{stderr}=.31$ , n.s.).

## Materials

Word problems in the following problem types in probability were created: conjunction problem with independent events, conjunction problem with dependent events, disjunction problems with intersecting events. Below are examples of problems used in the experiment:

1. *One day there are 36 patients in a provincial clinic, 16 of whom are male and 20 are female. A total of 12 male and 12 female patients are diagnosed with hypertension. What is the probability that if a patient is chosen at random, this patient is either male or has hypertension?*
2. *There are 240 employees in a government office. One hundred eighty (180) are regular civil servants and 60 are political appointees. A total of 60 civil servants and 45 political appointees are corrupt. What is the probability that if an employee is randomly chosen, this employee is either a civil servant or is corrupt?*

Probability problems were chosen to ensure that subjects had no prior experience in the problem domain; at the same time the problems were easy enough for those with a background in algebra. Four versions of each problem type were created. Each version of a problem-type had different surface content. One version of each of the four problem types were combined to form a study set making four sets of four *study problems*. All *study problems* were first written in English. These were then translated into Filipino by a student who was proficient in both languages. To ensure that the Filipino and English versions were equivalent, the Filipino translations were translated back into English by another student.

For the *transfer test problems*, a superficially similar analogous problem was created for each of the *study problems*. Some of the *transfer test problems* were written in Filipino and some in English. Using a counterbalancing procedure it was ensured that across the four sets of *study problems*, each problem type had an equal probability of having a *transfer test problem* in Filipino or in English.

Each *study problem* was typed in a separate sheet. Each *transfer test problem* was also typed in a separate sheet, with the problem on the top portion, and the rest of the page left blank for the solutions. The *study problems* and the *test problems* were arranged in a random order and combined to form a test booklet. The test booklet included instructions for the learning and test phases, and a questionnaire on subjects' language and math backgrounds. The instructions and questionnaire were written in Filipino for the Filipino study condition, and in English

for the English study condition. The English and Filipino versions were prepared following the procedures described earlier.

## Procedure

The subjects were run in groups not larger than eight. Subjects in one session were randomly assigned to either the Filipino or English study condition and given the appropriate test booklet. They were instructed to read each *study problem* and to try learn the material as best they can. They were encouraged to work through the problems themselves. They were given three minutes to study each problem and they were told when they had 30 seconds left for each problem. After studying the four *study problems*, the subjects were then tasked to solve the *transfer test problems* without directly referring to the *study problems*. They were given three minutes for each problem and informed when they had 30 seconds left. After completing the *transfer test problems*, they filled out the background questionnaire.

## RESULTS

Answers in the test phase were scored as showing transfer (1.0), partial transfer (0.5), or no transfer (0). A complete transfer was scored if the solution indicated that the subjects transferred the correct solution equation and instantiated it correctly for the *transfer test problem*; a complete transfer was scored even if the final answer was incorrect due to computation errors or incomplete computations. A partial transfer was scored if the solution showed the correct equation but the equation was not correctly instantiated for the *transfer test problem*. No transfer was scored if the correct equation was not transferred. The mean transfer scores are summarized in Table 1.

Table 1  
Mean Transfer Score and Standard Error As A Function of  
Language of Study and Language of Test

	FILIPINO TEST		ENGLISH TEST	
Filipino Study	.66	(.06)	.43	(.08)
English Study	.58	(.06)	.65	(.08)

The scores were analyzed using a 2 x 2 ANOVA for mixed designs. There was no main effect of either the language of the study problems,  $F(1,42) = 0.74$ ,  $MSe = .14$ ,  $p > .10$ , consistent with the view that there are no overall costs or benefits of using either English or Filipino as the language of study or test. Also as predicted there was a reliable interaction between language of study and language of test,  $F(1,42) = 4.35$ ,



$MSe=.11$ ,  $p<.05$ , suggesting that test performance is better if the language used in the test matches that used in the study.

To further test the reliable interaction effect, the scores were analyzed using  $t$ -test for paired comparisons. The analysis showed that subjects who studied problems in Filipino performed better with the *transfer test problems* in Filipino than in English,  $t(21)$ ,  $stderr=.10$ ,  $p<.04$ . But, for subjects who studied the problems in English, there was a no reliable difference in performance for the Filipino or English problems,  $t(21)=0.69$ ,  $stderr=.10$ ,  $p>.10$ .

I did some data snooping to determine why the apparent advantage in solving English *transfer test problems* among those given English *study problems* was not statistically reliable. I analyzed the proportion of solutions that showed complete transfer; in effect, I used a stricter criterion for scoring transfer. It is possible that subjects who got credit for partial transfer might have only remembered the equation without understanding its structural meaning. By requiring subjects to instantiate the equation correctly, we ensure that subjects who are scored for transfer have indeed made the appropriate structural mappings between the *study* and *transfer test problems*. The proportion of solutions that showed complete transfer are summarized in Table 2.

Table 2  
Proportion of Solutions Showing Complete Transfer  
As A Function of Language of Study and Language of Test

	FILIPINO TEST	ENGLISH TEST
Filipino Study	.59	.41
English Study	.50	.64

These proportions were then analyzed using a  $\chi^2$  test for independence. Similar to the results of the criterion scoring, the analysis showed no reliable main effect for the language used for study,  $\chi^2(1, N=176) = 0.82$ ,  $p>.10$ , and for the language used in the test,  $\chi^2(1, N=176) = 0.09$ ,  $p>.10$ . As with the earlier scores, subjects given Filipino *study problems* were better at transferring information to Filipino *transfer test problems* than to English ones,  $\chi^2(1, N = 88) = 2.01$ ,  $p<.05$ , one-tailed. Unlike the earlier scores, however, subjects given English *study problems* were better at transferring information to English *transfer test problems* than to Filipino ones,  $\chi^2(1, N=88) = 3.27$ ,  $p<.05$ , one-tailed. This reliable difference suggests that subjects who were given study problems in English were probably equally able to recall the equation with Filipino and English *transfer test problems* and that, using the scoring criterion, this ability to recall the equations masked difference in actual transfer.

## DISCUSSION

This experiment was designed primarily to test a specific hypothesis about the role of language in analogical transfer, partly in consideration of the observed difficulty some Filipinos have in expressing in the Filipino language what they have learned using the English language. The results support the hypothesis that transfer is better if the language in which a problem was studied is the same as the language of the test. By implication the data also support the position that some aspects of the semantic representation of word problems is described in the language used during the problem solving episode.

Before discussing the implications of such findings, I wish to emphasize that the study only focuses on one very specific aspect of math problem solving: the transfer of information from one word problem to a superficially similar analogous one. The effects associated with language use could be different for other aspects of word problem solving. For example, the results do not in any way inform us about the role of either language in developing a semantic representation for either the study problem or the test problem. Also, we cannot know the role of language in understanding the abstract, structural information in the study problem. The transfer effects are also observed under conditions where the problem solver's conceptual knowledge about the domain is poor. The role of language in transfer when the problem solver has more experience in the domain might be different from what is shown.

The results regarding the role of language on transfer could also be considered rather general. One could still ask the more specific theoretical question: Where among the specific components of transfer does language play the particular function demonstrated? Consider the following. First, it is possible that subjects were able to transfer the correct information only in cases where they understood the study problem. But this possibility could only be true if we find that (1) those who were given study problems in Filipino better understood the problem types that were subsequently tested in Filipino, and (2) those given study problems in English better understood the problem types that were subsequently tested in English. While the data cannot provide us information about which study problems were understood, this possibility was controlled for by using counterbalancing procedures that ensured that it will be equally likely that a problem type will be tested in Filipino and in English. Furthermore, there is no main effect of transfer performance due to language of study, which suggests that there is no overall difficulty associated with understanding the study problems in either language. Hence the possibility raised is not consistent with the experimental data nor with the control procedures used.

There are other possible explanations for the effects that relate to the actual process of transfer. For one, it was earlier posited that studying a problem using one language leads the problem solver to develop a

semantic representation of the problem that is described in terms of that language. It is possible then, that the language effects are obtained because this semantic representation is used to guide the understanding of the transfer test problem. Better understanding of the target problem then leads to better test performance. While it is likely that an earlier problem representation be used to guide the understanding of a new problem, there is the problem of determining which earlier problem to use as guide. The language used cannot specify which earlier problem should be used to guide the processing of a new problem.

Determining which earlier problem episode to use is addressed in another possible explanation of the results. As mentioned earlier, other research has shown that problem solvers use superficial similarity between problems to determine sources of analogous information. It is possible that having the study and test problems in the same language makes the similarities between them more salient. This then allows the problem solver to more easily access the information from the appropriate study problem.

The last possible explanation considered assumes that problem solvers have no difficulty in accessing information from the correct study problem. Instead, differences in transfer lies in the ability to instantiate the information correctly for the new problem. It is possible that having the study and test problems in the same language leads to a better grasp of the structural similarities between the problems that are necessary for the correct instantiation of analogous problem information.

It should be noted that the last three proposed explanations are not mutually exclusive. It is possible that similarity in language use operates in all three ways. Fortunately, all three explanations could be studied experimentally by manipulating variables relevant to access and use of problem information in transfer. So like any "good" experiment, the one described in this report raises a lot of useful questions that need to be further studied. These questions are currently being addressed in experiments being conducted in my laboratory.

All these caveats considered, the implications of the language effects in transfer can be discussed. First, the findings of this study suggest that the observed difficulty that Filipinos have in transferring knowledge from English to Filipino is not due to some limitation of the Filipino language. In fact, the results show that there is no advantage in the use of either Filipino or English as the language medium for studying or testing the problem information. Instead, the results suggest that information is represented, at least in part, in the language in which it was learned and that transfer is not always easy across languages; or to put it more positively, transfer is facilitated if one language is used.

The findings of the study also further contributes to our understanding of the relationship between language and thought. By showing how similarity in language use can facilitate analogical transfer,



another means by which language can influence thought has been specified. This influence is related to the pragmatic and not to the structural (i.e., semantic or syntactic) aspects of language. The influence is not such that one language is structurally better for processing information in math; instead, language is the medium in which information is carried or by which mapping of mathematical concepts is facilitated -- a pragmatic function. That the function is pragmatic and not structural to the effect that in order to think proficiently in math and science, one has to know English. (The more generic form of this argument is that a truly educated or learned person must know how to use English properly.) The results show that there is no structural relationship between knowing and using English and proficient performance in the mathematical problems. Students can learn and do math in Filipino, and under the proper conditions, they can even learn and do it very well.

Finally, the results of the experiment suggest that there is another approach to addressing the medium of instruction issue -- looking at the specific role of language in the cognitive skills that students are expected to learn. The results show that in the case of transfer, the issue is not whether one language is better than another. Instead, it is the consistency in the use of one language medium that better performance is achieved. We can see that this approach has at least one important implication: language can have different functions in particular aspects of a cognitive skill. Since cognitive skills can be broken down into smaller components, it is possible that language will play different specific roles for each component. If so, then there is no unitary relationship between medium of instruction and learning. That is, depending on the particular role of language in the operation of specific components, using one language might be more effective in terms of one component, but less effective in another, or some other property of language use is important as in the case with the transfer results.

What this approach buys us is a better appreciation of the complexities of the skills we teach our students (which will hopefully make us more patient with our students), as well as a finer understanding of the possible roles that language of instruction may have in developing these skills. In practical terms, this approach would tell us to be more cautious about any claims we may want to make about what language is better for teaching a subject, much so for teaching in general. On an issue which practically every person has an opinion strongly supported by personal anecdotes, the importance of such a precaution cannot be underestimated. The relationship between language and thinking and education is not as simple as most people make it sound to be. There is much more we have to know about the relationship between language and the different components of mathematical problem solving, and the different components of scientific thinking, and reading, and so on. But we know, from the example shown by this one experiment, that

our questions about these concerns can be answered. Once the experimental questions are raised, the appropriate experiments can be done without requiring so much time and expense, as evidenced by this study. Hopefully, a body of similar research findings can soon be developed to complement current research efforts towards resolving the medium of instruction issue.

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