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FOREWORD

We are pleased to present the PJEM special issue on the proceedings of the CEM Annual Educators' Conference held at the Mandarin Hotel in September 2007.

CEM takes another significant step toward realizing its goals of influencing all aspects of education with the theme *"Curriculum Improvement: Perspectives from Design and Assessment."* This issue provides evidence of the need to control and assess curriculum delivery in our classrooms in order to close the gaps that exist between the planned curriculum and the attained curriculum.

The guest speakers take on the theme to a macro perspective:

• Father Ramonclaro G. Mendez, in his keynote speech, shares his experience and perspectives on curriculum design and assessment as a school administrator.

• Dr. Yolanda Quijano reports on the efforts of the Department of Education in developing, implementing, and evaluating the Elementary Education Curriculum, a major component of the Basic Education Curriculum.

The researches done by CEM, which were presented at the Annual Conference of the International Association for Educational Assessment (IAEA) held in Singapore in 2006, focus on the Mathematics curriculum:

• Jesus Sevilla and Kathryn Tan show proof that the teaching of fractions requires more instruction time and exercises to enhance comprehension of mathematical concepts and mastery of procedures across grades.

• Ma. Angeles Sampang and Jason Moseros present progress maps that place cognitive skills and knowledge along a typical sequence of development as a learner moves across grade levels.

It is our hope that this issue would help curriculum planners and teachers assess critical concerns about curriculum improvement, and inspire them to strive for a more responsive curriculum that captures the various experiences and needs of teachers and students.

LENORE LL. DECENTECEO, PhD
President

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KEYNOTE ADDRESS: CURRICULUM IMPROVEMENT: PERSPECTIVES FROM DESIGN AND ASSESSMENT

Ramonclaro G. Mendez, O.P.
Aquinas University

Last week, our religious community went out for an integration at a hot spring at the foot of Mt. Isarog and, on our way back home, we dropped by a commercial center to spend some time before having our dinner. As I entered a department store, a salesgirl greeted and called me by my name. I was so surprised that I asked her how come she knew me. She answered that she just graduated from our University last April. I then asked what her course is, and she replied, "Industrial Engineering." Then I asked, "What are you doing here?" She laughed and replied, "I also asked myself the same, but this is my first job. *Sayang din*. My batch mates are already in Laguna at the industrial parks. I'll be there by November since I have already sent my biodata."

And don't we sometimes call biodata credentials, résumé, or curriculum vitae?

According to a Chinese proverb, "The beginning of wisdom is to call things by their right names." And talking of names, I remember a story of a Jewish couple who were arguing over the name to give their firstborn . . . finally they asked the Rabbi to resolve the conflict. "So what is the problem?" he asked. The wife said, "He wants to name the boy after his father and I want to name the boy after my father." "What is your father's name?" he asked the man. "Joseph" was the reply. "And what is your father's name?" he asked the woman. "Joseph" was the reply. "So what is the problem?" asked the Rabbi, who got more confused.

The wife spoke again. "His father was a horse thief, and mine was a righteous man. How can I know that my son is named after my father and not his?" The Rabbi thought for a moment. "Call the boy Joseph. Then see if he is a horse thief or a righteous man. You will know then which father's name he wears."

I wonder where the horse thief brought the horse. Perhaps to the hippodrome, which means a race course for horses, which is the same meaning for the Latin origin of the word *curriculum*.

In 1918, John Franklin Bobbitt explained that "curriculum must be understood as encompassing not only those experiences that take place within the schools, but the entire scope of formative experience both within and outside of schools. Further, this includes experiences that are not planned or directed, as well as experiences that are intentionally directed (in or out of school) for the purposeful formation of adult members of society."

Curriculum is the course of formative experience (in which a human being takes form) and, if I may say, the becoming of the human being.

Malcolm Gladwell, in his book, "The Tipping Point," proposes

> that we reframe the way we think about the world. . . We have trouble estimating dramatic, exponential change . . . There are abrupt limits to the number of cognitive categories we can make and the number of people we can truly love and the number of acquaintances we can truly know. We throw up our hands at a problem phrased in an abstract way, but have no difficulty at all solving the same problem rephrased as a social dilemma. All of these things are expressions of the peculiarities of the human mind and heart. A refutation of the notion that the way we function and communicate and process information is straightforward and transparent. It is not. It is messy and opaque. (p.257)

Our theme, "Curriculum Improvement: Perspectives From Design and Assessment," reminds me of a description of grade. It said, a grade is "an inadequate report of an inaccurate judgment by a biased and variable judge of the extent to which a student has attained an undefined level of mastery of an unknown proportion of an indefinite material" (P. Dressel). It sounds like a nongraded advocacy. The adjectives used, namely, *inadequate, inaccurate, biased, variable, undefined, unknown,* and *indefinite*, seem to be a problematic indication as I think of design and assessment.

One day, when I was still a young seminarian, I was asked by our Rector to check the temperature of one of my co-seminarians who was in bed. Our Rector had just called up, through the intercom, another seminarian who reported that the thermometer reading was 36 degrees Celsius. So our Rector instructed him to put the thermometer back in the mouth of the sick seminarian. Then he asked me to go up and check. I went up the dormitory and found out that the base of the thermometer was inversely inserted.

See what happens when we do not know how to use the instrument, or when something is wrong with the instrument itself. Was the seminarian really sick? The final reading was 39 degrees. As I relayed the information through the phone, the supposedly sick patient smiled and winked, as he waved the clove of garlic he used to induce the temperature.

Douglas Adams warns, "A common mistake that people make when trying to design something completely foolproof is to underestimate the ingenuity of complete fools." As Isaac Newton noted, "I can measure the motion of bodies but I cannot measure human folly." Nevertheless, the author of "The Lord of the Rings," J.R.R. Tolkien, wrote, "It does not do to leave a live dragon out of your calculations." [I understand that to mean that we should give allowance to the immeasurable.]

As I look into the five components of our theme, which are *curriculum, improvement, perspectives, design,* and *assessment*, I realize that I can readily and confidently speak just on *improvement* and *perspectives*.

Considering my own limitations, I believe it will be more practical for me to share with you my curricular encounters in the course of my formative journey as a school administrator and as a university president rather than present a treatise on the said theme.

In June 1984, a year after my ordination, I was assigned to UST (University of Sto. Tomas) and was later appointed as Regent of the College of Education, which covers the UST Elementary School, Education High School, and the College of Education.

We had two programs in high school: one was the regular curriculum and the other was a pilot program which had a more personalized approach. By the way, before I was assigned to UST, I taught religion at the Angelicum College in Quezon City. Angelicum is known for its nongraded program. In the UST College of Education, however, the pilot program used more of an individualized approach with orientation on research as contrasted with the regular curriculum which observes traditional instruction. I was not really keen on the details of the programs since they were directly under the principal and the college dean. The last time I inquired, I learned that the pilot program was discontinued because they found out that there was no significant difference in terms of academic performance between the students from the regular curriculum and the pilot program as well as in the teaching approaches of the student-teachers for both programs.

Differences could have been spelled out had the assessment tools covered other impact areas than just grades. But the alumni themselves began to articulate the difference; the program started in 1979 and was discontinued in 2000. Had the curriculum design and assessment been developed together at the onset, what curriculum improvement could have evolved?

I served in that department from 1984 to 1988, after which I was sent to St. Louis University, Missouri, for my doctorate in Education with special focus on foundations and administration of higher education from September 1988 to March 1992. It was there where I came across curriculum development and designed one for a core curriculum as a project (I could no longer remember what I did but I did pass the subject).

When I returned in May 1992, I was assigned to Letran College-Calamba and served as Rector and President for two terms, 1992 to 1999.

I did not have any plan when I entered Letran, so I had to grope for some light as if waiting for the clearing of the clouds that covered the face of Mt. Makiling on the day of my installation. It took some time for me to see Letran as I waited for its self-disclosure or revelation that I may be able to draw up a "curriculum," a race course or program for our organizational development as well as an itinerary of our institutional journey through the articulation and pursuit of our vision and mission and formulation of our strategic plan.

I remember when I was in Calamba, we came up with SOAP, "Science on the Air Program." It was a radio program in the vernacular (Tagalog for Laguna and Bisaya for the CARAGA Region). The intended levels were Grades Five and Six and then first year high school. We had an experimental group which was exposed to the program and then a control group which was using the traditional instruction supposed to be in English. In some remote areas, where the radio signal was poor and when they ran out of batteries in school, the teachers used the radio script as a teaching tool. We found out that the students understood better the scientific concepts in the native tongue than in English.

We had other projects, like the CAPA (S&T Caravan for Poverty Alleviation), INES (S&T Information Network and Extension Services), ACES (S&T Awareness Consciousness and Evaluation Studies), VEST (Values Encounter with Science and Technology), and ABAY (S&T Appreciation Building Among the Youth), in the promotion of consciousness and productivity of science and technology that merited Letran-Calamba the Gawad Florendo Award in 1997 as outstanding in the S&T public information. These programs were in line with our vision that Letran be perceived as the best center for science and technology in the region.

I established the Center for Research Development hoping that the research capability of our teachers and students would be developed from the elementary up to the graduate school. I also came up with the Center for Extension Services hoping that our community partnerships and exposures would be able to provide us the data for appropriate curriculum improvement. These initiatives have not fully ripened to bear the emergence and maturing of our curricula.

My Letran experience taught me to be more creative in my administration so as to be able to provide a space that is favorable for curriculum improvement. I learned that context is crucial in curriculum design and assessment, and culture is essential to it. Some would even define education as the transmission of culture. And in transmission, language plays a very important role. I was musing on the figure of a *banga* (earthen jar from where the name Calamba originated) to serve as the culture dish.

After my two terms in Letran-Calamba, I was elected president of Aquinas University of Legazpi. The first thing I did when I came to Aquinas University was to consult the people for the formulation of a vision of a life of truth and of love out of gratitude and to use Bikol terms to indigenize our planning cycle which begins and ends with "atang" or gift; and the articulation of our Anduyog principle which is to be "totally one with the other." We introduced Bikol history and language as part of our General Education in our curriculum. We also advocated the integration of instruction, research, and extension to come up with a more creative and responsive educational programming. In order to facilitate the space for curriculum improvement, we began loosening the hierarchical rigidity of our organizational structure by introducing core teams, namely, ACCENT (Aquinian Core Cultural Engagement and Networking Team), ACTMOST (Aquinian Core Technical and Material Optimization and Standardization Team), and then ACCEPT (Aquinian Core Creative Educational Programming Team). Then we came up with the Commission on Science and Technology (COST), Commission on Administration (COA), Commission on Culture (COC), and Commission on Ethics and Advocacy (COMETA).

In 2002, we established the AQFI (Aquinas University Foundation, Incorporated) to be able to fast-track our Research and Extension Services. By creating these structural changes, we were able to initiate curriculum improvement based on the recommendations and initiatives of the different commissions as well as the gains coming from research and extension projects like the Integrated Coconut Processing Project, Abaca Industry Rehabilitation, Integrated Health Care, Legal Enhancement (Governance), CARE (Comprehensive Aquinian Reconstruction Engagement), Cultural Heritage Project, and others. Exposure to these projects enabled us to make our curriculum design more significant and relevant to the context of our students and the needs of our communities. In fact, the expansion of our AQ Pharmacy and that of our HealthPlus outlets (*botika sa barangay*) prompted us to apply for the opening of the course Bachelor of Science in Pharmacy. Disaster management was also integrated into our curriculum; in fact, our Community Health Nursing Program in evacuation centers during the restive period of Mayon Volcano last year merited a front page feature story in a leading national daily.

The introduction of the ladderization program of TESDA (Technical Education and Skills Development Authority) moved us also to develop our curriculum. This will help us in the promotion of our "Education Beyond Margins," a program which will enable us to "include the excluded" and to give "the best to the least." Perhaps part of our colonial education was the intellectual elitism that when a student could no longer answer rightly the teacher's question, he would be called calabaza and advised to go home and plant camote, somehow etching the disdain and alienation from where they come from. In Aquinas, we are literally planting camote as an intercrop in the abaca plantation in our efforts to revive the abaca industry. We are sending our students to discover the wisdom in the communities. Our concept of collateral education prompts us to come up with an educational programming that allows our students to have an impact on the communities where they come from and with our institution becoming an active catalyst of change as well as a sanctuary of development.

I also introduced AQUI (*aki* in Bikol means progeny, child), the Aquinas University Integrated School. Our Science-Oriented High School became a full-fledged Science High School and four years ago, we came up with the Special Program in the Arts, which has now received government recognition. Now, we are still designing a curriculum for our preschool and elementary school while at the same time developing its respective developmental assessment tools.

Mayon Volcano was actually showing eruptive signs at my installation in June 1999 as if forewarning me of the coming natural calamities. As my friend wrote:

> Reming stormed through Bicolandia and Aquinas University was one of the hardest hit. It was a devastation reminiscent of the apocalypse. What used to be lush and green and cool turned into a surreal landscape of torn trees, scattered debris, and human bodies in various stages of decay. Everything was either black or gray. Structures were rolled over by mud, buried down under, beneath the thick mantle of carbon-colored soil. There was pain in every square inch of it.

It was the worst time for AQ but it was also its best. It would take only a while before it realized that what it possessed was a lot richer than what it has lost. Soon, the "Anduyog AQ: Tabang sa Tugang" was born—victims helping fellow victims, the wounded healing the fellow wounded, the survivor refusing to give up, refusing to ignore another person's cry for help. It was the human spirit at its godliest. Reming was a tragedy nobody wanted, but it was also a lesson nobody missed. And for AQ, Reming was its rebirth. It was rather ironic for AQ to find a way to be reborn just when everybody has given it up for dead. It was, as we should say, its "phoenix" moment.

"Learning does not consist only of knowing what we must or we can do, but also of knowing what we could do and perhaps should not do" (Umberto Eco, The Name of the Rose).

In the conclusion of "The Tipping Point," Gladwell used the story of Georgia Sadler to illustrate his point. Georgia Sadler is a nurse who began a campaign to increase the knowledge and awareness of diabetes and breast cancer in the Black community of San Diego. She began setting up seminars in Black churches around the city but she couldn't get her message to tip outside of that small group. She realized she needed a new context. She moved the campaign from Black churches to beauty salons. She gathered together a group of stylists from the city for a series of training sessions. She brought a folklorist to help coach the stylists on how to present their information in a compelling manner. And how much easier it was to hang the hooks of knowledge on a story.

Sadler took the small budget that she had and thought about how to use it more intelligently. She changed the context of her message. She changed the messenger, and changed the message itself. She focused her efforts.

Remember the book, "All I Really Need to Know I Learned in Kindergarten"? It has indeed become a phenomenal credo. Although not everyone thinks so, like Cathy Lowery Graham, all she really needs to know about how to live, what to do, how to be, and didn't learn in kindergarten, she rather learned from Extension. She said, "Wisdom does not always come from Ricks Hall (classroom), but frequently from the volunteers and children playing in the sandpile."

Yet according to Robert Fulghum, author of "All I Really Need to Know I Learned in Kindergarten":

> I believe that imagination is stronger than knowledge. That myth is more potent than history. That dreams are more powerful than facts. That hope always triumphs over experience. That laughter is the only cure for grief. And I believe that love is stronger than death.

And this is perspective. In fact, John Constable held that he never saw an ugly thing in his life: "For let the form of an object be what it may, light, shade—perspective will always make it beautiful."

Design is a creative endeavor . . . as a verb and as a noun; it denotes a process and a solution (plan). It is often viewed as a more rigorous form of art, or art with a clearly defined purpose. For D. H. Lawrence:

> Design, in art, is a recognition of the relation between various things, various elements, in the creative flux. You can't invent a design. You recognize it, in the fourth dimension. That is, with your blood and your bones, as well as with your eyes.

For Mike Davidson, an artist creates things to evoke emotion. Being a designer goes a step further than that, not only trying to evoke emotion but trying to make a reaction. It is very objective-driven. Charles Eames held that, "Design is a plan for arranging elements in such a way as best to accomplish a particular purpose." And according to Freeman Thomas, "Good design begins with honesty, asking tough questions, comes from collaboration and trusting your intuition." As Robert Frost wrote, "The artist in me cries out for design."

A curriculum design coming from honesty, courage, collaboration, and intuition would indeed be friendly; which is desirable, functional, creative, and transformative.

If assessment deals with measures, then it denotes not just measurement or standard units but the administration of something for the betterment, like the dispensation of medicine or remedy and punishment as well. According to Dave Carter, "Teachers assess to test; educators assess to assist learning." For Ingrid Bucher, "Measurements are not to provide numbers but insight." I guess it's a movement beyond measures for Anne McCaffrey who upholds to "make no judgment where you have no compassion." Assessment along these lines then is clearly meant for development, hence all assessment, as Linda Suske puts it, "is a perpetual work in progress." And if indeed curriculum design is a work of art, then the assessment is truly the continuing act of the master or the connoisseur.

From these perspectives of design and assessment, I believe we can truly come up with an authentic curriculum improvement.

Two years ago, we introduced "True Colors" for our institutional planning using arts workshop. We wanted to translate the numerical figures coming from our evaluations of our institutional activities, including our dreams, for the next ten years. We came up with this resonant vision:

Aquinas University will be a sanctuary of development which is dynamic, connecting, nurturing, and evangelizing, marked by a tradition of excellence and innovation, cultural transformation, transformative education, and organizational effectiveness, reflective of our Aquinian context and that of the borderless world through a committed, competent, and creative teaching and learning community.

Along this vision shall our curriculum be designed, assessed, and improved.

Going back to the names where we started.

Rudyard Kipling considered six honest servants who taught him all he knew. "Their names are What and Why and When and How and Where and Who." Looking at curriculum improvement from the perspectives of design and assessment, we cannot ignore the what, the why, the how, the where, the when and, most importantly, the who. For the former defines the circumstances and the latter acts (lives) on them. As Aldous Huxley wrote, "There is only one corner of the universe you can be certain of improving, and that's your own self." Indeed what will happen if we are only anxious on improving our circumstances but unwilling to improve ourselves? Crossing the distance from mediocrity to excellence is the course of improvement which requires so much from our very own selves. According to Jose Ortega Y Gasset, "We distinguish the excellent man from the common man by saying that the former is the one who makes great demands upon himself, and the latter who makes no demands on himself."

After all, what is education all about? Knowing ourselves. How truly wonderful for Charles Dickens is the fact "that every human creature is constituted to be that profound secret and mystery to the very other." Education as knowing (teaching and learning) is indeed a lifelong process.

In our True Colors Workshop, one of our nonacademic employees, who is also a student of our College of Law, wrote:

Paaralan ng buhay. Sa panahon ng pangangailangan, kalituhan, at kadiliman ng buhay, sa paaralang ito nakahanap ng kanlungan. Isang dating walang pakialam at nag-iisip na kahit na walang ibang tao'y kayang mabuhay. Sa institusyong ito, natuklasan kong hindi nilikha ang anumang bagay kung ito'y walang kaugnayan sa iba pa. Sa pananatili, pakikibahagi, at pakikiisa sa mga taong aking nakasama at nakasalamuha sa AQ, ako ay natuto. Natutong magsuri sa pagitan ng tama at mali; natutong makibagay at makibahagi, makiisa at makipag-isa, maniwala at manaig, kumilos at magpakilos. At higit sa lahat, magtiwala sa sarili at sa kakayahan ng iba, may boses man sila o wala, mayaman man o mahirap. Ang AQ ay isang maliit na lugar ng pakikibaka . . . isang tahanan, kanlungan, at maliit na salamin ng paaralan ng buhay at dito nagmumula ang maliit na boses na lalakas at aabot sa iba pang kailangang makarinig.

The girl who wrote this recently resigned from her job in our University for a position in a Spanish NGO (nongovernment organization) which happened to be our partner. Yet she remained a volunteer in our institution she called the School of Life. I was sad to let her go, but at the same time happy because she has designed a plan for her life and pursued its course, the blessing for which I cannot deny.

I hope that the salesgirl I met at the department store did not only send her résumé but had truly drawn the curriculum of her life. After all, the design, the assessment, and the improvement in the ultimate perspective redound to the very curriculum of life. Yes, our curriculum vitae, the course we take to the fullness of our life.

Note: No references were submitted.

Rev. Fr. Ramonclaro G. Mendez, O.P., PhD, is currently the Rector and President of Aquinas University of Legazpi, Legazpi City. He obtained his Master of Arts in Education and Doctor of Philosophy in Foundation and Administration of Higher Education degrees from St. Louis University, Missouri, USA. He has worked with other higher educational institutions and is an active member of the congregation. His other current involvements include: Regional Director of the Catholic Educational Association of the Philippines (CEAP), Founder and President of the Aquinas University Foundation, Inc., and President of the Bicol Association of Catholic Schools (BACS).

ELEMENTARY EDUCATION CURRICULUM: ITS DEVELOPMENT AND IMPLEMENTATION

Dr. Yolanda S. Quijano
Bureau of Elementary Education, Department of Education

The Elementary Education Curriculum (EEC), as a major component of the Basic Education Curriculum (BEC), was first implemented in 2002. Its rationale is anchored on the belief that an ideal Filipino learner in a rapidly changing world should be empowered for lifelong learning, competent in learning how to learn, equipped with life skills, and a self-developed person who is makabayan (patriotic), makatao (mindful of humanity), makakalikasan (respectful of nature), and maka-Diyos (godly).

A curriculum committee composed of specialists from DepEd, teacher education institutions, and other government agencies directly involved in education prepared the first draft. Consultations and dialogues with internal and external stakeholders were conducted to review the curriculum. Furthermore, the curriculum was validated in organized fora for practitioners in the different learning areas at various levels: region, division, district, and school.

The curriculum design includes objectives, features, framework, standards, content, structure, delivery, learning areas, and assessment. Its implementation guidelines were contained in Department Order No. 43, s. 2002. Trainings were conducted at the different levels to provide implementers with working knowledge on the curriculum. Other mechanisms for support and quality control include the provision of the revised Philippine Elementary Learning Competencies (PELC) and textbooks, continuous training on the different teaching strategies, monitoring, evaluation, and provision of technical assistance undertaken by the division, the region, and the Bureau of Elementary Education (BEE).

After the fourth year of implementation, the BEE commissioned the Philippine Normal University (PNU) to

evaluate the progress of its implementation. Results showed that there were more problems than strengths in the implementation of the curriculum. Recommendations of the evaluators focus on areas that include (1) the BEC program: content, competencies, support materials, assessment, monitoring, and research activity; (2) teacher preparation and upgrading; (3) administrative support; and (4) parent-community-business support.

Among the projects being undertaken by the BEE to implement the recommendations are: revisions of the learning competencies in different learning areas and development of prototype lessons; formulation of professional standards, design and modules for training of elementary teachers; and preparation of sector monitoring framework and design with corresponding tools and instruments.

Curriculum Review/Development – 1970 to 1982

A curriculum develops through a dynamic process and is subject to periodic evaluation, which produces recommendations for modifications or even major changes. The elementary curriculum has undergone several changes. We need a curriculum which will respond to the needs of our children and society as well. We need a curriculum that is responsive and viable.

The 1970 Presidential Commission to Survey Philippine Education (PCSPE)

The Revised Elementary Education Curriculum was overcrowded with seven (7) subject areas for Grades I and II and eight (8) subjects for Grades III-VI. The Presidential Commission to Survey Philippine Education was formed to address the deficiencies at the foundation level of the educational system.

The 1974 Survey of Outcomes of Elementary Education (SOUTELE)

After four years, a body was commissioned to evaluate the educational system. This provided information necessary to make educational plans and policies more relevant to present-day needs, more focused curricular programs, and more organized researches in education to contribute to a better understanding of the problems in education.

The body provided 23 recommendations to improve the quality of elementary education. A significant recommendation was the restructuring of the elementary education to make it more responsive to present-day needs, less subject-centered, not overcrowded, more flexible in scheduling, and more development-centered.

The 1978 Experimental Elementary Education Program (EEEP)

This experimental program was conducted for two years. The program featured the following: (1) fewer subjects in Grades I-IV; (2) more time allotment for Reading, Writing, and Arithmetic; (3) integration of Language and Reading in Communication Arts; and (4) introduction of Work Education as a subject beginning Grade I. Findings of this program gave direction to the development of the 1983 curriculum.

1982 Program for Comprehensive Elementary Education (PROCEED)

This program created a ten-year comprehensive development plan for elementary education, which included the formulation of mission and values. Several documents were gathered and analyzed in this regard.

Two consultative conferences were conducted in order to come up with the program. The first consultative conference was attended by five prominent national leaders, professionals, experts, and 30 citizen representatives from various sectors. Delphi questionnaires were administered to experts, subject area specialists, academe, and people from all walks of life. The questionnaires aimed to determine what values the schools should teach and develop in the students. Results revealed the need to articulate the following values in the classroom: self-actualization, nationalism, cultural heritage as well as global citizenship.

The second consultative conference, on the other hand, tackled the following: (1) the kind of Philippine Society we want, (2) profile of Filipino citizens we want to populate the country, and (3) beliefs that all Filipinos can share about their country and themselves.

The 1983 New Elementary School Curriculum (NESC)

The development of the New Elementary Education Curriculum featured the following: (1) four subjects in Grades I and II, (2) six subjects in Grade III including Science and Health, (3) seven subjects in Grades IV to VI including HELE, and (4) the infusion of values in all learning areas.

The 2002 Basic Education Curriculum (BEC)

Background and Rationale

The Elementary Education Curriculum (EEC), as a major component of the Basic Education Curriculum (BEC), was first implemented in 2002.

Its rationale is anchored on the belief that an ideal Filipino learner in a rapidly changing world should be empowered for lifelong learning; competent in learning how to learn; equipped with life skilis; and become a self-developed person who is makabayan (patriotic), makatao (mindful of humanity), makakalikasan (respectful of nature), and maka-Diyos (godly).

Development Process for the BEC-PELC

A Curriculum Committee composed of specialists from the Department of Education (DepEd), teacher education institutions, and other government agencies involved in education prepared the first draft. The draft contained the philosophy, framework, objectives, features of the BEC-EEC, and the Philippine Elementary Learning Competencies (PELC). Consultations and dialogues with internal and external stakeholders followed, and after comments and recommendations were incorporated, BEC was validated in organized fora for practitioners in different learning areas at various levels: regions, divisions, districts, and schools.

Curriculum Design

The curriculum design includes objectives, features, framework, standards, content, structure, delivery, learning areas, and assessment.

Objectives. The objectives of the curriculum are the following:

1. Raise the quality of Filipino learners and graduates and empower them with lifelong learning;
2. Focus on tool learning areas for adequate development of the competencies on learning how-to-learn;
3. Provide experiential learning areas where students can apply practical knowledge and life skills and demonstrate deeper appreciation of Filipino culture and heritage; and
4. Make values development integral to all learning areas.

Features. The curriculum has the following features:

1. Emphasis on helping every learner, particularly those in Grades I to III, become a successful reader;
2. Emphasis on interactive, integrative, experiential, and collaborative learning approaches (teachers and students, students and self-instructional materials, between and among students, students and multimedia-assisted instruction);
3. Emphasis on the development of creative and critical thinking; and
4. Greater focus on values formation through integration within and across learning areas.

Framework. The curriculum consists of four tool learning areas that address the learner's individual needs and an experiential learning area that addresses primarily societal needs. The four tool learning areas are English, Filipino, Science & Health, and Mathematics. The experiential learning area is called *Makabayan* which has different components for the different grade levels: *Sibika at Kultura (SK)*, *Heograpiya, Kasaysayan, at Sibika (HKS)*, *Edukasyong Pantahanan at Pangkabuhayan (EPP)*, *Musika, Sining, at Edukasyon sa Pagpapalakas ng Katawan (MSEP)*, and the last one added is *Edukasyong Pagpapahalaga* or Character Education. *Makabayan* is where the learner can apply practical knowledge and life skills and demonstrate a deeper appreciation of Filipino culture. Values and skills are clustered in order to develop the love and pride for one's country and also to develop the love and value of work. What students learn also in the tool learning areas are ensured to be applied in *Makabayan*.

Standards and Content. Standards are based on learning outcomes derived from student performance. There are two kinds of standards: content standards and performance standards. Content standards are learning competencies that teachers should teach and students are expected to learn. Performance standards are the degrees of mastery or levels of attainment.

The curriculum has five basic academic subjects with specific learning competencies and content. Thus, the curriculum is classified both as content-based and competency-based. For every topic or concept, there is a corresponding competency, objective, and skill. Developed skills should be used in the topic or concept.

Structure and Delivery. The structure of the curriculum can be described as both linear and spiral. It is linear because the skills are presented in a prescribed order and the mastery of immediate previous skill or concept is required. It is, at the same time, spiral, in the sense that the concepts and skills are taught in different ways at different grade levels. The same concepts may be introduced in grade 1, grade 2, grade 3, across grade levels, but the degree of difficulty of the development of the concept increases.

On the other hand, the delivery can be described by the following characteristics:

1. Discipline-based – subjects are taught individually during separate times of the day;
2. Generalized approach – students are taught academic skills that they can apply across different contexts, tasks, time, and people;
3. Interactive – interactions between teacher and student and among students are promoted; and
4. Integration of values – there is integration of values within and across learning areas.

Learning Areas and Time Allotment. The daily time allotment for each learning area and grade level is shown in Table 1.

Table 1
Distribution of Daily Time Allotment by Learning Area and Grade Level

Learning Area	Daily Time Allotment in Min. Per Day					
	Grade I	Grade II	Grade III	Grade IV	Grade V	Grade VI
English	90	90	90	60	60	60
Filipino	70	70	70	60	60	60
Mathematics	70	70	70	60	60	60
Science & Health			40	60	60	60
Makabayan						
Sibika at Kultura	60	60	60			
HK				40	40	40
EPP				40	40	40
MSEP				20	40	40
Edukasyong Pagpapakatao	30	30	30	20	20	20
Total Number of Minutes per Day	320	320	360	380	380	380

There was more time allotted for English from grades 1 to 6 and for Filipino and Mathematics from grades 1 to 3. The time deducted from these learning areas were allotted for *Edukasyong Pagpapahalaga* or Character Education. For *Makabayan* grades 1, 2, and 3, *Musika, Sining at Edukasyong Pangkalusugan* (Music, Arts, & Physical Education) is integrated in Sibika at Kultura (Civic and Culture). For grades 4, 5, and 6, there are different time allotments for each component of *Makabayan*.

Assessment System

Classroom Assessment. Inside the classroom, teachers assess the students using different methods:

1. Curriculum-based assessment *(the assessment for the different learning areas)*
2. Criterion-referenced tests *(the status of the pupil in an identified specific assessment)*
3. Paper-and-pencil tests *(the usual measure being done)*
4. Performance assessment *(the grades are not based only on the quizzes or the periodical test; performance measures are also being utilized as basis for the student's grades)*
5. Authentic assessment *(tests wherein there are constructed responses – the application of knowledge like problem solving)*
6. Portfolio assessment *(not only a single occasion assessment, but samples over time; there is recording of different performance the children achieve for the day throughout the year)*

Graduation Requirement. To be able to graduate from elementary, a student has to pass the periodical tests for each learning area.

National Assessments. Reading Assessment Test for grade 3 and National Achievement Test which is the exit assessment for grade 6.

Implementing Guidelines for Quality Control

The implementation guidelines of the Basic Education Curriculum are contained in the Department of Education (DepED) Order No. 43 s. 2002. National trainings for regional and district offices and schools were conducted to provide implementers with working knowledge on the curriculum. Other mechanisms for support and quality control include the provision of the revised Philippine Elementary Learning Competencies (PELC) and textbooks; continuous training on the different teaching strategies; and monitoring, evaluation, and provision of technical assistance undertaken by the Division and Regional Offices and the Bureau of Elementary Education (BEE).

Evaluation of the Elementary Education Curriculum Implementation

After the fourth year of implementation, the Bureau of Elementary Education (BEE) commissioned the Philippine Normal University to evaluate the progress of elementary education curriculum implementation. The evaluation was conducted from June 2005 to June 2006. The general objective was to gather information and feedback on the progress of the implementation as basis for policy formulation. Specifically, data were to be gathered on the following:

1. Teachers' and administrators' awareness and attitudes on the roles expected of them (promoter, facilitator of collaborative, interactive, integrative, and experiential learning, creative and critical thinking; developer of lifelong learning; reading teacher; values teacher; enhancer of multiple intelligences; assessor of authentic learning);
2. Teachers' and administrators' extent of engagement in performing the roles (innovative learning activities, INSET trainings, lifelong learning, grading or evaluation system, linkages/partnerships);
3. Teaching-learning processes in the classroom;
4. Use of other support structures; and
5. Problems encountered, solutions/actions taken and recommendations.

Results of the evaluation showed areas of strengths and problems encountered. In particular, among the strengths noted were: 1) administrators have positive attitude and adequate knowledge of teachers' roles, have given full support in the implementation and showed initiatives in solving problems; 2) teachers have favorable attitude, showed confidence that they have engaged their pupils in learning activities aligned with BEC, showed evidences of emerging shifts in the teaching-learning process from product-oriented to process-oriented schemes; and 3) there was increased support structures and resources from internal and external stakeholders.

On the other hand, teachers, curriculum and administrative support were the areas that need improvement. Among the specific problems encountered are: 1) teachers were not adequately trained as facilitators of learning as intended for in the BEC implementation, 2) integrative feature that focuses on values integration was not readily evident,

3) Makabayan subjects were still taught the way they were done before; team teaching has not fully developed because there was no structure that supported it, 4) there was a shift of emphasis from traditional to non-assessment but teachers have inadequate knowledge on this and rubrics were not available, 5) not all teachers were provided with BEC manual, 6) textbooks were not yet aligned with the features of BEC, and 7) equipment and materials were not readily available.

It was also noted that parent support was lacking in terms of direct involvement in the child's education and that schools have limited network with the industry sector.

Curriculum Revisions

In the light of the findings and recommendations, revisions of the learning competencies in the different learning areas were undertaken. These include the completion of the Mathematics lesson guides prepared by the Bureau of Elementary Education together with Ateneo de Manila University (ADMU); completion of Science and Health learning competencies; and development of prototype lesson guides on this area. Still being developed are prototype lesson guides in Makabayan (Edukasyong Pagpapakatao at Edukasyong Pantahanan at Pangkabuhayan).

Initiatives being implemented in relation to the support materials include: 1) Readers in English and Filipino (grades 1 and 2 – being printed), 2) PHIL-IRI Assessment Tools for English and Filipino (grades 1 to 6), and 3) Monitoring Tools in Elementary Education (Inputs, Process, Outputs, Outcomes). Likewise, project-based interventions at various levels (national, regional, division, and school) are being implemented, and these are: 1) Every Child-a-Reader Program; 2) Upgrading English, Science and Math Instruction; 3) Teacher Training and Development; and 4) Procurement of Textbooks and Supplementary Materials.

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IDENTIFYING PATTERNS OF SKILLS ACQUISITION IN ELEMENTARY MATHEMATICS AMONG A COHORT GROUP OF PUPILS: IMPLICATIONS TO TEACHING AND LEARNING

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This study explores the use of test performance to identify patterns of skills acquisition that differentiate good and poor performers in elementary mathematics. Good and poor performers in mathematics were identified through their cumulative raw score on six achievement tests in grade 1 to grade 6 mathematics. These tests were administered consecutively for six school years to an intact cohort group of 1,347 pupils towards the end of each school year. Discrimination and difficulty indices of all test items were computed to identify "critical" skills that highly discriminate the good performers from the low performers. The connection between the critical as well as non-critical skills in doing fractions and the patterns of acquiring these skills from one grade level to the next were then described and illustrated.

The results showed that majority of the critical items are more difficult than the non-critical items. The pattern of difficulty and discrimination indices of items on fractions indicated that both good and poor performers acquire the ability to identify fraction concepts from illustrations and perform addition and subtraction on similar fractions. Both groups, however, need to extend their conceptual understanding of fractions. The competencies of good and poor performers diverge at the point when they are required to compare fractions and execute basic operations on dissimilar and/or mixed form fractions. The results also showed how proficiency may be demonstrated with procedural knowledge without necessarily implying a good grasp of underlying concepts.

For many years, the Center for Educational Measurement (CEM) has been collecting and processing achievement test data in English, Mathematics, and Science at all levels of basic education for diagnostic purposes. Over 300,000 students from an estimated membership of at least 450 private and public schools take these tests annually before the academic year ends in March.

Although the databases of these tests have grown significantly from the time CEM was established, not much has been done to utilize the data to generate information that could systematically help build and create a knowledge base about what the Filipino learner learns and how he or she develops. This void prompted us to search for a cohort of pupils whose achievements in mathematics across six years of elementary education have been documented by our tests. It is hoped that this cohort study would yield the baseline data we need to be able to institute a viable research program on the cognitive development of the Filipino Learner.

Objectives

This study (1) explores the possibility of using performance in curriculum-aligned standardized tests to identify patterns of skills acquisition that differentiate good and poor performers in elementary mathematics and (2) attempts to look into implications of these patterns to teaching and learning by contrasting levels of good and poor performance.

Method

Selection of the sample

An intact cohort group of 1,347 grade 6 pupils from 11 schools was extracted from the database of CEM schools that subscribed to the Mathematics Diagnostic Tests for six consecutive school years. This group of pupils took the tests from grade 1 to grade 6. They entered first grade in 1996-97 with a mean age of about seven years, and finished elementary education in 2001-02 at more or less 13 years of age. A cohort group was the appropriate sample for this study because it allows us to consider developmental changes in skills acquisition from one grade level to the next.

Instruments

Acquired levels of knowledge and skills in elementary mathematics were measured using six standardized achievement tests in mathematics from grades 1, 2, 3, 4, 5, and 6; developed by CEM and administered consecutively for six school years to the same group of examinees towards the end of each school year. The test results are reported individually and by group (according to class section and school) in both the content and skills areas for each grade level prescribed by the national curriculum. The entire set of six tests consists of 320 multiple-choice items that are distributed as follows:

Table 1

Distribution of Multiple-Choice Items by Content Area and Grade Level

Content Area	Grade Level 1	2	3	4	5	6	Total
Number Concepts & Numeration	12	12	8	4	4	4	44
Number Theory	....	....	4	8	....	8	20
Addition	8	4	4	3	2	4	25
Subtraction	8	4	4	3	5	4	28
Multiplication	....	4	4	5	5	4	22
Division	....	4	4	5	4	4	21
Fractions	4	4	8	12	12	12	52
Decimals, Ratio, & Proportion	....	....	4	8	16	16	44
Geometry & Measurement	8	8	8	8	8	8	48
Graphs, Maps, & Scales	....	....	4	4	4	4	16
Entire Test	40	40	52	60	60	68	320

Organization and analysis of data

Individual responses of the pupils to all items of the six Mathematics Diagnostic Tests constitute the basic unit of analysis of this study. A correct or incorrect response to an item was scored as 1 or 0, respectively. Unanswered items, although computed as part of a cumulative score, were not included in the analysis. The analysis yielded the following statistics and classifications:

1. *Cumulative raw score.* This score is a summation of an individual student's scores in the mathematics tests from grade 1 to 6. It was computed and used simply to classify students as good or poor performers when their scores were arranged from highest (320) to lowest (0).

2. *Good vs. poor performers.* From the distribution of cumulative raw scores, the top 27% of the sample were labeled good performers while the bottom 27% were labeled poor performers.

3. *Item discrimination index (D).* To identify skills that separated the two groups, item discrimination indices were computed for all items. The discrimination index, D, of an item is computed as the difference between the proportions of good and poor performers who were able to answer the item correctly.

4. *Critical vs. non-critical items.* An item is labeled critical if D is equal to or greater than 0.40, and non-critical if D is less than 0.40. The critical items refer to skills that separate the cumulatively good and poor performers in elementary mathematics.

5. *Item difficulty index (p).* The difficulty index, p, of an item is computed as the proportion of pupils in the cohort group who were able to answer the item correctly. This index is used to ascertain which skills are relatively easy or difficult for the students to learn at a particular grade level.

Limitations of the Study

This study is archival, *ex post facto* research. A convenient sample was used, whose raw scores are not normally distributed but skewed towards the high scores, with a mean of about 65% correct answers. In addition, although the test instruments used are aligned with a prescribed curriculum, only the specific learning competencies deemed important by curriculum experts are measured by the final set of test items.

Results and Discussion

This section focuses on (1) a description of the performance of the cohort sample on the six diagnostic tests; (2) the distribution and description of critical items in the content areas at each grade level; (3) a presentation of the difficulty levels of the test items; and (4) a discussion on the acquisition of skills in the area of fractions.

Test performance profile

The performance of the entire cohort is shown in Table 2. The minimum and maximum values at each grade level and for all levels combined indicate wide variation in scores from 15% to 100%. It must be noted that the mean total percent correct scores of the cohort tend to decrease as the group moved toward higher grade levels. Grades 4 and 5 showed the lowest mean scores. However, these scores went up again at grade 6. This tendency can be seen also with percentile points.

Table 2

Descriptive Information on the Achievement Levels[1] of the Cohort Sample (N=1,347)

Statistic	Grade Level 1	2	3	4	5	6	All Levels Combined[2]
Mean	75	69	60	57	56	64	63
Std. Deviation	15	18	17	18	19	19	16
Minimum	18	15	15	18	17	19	27
Maximum	100	100	100	100	100	100	99
25th Percentile	65	58	46	43	42	49	50
50th Percentile	78	72	60	55	55	65	63
75th Percentile	88	82	75	70	70	79	75

[1]Achievement is measured in terms of total percent correct scores at each grade level and for all levels combined

[2]Denotes total percent correct scores when raw scores for each grade level are summated and expressed as a percentage of the total number of items for all grade level tests combined

Comparing good and poor performers. Table 3 shows that the mean scores of the good performers are higher than the scores of the entire cohort. The percentile points indicate that approximately three fourths of the group obtained scores at the relatively high end of the score range (greater than 75% correct). This is true for all levels except for grades 4 and 5.

It will be noted that at grade 5, the performance of the good group showed wide variability. The scores range from 25%-100%, while in other grade levels, scores do not range wider than 40%-100%. Around one-fourth of the good group scored between 25%-65% at grade 5, with approximately 10% scoring between 25%-40%. This may indicate that the examinees found the grade 5 content more difficult than the content in other grades.

Nevertheless, at each grade level, Table 3 shows that the mean performance of the poor group is substantially lower (29-43 mean percentage points lower) than the performance of the good group. For the poor group, the mean total percent correct scores for grades 3 and above are less than 50%. The maximum scores of the poor group for grades 3 and 4 are also lower than in other grades. The percentile points indicate that approximately half of the examinees in the poor group scored within the range of 30%-50% for grades 3 and up.

Table 3
Descriptive Information on the Achievement Levels[1] of Good and Poor Performers

Statistic	Grade Level 1	2	3	4	5	6	All Levels Combined[2]
			Good Performers (n = 364)				
Mean	89	86	81	78	74	85	83
Std. Deviation	8	8	9	9	17	8	6
Minimum	55	55	42	50	25	56	74
Maximum	100	100	100	100	100	100	99
25th Percentile	85	82	75	72	65	81	77
50th Percentile	90	88	81	78	75	86	82
75th Percentile	95	92	87	85	88	91	87
			Poor Performers (n = 364)				
Mean	60	50	41	38	42	42	43
Std. Deviation	13	13	9	8	15	10	6
Minimum	18	15	15	18	17	19	27
Maximum	98	88	63	60	98	87	51
25th Percentile	52	40	35	32	32	34	39
50th Percentile	60	50	42	37	38	41	44
75th Percentile	70	58	46	43	47	49	48

[1]Achievement is measured in terms of total percent correct scores at each grade level and for all levels combined

[2]Denotes total percent correct scores when raw scores for each grade level are summated and expressed as a percentage of the total number of items for all grade level tests combined

Overall elementary mathematics performance is substantially different for the two groups. The summated scores for all grade levels for the high group yielded a mean total percent score of 83%. The bottom 25% in this group scored between 74%-77% correct. In contrast, the mean total percent correct score for the poor group for all the elementary mathematics tests combined is 43%. For this group, the bottom 25% scored between 27%-39% correct.

Another way of characterizing the performance of the contrast groups is by comparing the mean difficulty levels obtained by these groups with those attained by the entire cohort and by the norm group for the diagnostic tests. As can be seen in Figure 1, the mean p levels for each grade level test for the good performers were substantially higher than the levels for the poor performers, the entire cohort, and the norm group.

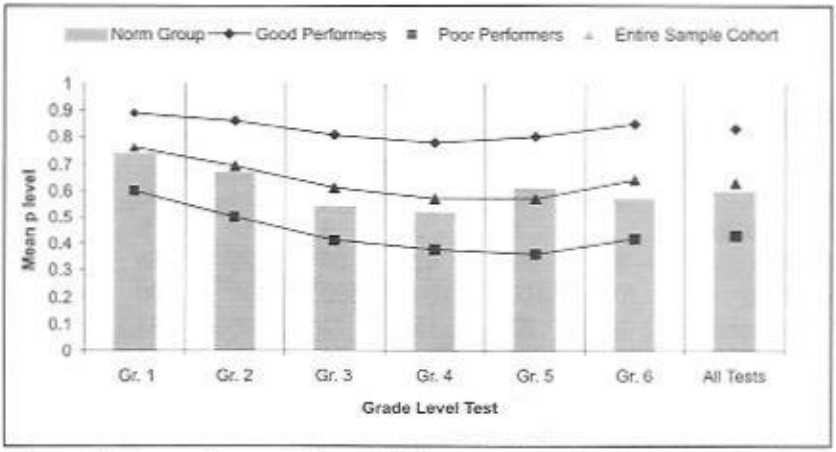


Figure 1. Comparison of Mean Difficulty Levels for Each Test for the Contrast Groups, the Entire Cohort, and the Norm Group

Items that discriminate between good and poor performance

Content area. The distribution of items per content area and grade level, and the proportion of these items that were identified as "critical" are presented in Table 4. From the table, it will be noted that the number of items increases with increasing grade level. However, even when expressed as a percentage of the total number of items per test, Table 4 shows that critical items increase with increasing grade level. This suggests a growing disparity between the skills learned by the good performers compared to the poor performers as they progressed through elementary level mathematics.

Also from Table 4 it will be observed that except for grades 3 and 6 *Addition* and grades 1-3 *Fractions*, all relevant content areas at each grade level yield critical items. For *Number Concepts and Numeration* and *Number Theory*, the percentage of critical items reach their highest for grades 3 and 4; for *Addition*, the highest percentage of critical items is at grade 2, while for the other operations, majority of items (more than 50%) are critical throughout the elementary period. For *Fractions* and *Decimals*, the highest percentage of critical items are at grades 5 and 6, for *Geometry and Measurement* at grades 3 and 6 and for *Graphs, Maps and Scales*, at grades 4 and 6.

Table 4

Distribution of Critical Items at each Grade Level According to Content Area

Content Area		Grade Level 1	2	3	4	5	6	All Levels
Number Concepts & Numeration	No. of Items	12	12	8	4	4	4	44
	% Critical	33%	17%	63%	75%	50%	50%	41%
Number Theory	No. of Items	....	....	4	8	....	8	20
	% Critical	....	....	75%	63%	....	25%	50%
Addition	No. of Items	8	4	4	3	2	4	25
	% Critical	38%	100%	0%	67%	50%	0%	40%
Subtraction	No. of Items	8	4	4	3	5	4	28
	% Critical	38%	100%	100%	100%	100%	50%	75%
Multiplication	No. of Items	....	4	4	5	5	4	22
	% Critical	....	50%	100%	100%	60%	75%	77%
Division	No. of Items	....	4	4	5	4	4	21
	% Critical	....	50%	75%	100%	100%	100%	86%
Fractions	No. of Items	4	4	8	12	12	12	52
	% Critical	0%	0%	0%	17%	83%	83%	42%
Decimals, Ratio, & Proportion	No. of Items	....	....	4	8	16	16	44
	% Critical	....	....	25%	38%	63%	63%	55%
Geometry & Measurement	No. of Items	8	8	8	8	8	8	48
	% Critical	13%	25%	50%	13%	25%	75%	33%
Graphs, Maps, & Scales	No. of Items	....	....	4	4	4	4	16
	% Critical	....	....	25%	100%	50%	75%	63%
Entire Test	No. of Items	40	40	52	60	60	68	320
	% Critical	28%	40%	48%	55%	65%	62%	52%

Difficulty level. Table 5 shows the mean difficulty levels for each content area and item type at corresponding grade levels. As shown in Table 4, p values for each test indicate that generally, critical items are relatively more difficult than non-critical items. An exception is noted in grade 4, where mean p value for critical items is higher than non-critical items, indicating that critical items for this grade are relatively easier. However, when p values are inspected per content area, it will be noted that the relationship between item type and difficulty varies with content area. That is, for certain content areas, mean p values for critical items indicate that they are relatively easier than non-critical items or that the two item types have relatively similar difficulties. The former case is true for *Number Theory*, grade 3 *Division, Decimals,* and *Graphs, Maps and Scales*, grade 4 *Geometry and Measurement* and grades 4-6 *Fractions.*

Table 5

*Mean Difficulty Levels at each Grade Level according to Content Area and Item Type**

Content Area	Item Type	Grade Level 1	2	3	4	5	6	All Levels
Number Concepts & Numeration	*Critical*	*0.64*	*0.60*	*0.62*	*0.61*	*0.50*	*0.65*	*0.61*
	Non-Critical	0.76	0.71	0.69	0.88	0.84	0.81	0.75
	All Items	0.72	0.69	0.65	0.67	0.67	0.73	0.69
Number Theory	*Critical*	....	....	0.56	0.64	....	0.72	0.63
	Non-Critical	....	....	0.28	0.47	....	0.62	0.54
	All Items	....	....	0.49	0.57	....	0.65	0.59
Addition	*Critical*	*0.76*	*0.70*	....	*0.72*	*0.61*	....	*0.71*
	Non-Critical	0.85	....	0.80	0.90	0.95	0.81	0.84
	All Items	0.82	0.70	0.80	0.78	0.78	0.81	0.79
Subtraction	*Critical*	*0.67*	*0.57*	*0.55*	*0.64*	*0.74*	*0.62*	*0.64*
	Non-Critical	0.74	....	....	....	....	0.89	0.78
	All Items	0.71	0.57	0.55	0.64	0.74	0.75	0.67
Multiplication	*Critical*	....	*0.59*	*0.58*	*0.59*	*0.53*	*0.59*	*0.58*
	Non-Critical	....	0.71			0.82	0.80	0.77
	All Items	....	0.65	0.58	0.59	0.65	0.64	0.62
Division	*Critical*	....	*0.64*	*0.58*	*0.58*	*0.67*	*0.68*	*0.63*
	Non-Critical	....	0.78	0.38	....	....	....	0.65
	All Items	....	0.71	0.53	0.58	0.67	0.68	0.63
Fractions	*Critical*				*0.57*	*0.46*	*0.57*	*0.52*
	Non-Critical	0.78	0.80	0.70	0.55	0.42	0.45	0.64
	All Items	0.78	0.80	0.70	0.56	0.46	0.55	0.59
Decimals, Ratio, & Proportion	*Critical*	....	....	*0.54*	*0.44*	*0.54*	*0.58*	*0.55*
	Non-Critical	....	....	0.33	0.52	0.55	0.59	0.52
	All Items	....	....	0.38	0.49	0.55	0.58	0.53
Geometry & Measurement	*Critical*	*0.65*	*0.59*	*0.57*	*0.65*	*0.42*	*0.64*	*0.59*
	Non-Critical	0.82	0.77	0.57	0.49	0.43	0.85	0.64
	All Items	0.80	0.72	0.57	0.51	0.43	0.69	0.62
Graphs, Maps, & Scales	*Critical*	....	....	*0.72*	*0.53*	*0.60*	*0.54*	*0.57*
	Non-Critical	....	....	0.70	....	0.68	0.66	0.69
	All Items	....	....	0.70	0.53	0.64	0.57	0.61
Entire Test	*Critical*	*0.68*	*0.62*	*0.58*	*0.59*	*0.56*	*0.60*	*0.59*
	Minimum**	0.58	0.46	0.36	0.40	0.31	0.36	0.31
	Maximum†	0.80	0.77	0.76	0.82	0.80	0.82	0.82
	Non-Critical	0.79	0.74	0.63	0.54	0.59	0.69	0.67
	Minimum**	0.45	0.36	0.20	0.18	0.20	0.33	0.18
	Maximum†	0.97	0.89	0.91	0.90	0.95	0.93	0.97
	All Items	0.76	0.69	0.61	0.57	0.57	0.64	0.63
	Minimum**	0.45	0.36	0.20	0.18	0.20	0.33	0.18
	Maximum†	0.97	0.89	0.91	0.90	0.95	0.93	0.97

*Item type refers to whether an item is "critical" or not.

**,† Shows the lowest and highest values respectively, not the mean values

Difficulties for critical and non-critical items are comparable for grades 3 and 5 *Geometry and Measurement*, and grades 5-6 *Decimals, Ratio and Proportion*. For the rest, in general, critical items are more difficult than non-critical items. It will be noted from Table 5 that critical items do not occupy the extreme ends of the difficulty range for the entire test. These indicate that non-critical items may fail to discriminate between good and poor performers because the entire cohort found them too easy or too difficult

Patterns of skills acquisition in the content area of Fractions

The highly discriminating items can be thought of as items where achievement gaps between good and poor performers in elementary mathematics are widest. They represent areas of variable performance, being neither the easiest nor the most difficult items, and hence are a potential source of insight on what skills make the difference between the two groups. With a longitudinal cohort group, it might also be traced at what grade level, and along what competencies the separation between the two groups begin. For purposes of illustration, the following discussion of acquired mathematics skills or competencies will focus on one particular content area: Fractions. This particular content area was chosen because it is consistently one of the lowest-scoring areas in elementary mathematics according to CEM data compiled from 1998-2003 (CEM, 2003).

The distribution of Fraction items in the diagnostic tests is shown in Table 6. Learning competencies evaluated by these items can be sorted into the following general categories: (1) *Fraction concepts,* (2) *Kinds of fractions*, (3) *Equivalence and ordinal relations, and* (4) *Basic operations and word problem solving on fractions*. In Table 5, cells without entries indicate that there were no items evaluating that topic. This may be due to either one of 2 reasons: items are randomly selected for each test, and so not all prescribed learning competencies for a particular grade level may be evaluated in the test. Another reason is that the topic may not be part of test content for that grade, in alignment with the country's recommended curriculum from the Department of Education. Therefore it may also be the case that competencies that are supposed to be acquired at a previous grade are not included for assessment in diagnostic tests for succeeding grades.

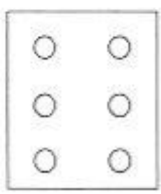
Table 6

Distribution of Fraction Items by Learning Competencies

Learning Competency	Grade Level 1	2	3	4	5	6
Fraction concepts	4	4	2	......	......	......
Kinds of fractions	......	......	......	2	1	2
Equivalence and ordinal relations	......	......	2	1	1	2
Basic operations & word problem solving						
Addition & subtraction of fractions	......	......	4	4	4	3
Multiplication of fractions	......	......	......	3	3	1
Division of fractions	......	......	......	2	3	4

Table 7 shows the difficulty levels of specific learning competencies evaluated at each grade. Whenever possible, items tapping comparable learning competencies across grade levels are aligned horizontally with each other. These learning competencies will be discussed by category in the following sections.

Fraction concepts (Grades 1-3). Children's initial understanding of fraction concepts is established through pictures or models. Typical illustrations used to expound these fraction concepts are whole objects separated into parts, or sets of objects where the objects are divided into smaller subgroups. From grades 1-3, the concepts are explored using such figures, moving from even-numbered to odd-numbered fraction parts, i.e.,



Grade 1: Item 20; $p = .57$: *Which numeral shows 1/2 of the number of circles in the set above?*

Grade 3: Item 27; $p = .20$: *What is 1/3 of the number of marbles above?*

Figure 2. Sample stimulus and stems of items assessing understanding of fractional parts of sets (difficult)

More than half (.57) of the cohort correctly answered the grade 1 item, but, only 2 out of every 10 students (.20) did for the grade 3 item. Particular difficulties with this question may be conjectured. One is that there are no visual cues to the answer. On items where the fractional part is indicated with shading, children can simply count how many parts or objects are shaded, how many parts or objects there are in all, and choose the appropriate fraction notation whose numerator and denominator, respectively, correspond to the counted amounts.

Table 7
Mean Difficulty Levels (p) of Critical and Non-critical Fraction Items from Grades 1 to 6

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
Fraction concepts					
Item# 26; p=.90 Recognizes 1/2 and 1/4 of a whole					
Item# 4; p =.85 Separates a whole object into fourths	Item# 12; p =.77 Separates a whole object into sixths				
Item# 27; p =.80 Separates a whole object into thirds	Item# 28; p =.85 Separates a whole object into sixths	Item# 29; p =.90 Separates a whole object into thirds			
Item# 20; p =.57 Separates a group of objects into halves and fourths	Item# 30; p =.79 Identifies 1/3 of a given group of objects	Item# 27; p =.20 Finds the fractional part of a set			
	Item# 6; p =.81 Identifies 1/5 of a given group of objects				
Kinds of fractions					
			Item# 3; p =.82 Identifies improper fractions from a given set of fractions		Item# 64; p =.44 Identifies improper fractions from a given set of figures
			Item# 47; p =.58 Identifies similar fractions from a given set of fractions	Item# 7; p =.69 Identifies similar fractions from a given set of fractions	Item# 57; p =.46 Identifies dissimilar fractions from a given set of fractions
Equivalence and ordinal relations					
		Item# 40; p =.64 Compares unit fractions			Item# 27; p =.48 Identifies equivalent fractions
		Item# 1; p =.85 Orders fractions less than one or equal to one (similar fractions)	Item# 60; p =.28 Orders dissimilar fractions in simple form	Item# 59; p =.31 Orders dissimilar fractions in simple form	Item# 18; p =.63 Orders dissimilar fractions in mixed form

Table 7 *(continued)*

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
Addition and subtraction of similar fractions					
			Item# 16; p =.56 States a principle involved in adding fractions		
		Item# 30; p =.78 Adds similar fractions with denominators in a range of 1 to 3			
		Item# 9; p =.74 Adds similar fractions with denominators in a range of 4 to 6	Item# 15; p =.63 Adds similar fractions		
			Item# 36; p =.70 Adds mixed numbers with similar fractions		
		Item# 33; p =.72 Subtracts similar fractions with denominators in a range of 6 to 10	Item# 31; p =.86 Subtracts similar fractions		Item# 67; p =.47 Subtracts similar fractions in mixed forms
		Item# 6; p =.80 Subtracts similar fractions with denominators in a range of 11 to 15			
Addition and subtraction of dissimilar fractions					
				Item# 56; p=.34 Adds mixed forms (dissimilar fractions)	Item# 29; p=.63 Adds dissimilar fractions in simple or mixed forms
				Item# 44; p=.49 Subtracts dissimilar fractions	Item# 16; p=.68 Subtracts dissimilar fractions in mixed forms
				Item# 27; p=.38 Subtracts mixed form from whole numbers	
				Item# 22; p=.42 Solves 1-step word problems involving subtraction of fractions	

Table 7 *(continued)*

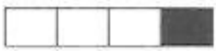
Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
Multiplication of fractions					
				Item# 21; p =.53 Multiplies similar fractions in simple or mixed form	
			Item# 7; p =.82 Multiplies dissimilar fractions	Item# 57; p=.37 Multiplies dissimilar fractions in simple or mixed form	Item# 49; p=.62 Multiplies whole numbers by fractions
			Item# 26; p =.40 Solves word problems involving multiplication of a fraction and a whole number		
			Item# 59; p =.31 Solves word problems involving multiplication of a mixed fraction and a whole number	Item# 55; p=.42 Solves word problems involving 2 or more fundamental operations on fractions	
Division of fractions					
			Item# 28; p=.30 Divides a whole number by a fraction		Item# 30; p=.57 Divides whole numbers by fractions
			Item# 55; p=.41 Divides similar fractions	Item# 47; p=.55 Divides a fraction by another fraction	Item# 66; p=.56 Divides fractions by another fraction
				Item# 20; p=.54 Divides a fraction by a whole number	
				Item# 24; p=.45 Solves 1-step word problems involving division of fractions	Item# 59; p=.53 Solves 1-step word problems involving division of fractions
					Item# 32; p=.48 Solves 2-step word problems involving multiplication and division of fractions

For the given stimulus figure, a bit of flexibility in fraction understanding is required. Some strategies that children have been observed to use in experiments (involving manipulatives in the form of set models) were to "dole out" or divide the objects among recipients equally until all the objects have been given, and then count how many objects each recipient had. Other strategies include using multiplication or division knowledge to figure out the answer (Jensen, 1993).

Another feature that makes these two items more difficult than others tapping similar competencies is that the number of objects in the illustrated set, 6 objects, does not correspond to the number in the denominator of the fractional notation the children are being asked to express:

Grade 1: Item 4; p=.85

What part of the rectangle is shaded?



(A) $\frac{1}{5}$ (B) $\frac{1}{4}$ (C) $\frac{1}{3}$ (D) $\frac{1}{2}$

Grade 2: Item 30; p=.79

Which of the following sets shows that $\frac{1}{3}$ *of it is shaded?*

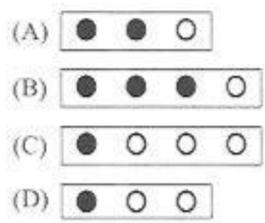


Figure 3. Sample items for assessing understanding of fractional parts of sets (easy)

Kinds of fractions (Grades 4-6). At grade 4, introduction to more formal labels of fraction concepts begins. Terms such as similar, dissimilar, proper, improper, and mixed form fractions are defined. As can be noted from Table 6, grade 4 and 5 competencies that relate to identifying kinds of fractions (specifically similar fractions) discriminate between good and poor overall math performers.

Addition and subtraction can only be directly done on similar fractions, thus, recognizing similar fractions or converting fractions into such a form is an essential step. Much of the later work on fractions is on calculation and problem solving and clarity of the similar fractions concept may be important for properly carrying out certain operations.

While the grade 4 and 5 items on identifying similar fractions clearly discriminated between overall good and poor math performers, (approximately 8-9 out of every 10 good performers correctly answering versus only 3-4 out of every 10 poor performers) it will be noted that the grade 6 item on the opposite concept (identifying dissimilar fractions), indicated relatively greater difficulty for the entire cohort, with only 6 out of 10 good performers answering correctly (see grade 6 item number 7 in Table 7, however this is still considerably higher than the proportion in the group of poor performers who answered the item correctly, 3 out of 10). *

The grade 4 item on identifying improper fractions on the other hand, is a relatively easy task for the entire cohort. Approximately 8 out of every 10 students correctly answered it. The grade 6 item on the same competency however, was relatively more difficult for the cohort. The item asks the student to indicate which set of shaded figures correctly represents an improper fraction. Even among good performers, only half correctly answered the item. Again this may have to do with the students not yet fully grasping the meaning of this fraction type hence failing to see its figural representation.

Establishing equivalence and ordinal relations–comparing and ordering fraction values (Grades 3-6). Understanding fraction sizes in relation to each other is another important and often difficult concept for elementary students. Often, size relations among fractions seems counterintuitive to size relations established with whole numbers: 5 is *greater than* 3 but 1/5 is less than 1/3. In this respect comparing sizes of similar fractions probably follows a reasoning process that is closer to whole number thinking and thus might be easier for those beginning to study fractions.

This does seem to be the case with the present data. Note from Table 7 that item 1 under the Grade 3 column, which required sequencing similar fractions according to magnitude, are associated with relatively low difficulty. Eight out of every 10 students in the entire cohort correctly answered this item. For item 40 under the grade 3 column, while the fractions being compared are not similar, it is supposed that the relative sizes of unit fractions (1/2,1/4, 1/3, 1/5) is a basic lesson that is often rehearsed and thus becomes memorized fact. Six out of every 10 students in the cohort correctly determine relative sizes of unit fractions.

*Based on difficulty levels for the good and poor performers. Data not shown.

For succeeding grade levels, the introduction of dissimilar fractions into the sequencing activity increases the difficulty of the task. At grades 4 and 5, only 3 out of every 10 students in the entire cohort correctly sequence dissimilar fractions according to magnitude. However, by grade 6, the competency becomes a discriminating item, indicating that distinctly more good performers successfully complete such a task (8 out of every 10 good performer versus 4 out of every 10 poor performer). Similarly, proficiency at identifying equivalent fractions at this grade distinguishes good from poor performers.

Performing basic operations and problem-solving in fractions (Grades 3-6). As can be seen in Table 7 under the grade 3 and 4 columns on addition and subtraction of similar fractions, good and poor performers' skills at these tasks do not differ greatly. Difficulty levels for these items at grades 3 and 4 indicate that the entire cohort found the tasks relatively easy (.63 p .86). A curious observation at grade 3 is the facility shown by the pupils for computational algorithms used to solve fractions (.72 p .80 for computation items), although they had a fairly weak understanding of some fraction concepts (grade 3, item 27, p=.20).

The ability to recognize a principle involved in adding fractions, that they must be similar in form, is a critical item at grade 4 (see grade 4, item 16). This recognition facilitates carrying out the correct procedure when operating on fractions (see items 15, 31 and 36). Multiplication at grade 4 (excluding word problem solving), is also relatively easy for the entire sample (p=.82), perhaps because the fractions being multiplied for that particular item are unit fractions, and so requires a relatively simple procedure to answer. Division of fractions and problem-solving at grade 4 are relatively difficult for the whole cohort (.30 p .41).

At grades 5 and 6, good and poor performers' competencies at basic operations on fractions become more distinct. Note from the grades 5 and 6 columns of Table 7 that more items become critical at these grade levels (10 out of the 12 items pertaining to fractions), and typically involve performing operations and problem-solving on fractions in dissimilar and/or mixed forms.

Findings and Implications

Based on the pattern of difficulty levels and discrimination indices on this sample, both good and poor performers show the ability to identify fraction concepts when presented in fairly simple forms and with visual cues. Both groups however, need to extend their conceptual understanding of fractions. Both groups also competently perform addition and subtraction on similar fractions. However, the competencies of good and poor performers diverge at the point when they are required to compare values and execute basic operations on dissimilar and/or mixed form fractions.

Thus, as may rightly be expected, tasks that impose greater cognitive demands (i.e., involve more procedural steps) are what separate good and poor performers in elementary mathematics. However, an unexpected though related finding also points to the fact that demonstrating proficiency on such procedures does not necessarily imply a good grasp of the underlying concepts. The implications of these results are further drawn out in the following discussion.

Implications to Mathematics Learning and Instruction

The topic of fractions is usually an area of difficulty for most students. For one, children are not typically exposed to the use of fraction labels in everyday language. Whole numbers are more familiar. Moreover in terms of notation, size relations in fractions seem to contradict what is learned with whole numbers, i.e. while 5 is bigger than 3, 1/5 is smaller than 1/3. The procedures for performing basic operations on fractions are also more complicated than those for whole numbers. For addition and subtraction, only the numerators are operated on, but only if the denominators are similar; to make fractions similar, steps involving division and multiplication have to be carried out. In multiplication, both numerator and denominator are multiplied, while in division, the inverse of the divisor is obtained and is actually *multiplied* to the dividend.

These difficulties involved in learning mathematics have been explained from both constructivist and information-processing perspectives (Byrne, 2001). When children move from studying whole numbers to studying fractions, they find that many of their previous *schemata*, or "mental templates" if you will, for understanding numbers no longer work. The confusion in understanding fraction size relations is an example of this. There is a need to reconstruct the number system in the child's mind, and often this is done by relating fractional notations to concrete figures or collections of objects, to impart the initial understanding that fractions represent parts of wholes.

Yet, while instruction may start with such a purpose in mind, how well is this understanding conveyed? Is it imparted at all? The use of figures to illustrate concepts is done primarily in the early grades and instruction moves on to emphasize techniques for calculation. In the present study, there is some evidence to say that at higher grades conceptual understanding of fractions may still not be well developed, although ability to carry out procedures for computation may indicate mastery. This finding has been noted in other studies (Goldin & Passantino, 1996), and raises the question: what are we really teaching our students about math? And what does it indicate of the system that a student may progress to higher levels of study without really understanding some basic concepts?

A constructivist approach to teaching and learning would emphasize the need to relate new information to experience and previous knowledge, to facilitate reorganization of the child's current understanding of a topic. At the elementary level, a crucial concept that might do well to bridge the understanding between whole numbers and rational numbers (fractions) is the idea of numbers as comprising other numbers; even whole number notations express a quantity that can be thought of as being made up of smaller parts. This has been termed the *part-whole schema*, and is considered "an important breakthrough in mathematical development" (Jensen, 1993). For example, the notation *5* denotes not just the size of a set, but may also describe a set consisting of smaller sets of *3* and *2* members. Now certainly, such thinking about whole numbers is closer to the part-whole meaning of fractions (Jensen, 1993).

Nevertheless, while it makes intuitive sense to expect that enriching conceptual knowledge will enhance memory for procedural knowledge, studies have shown this is not always the case (Byrne, 2001). Even with instruction that is oriented toward a richer conceptual understanding of numbers and why certain procedures are more appropriate for solving certain problems than are others, students may continue to employ the wrong procedures, simply because they cannot remember the steps for the correct one. The information-processing approach would explain this as error in "retrieval" or recollection of the correct information, and the simple, straightforward strategy of "practice makes perfect" is still the solution (Byrne, 2001).

There are numerous benefits to linking conceptual and procedural knowledge. Mastery of concepts can help in recalling and applying procedures correctly, whereas well-learned procedures can help in building new concepts. Certainly, mathematics competency would not be complete if either were deficient (Hiebert, 1986). Instruction should build on both, in order for the student to have a truly sound understanding of mathematics. For the present study, results suggest the need for instruction that would further develop students' grasp of elementary fraction concepts.

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REDESIGNING THE CEM MATHEMATICS DIAGNOSTIC TESTS AS DEVELOPMENTAL ASSESSMENT INSTRUMENTS

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Center for Educational Measurement, Inc.

Current efforts of the Center for Educational Measurement to redesign its diagnostic tests in mathematics across six grade levels are guided by the developmental approach to assessment adopted by the Australian Council for Educational Research. This approach generates progress maps which place a learner's skills and knowledge along a typical sequence of development as the learner moves within one grade level and on to the next level. Progress is measured in terms of degree of mastery of content and subsequent attainment of higher levels of performance. This is based on the notion that one's competence in an area of learning improves over time.

The progress map described in this paper is drawn from a synthesis of logical connections among the contents and skills found in the various learning areas covered by the CEM mathematics diagnostic tests. The map is the result of a series of consultations between CEM test developers and subject area experts. The competencies measured by the tests are specified by a national core curriculum–the 2002 Basic Education Curriculum–with the inclusion of some topics not part of the core but found to be commonly taken up by a surveyed sample of private schools. This paper also explores the impact of progress maps on (1) measuring a learner's growth, and (2) aligning assessments to development across the curriculum.

Background

Basic education in the Philippines involves six years of compulsory elementary education and four years of secondary education. Filipino students, on the average, finish elementary school at age 12 or 13 years and secondary school at age 16 or 17 years. Afterwards, they may enroll in tertiary institutions to obtain a degree or a certificate in a course of their choice.

The Philippines has a national curriculum. The Department of Education (DepEd) prescribes the content areas and learning competencies for all levels. The Department's Bureau of Elementary Education and Bureau of Secondary Education define the specific learning competencies under each of the content areas in all subjects in each grade or year level. These bureaus are responsible for developing, publishing, and disseminating these specific learning competencies to the field. The competencies in each learning area are expected to be mastered by the student at the end of each grade and year level and at the end of their elementary and secondary schooling.

It must be noted, however, that schools are given the option to modify the national curriculum to suit local contexts. Variations may be seen in terms of content sequence, teaching strategies, and other co-curricular activities that could further enhance learning. In fact, the DepEd does not discourage such modifications as long as the basic requirements of the curriculum are fulfilled (Mariñas and Ditapat, 2000).

Restructuring the Curriculum

Studies made by the DepEd revealed an overloaded basic education curriculum that has been implemented for more than a decade. There were too many subjects and the required competencies and daily assignments for each subject could not be tackled reasonably well within a school year. As a result, the teaching and learning of the "untaught" competencies would be given priority in the following year because they were preconditions to learning of higher-order skills for that year level. Consequently, the DepEd restructured the 1983 Elementary School Curriculum and the 1989 Secondary Education Curriculum and came up with the 2002 Basic Education Curriculum, or the BEC (Iwai, 2003). This "new" curriculum was first implemented at all levels (except Grade 6 and Fourth Year) in all public schools in school year 2002-2003. For private schools, its implementation was made optional (Department of Education, 2002).

Changes in the curriculum significantly affected the existing achievement tests of the Center for Educational Measurement (CEM). Thus, the subject area tests had to be realigned to the new curriculum. In the process, we injected the developmental approach adopted by the Australian Council for Educational Research.

Redesigning the CEM diagnostic tests

The CEM tests were designed to reflect the achievement of students as they move through the grade levels. Apart from aligning the tests with the prescribed curriculum, there was no deliberate attempt to connect the expected grade level competencies to student growth. The task of articulating contents and skills across the academic ladder is generally assumed by curriculum developers. The information generated by the tests were confined to mere numerical and descriptive reports about what a student's strengths and weaknesses are in the academic subject and how the student's performance compares with those of other students. Thus, instead of connecting performance progressively across time, scores were interpreted discretely.

In 2004, we began to redesign our subject area achievement tests as developmental assessment instruments. Current efforts to improve the design of our tests follow from the recommendations of the National Council Research 2001 Report and the Developmental Assessment Program of the Australian Council for Educational Research. As Tognolini (2004) pointed out:

> ...the key feature of the [developmental] model of assessment is that the student's progress or growth in the subject is monitored, in much the same way as a child's physical growth is monitored, along a linear continuum that is referred to as a developmental continuum.

Thus, to make tests more informative and useful, they should not be based solely on a hierarchical array of items measuring various levels of difficulty. Conceptually, the tests should be tied to cognition and learning models, enabling them to "yield richer inferences about student knowledge" (NRC, 2001).

The developmental assessment approach is based on the notion that one's competence in an area of learning improves over time. It requires the use of a progress map of learning outcomes as basis for monitoring student progress. This map presents a detailed description of the learning competencies and skills arranged in the order by which they normally develop as the learner moves within one grade level and on to the next level. Progress is measured in terms of the degree of mastery of skills and the subsequent attainment of higher levels of performance (NRC, 2001).

This paper describes the first major step taken by CEM toward redesigning its current Mathematics Diagnostic Tests as developmental assessment instruments—the creation of a progress map in elementary mathematics. The succeeding steps (which will be the topic of another paper) include [1] the validation of the progress map, [2] the restructuring of the map based on validation results, and [3] the establishment of performance standards.

The CEM Elementary Mathematics Diagnostic Tests

The Mathematics tests for Grades 1 to 6 are designed to measure the strengths and weaknesses of students in Mathematics across the six grade levels. The tests cover content areas included in the BEC and the items are classified according to the specific learning competencies and major content areas they measure. (See Appendix for a description of the development of the test.)

Developing the Progress Map

The progress map was drawn from a synthesis of logical connections among the contents and skills found in the various learning areas covered by the existing CEM mathematics tests. The competencies measured were based on the national core curriculum–the 2002 Basic Education Curriculum–with the inclusion of some learning competencies not part of the core but found to be commonly taken up by a surveyed sample of private schools. The survey had to be done because the implementation of the BEC is optional for private schools.

The test specifications for the elementary mathematics tests served as the basis for the content areas and learning competencies that were included in the progress map. The test specifications were shown to a mathematics curriculum expert for review. The expert was asked to [1] make an aligned presentation of the Mathematics Diagnostic Test sequential skills from Grades 1 to 6 and [2] map and establish the interconnections between and among the different content areas based on the critical skills, vertically (within a particular grade level) and horizontally (across all the grade levels). The resulting map was then shown to other mathematics experts for initial validation.

The interrelationship of the content areas and specific learning competencies presented in the map would help teachers and, consequently, the students to experience and to view Mathematics as a cohesive whole.

The mastery of prerequisite skills at a certain level prepares the learner to cope with the demands of more difficult concepts and applications in the succeeding level. As one progresses through the learning experiences of higher levels, more opportunities become available for mastering increasingly more complex concepts and competencies and for optimizing the development of higher thinking skills, including analysis, synthesis, problem solving, and decision making.

This paper illustrates the progress map for the teaching and learning of *Fractions*. Over time, the concept of fractions proved to be one of the most difficult learning area for elementary students. True understanding of this area is essential towards having a more realistic perspective of what is encountered daily in life — that there is always an element of "sharing" (for instance, no one is served a whole [uncut] pizza nor is anyone served and expected to finish a whole pot of soup).

Figure 1 shows a portion of the progress map for elementary mathematics. It presents the vertical and horizontal interconnections of some of the learning competencies under the area of Fractions. To facilitate identification, the learning competencies were coded (1A to 6D). The letters represent the specific learning competencies, while the code numbers stand for the grade level under which the competency is found. Figure 2 shows some sample items that measure competencies from 1A to 3C.

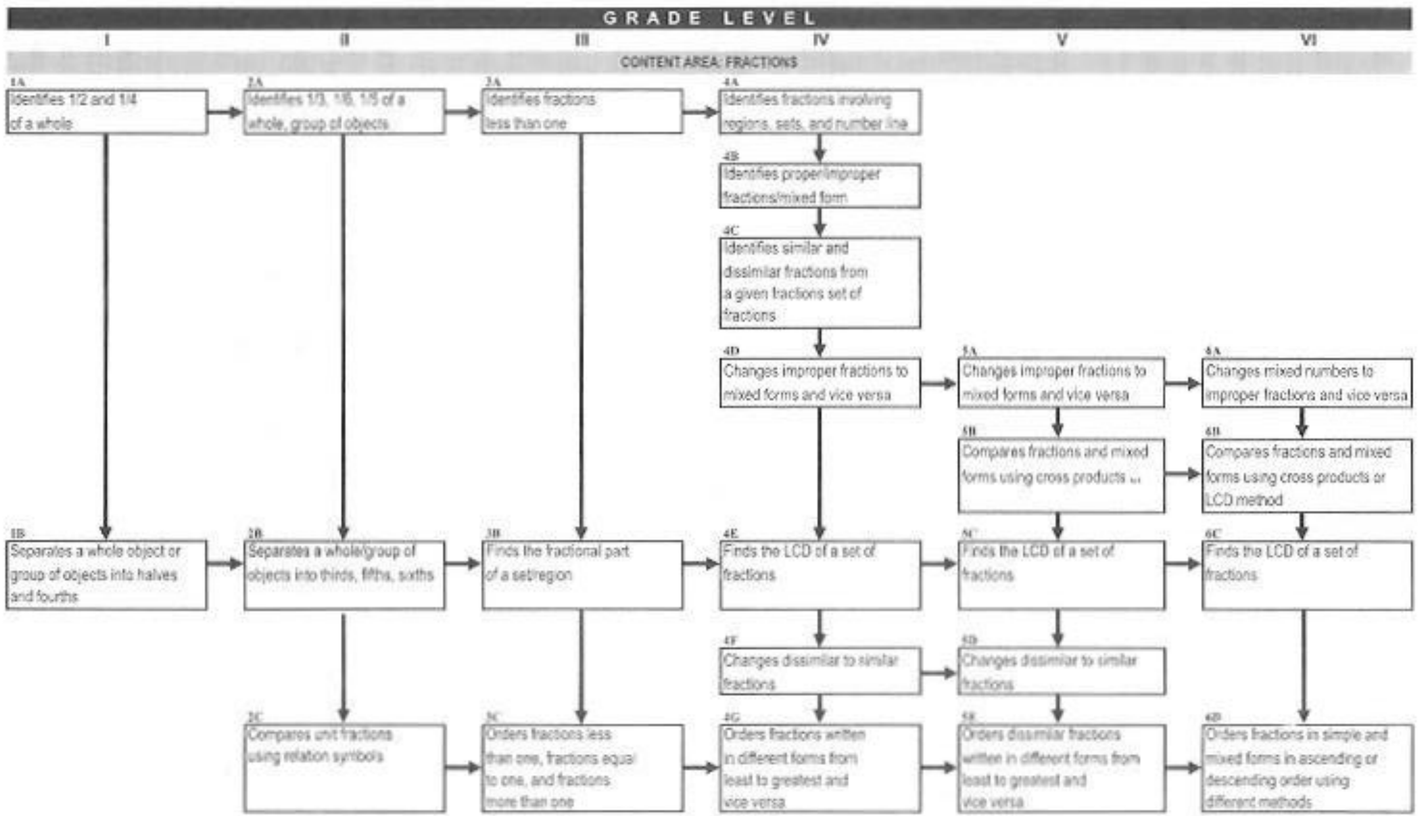

Figure 1. Progress Map on Fractions

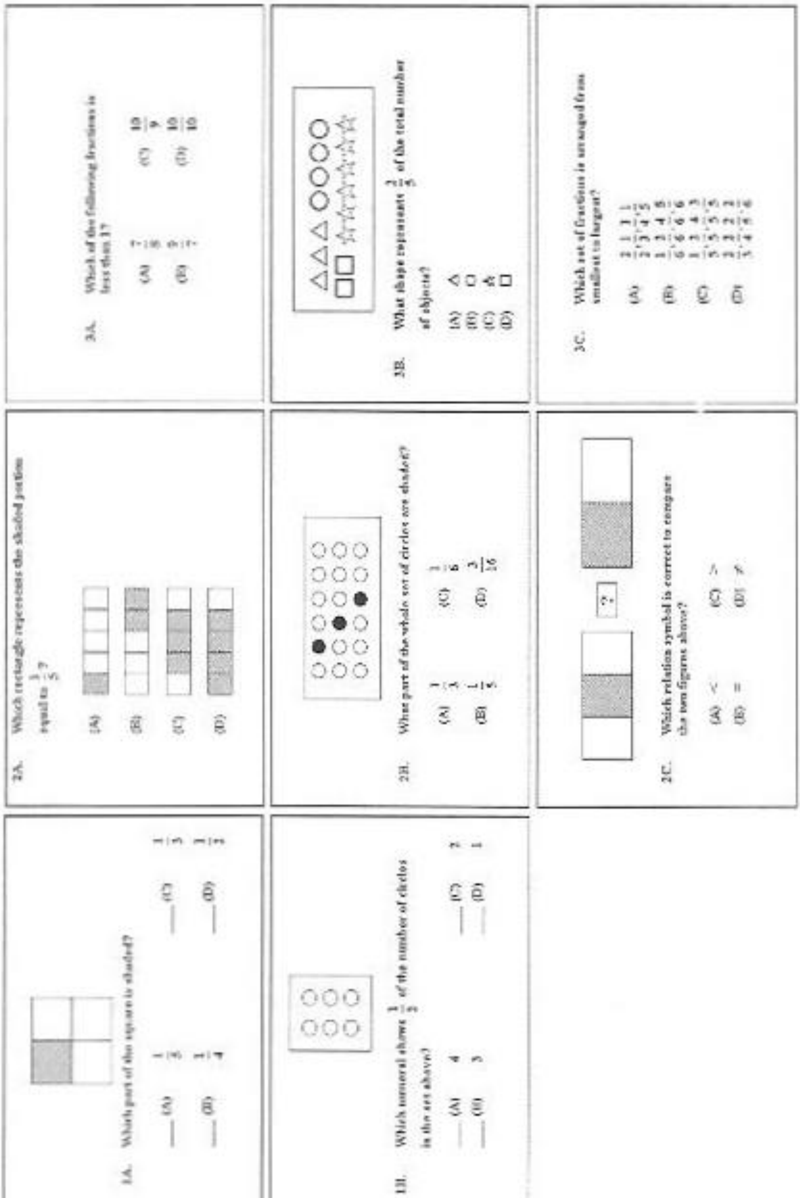

Figure 2. Sample Items for Fractions

An illustration of the development of the lesson on comparing and ordering fractions within the grade level and across grade levels from grade 2 to grade 6 is shown as follows:

Grade 2 – Lesson: Compares Unit Fractions Using Relation Symbols (*referring to 2D*)

The development of this lesson starts with the use of cutouts of circular or rectangular cardboards (*referring to 2A*). The cardboard is partitioned into 3 equal parts with one part (1/3) marked or shaded. Another cardboard of the same size and shape as the first one is partitioned into 6 parts with one part (1/6) shaded or marked. A third cardboard of the same kind as the first two is cut into 5 equal parts with one part (1/5) also marked or shaded. These three unit fractions add up to their first collection of fractions they learned in grade 1, namely 1/2 and 1/4 (*referring to 1A and 1B*). If the first set of cutouts is taken from a circular region, then the same fractions can be shown using, this time, a rectangular region and then a square region. The lesson progresses through the use of a model like a bamboo stick showing 1/3 of it, 1/6 of it, and 1/5 of it. The use of a set of objects (*referring to 2B*), say 30 marbles grouped into 10's (1/3 of the set), grouped into 5's (1/6 of the set), and grouped into 6's (1/5 of the set).

The pupils should be guided in comparing the fractions using the cutouts. The cutouts showing 1/3, 1/6, and 1/5 of the same circular region can be put side by side. The learners can clearly see that the 1/3 piece is bigger in size than the 1/5 piece which in turn is bigger than the 1/6 piece. The same pattern is observed when the learners compare the fractional pieces using the cutouts from the rectangular and square regions. It is even clearer when the children work on three sticks of the same length. They can notice that 1/3 of the first stick is longer than 1/5 of the second stick which in turn is longer than 1/6 of the last stick. In the use of sets, the learners employ counting. A set of 30 marbles shows 10 marbles for 1/3 of the set, 6 marbles for 1/5 of the set, and 5 marbles for 1/6 of the set. Seeing that $10 > 6 > 5$, it is easy to say that $1/3 > 1/5 > 1/6$. The comparison may include the fractions 1/2 and 1/4, which are taught in grade 1.

Grade 3 – Lesson: Orders Fractions Less than One, Equal to One, and Greater than One ***(referring to 3C)***

It is already clear for the grade 3 learners that the fractions they learned in grades 1 and 2 were just parts of a whole. Hence, 1/3 piece/cutout from a whole (1) indicates that $1/3 < 1$. This should be supported with an illustration or model by putting 1/3 piece of a region and 1 whole piece of the same kind of region (*referring to 3A*). To put emphasis on this concept, use cutouts to compare 1/6 and 1 whole, 1/5 and 1 whole, 1/2 and 1 whole, and 1/4 and 1 whole. Once the concept is already clear, other fractional parts can be taken, like 2/3, 3/4, 2/5, 5/6, and other denominators (*referring to 3B*). Other fractional values may now be introduced like shading all the parts of a whole cut into 3 parts, 5 parts or 6 parts to indicate that the fractions 3/3, 5/5, and 6/6 are equal to 1. Use of realistic approach should now be introduced, like cutting 2 apple pies of the same kind/size into 6 pieces each for a total of 12 pieces in all. If 7 pieces are taken, this indicates the fraction 7/6 wherein 1 whole pie is taken and 1 slice from the second pie is taken for a total of 1 and 1/6. The learners can see that this fraction is greater than 1 (*still referring to 3B*).

Comparison of fractions less than 1, equal to 1, and greater than 1 can be easily understood using the cutouts (*referring to 3C*). Comparing fractions with denominator 6 can be easy for the learners if they work on cutouts of 1/6, 2/6, 3/6, 4/6, and 5/6. From these cutouts, they can see that the 1/6 piece is smaller than the 2/6 piece, the 2/6 piece is smaller than the 3/6 piece, and so on until 6/6, 7/6, 8/6, etc. Fractions of other denominators should also be presented. Since they can already compare unit fractions, they are ready to compare other fractions from different denominators.

Grade 4 – Lesson: Orders Fraction Written in Different Forms from Least to Greatest and vice versa ***(referring to 4G)***

A thorough review of lessons in the previous grade is necessary to check learners' level of mastery (*referring to 4A*). The cutouts used in the previous grade can be used again to introduce the terms proper fraction, improper fraction, and mixed form and to use the concept to generate more proper, improper, and mixed fractions (*referring to 4B*). From these cutouts, learners should be able to associate that proper fractions have numerators less than the denominators (2/6), improper fractions have numerators equal to or greater than the denominators (7/3), and mixed fractions have a whole number and a fraction (2 1/5). The same cutouts can be used to group fractions that are similar and dissimilar. Since the learners can distinguish 1/2 from 1/3 as dissimilar, they should be able to associate 1/2 with 3/6 and 1/3 with 2/6. From this, the dissimilar fractions 1/2 and 1/3 are now made similar using 3/6 and 2/6. Other unit fractions can be done/introduced similarly (*referring to 4C*).

There is a need to practice the learners in determining cutouts of the same size like 1/3 which is as big as 2/6, 1/2 being as big as 2/4 or 3/6, 3/4 being as big as 6/8, and so on. The comparison that the learners do on the cutouts should be the basis for ordering the fractions in order of magnitude, i.e. least to greatest and greatest to least (*referring to 4G*).

After a thorough exposure to cut outs, passing the concrete and semi-concrete stage, and with a deeper understanding of similar and dissimilar fractions (*referring to 4C*), the learners are now ready to tackle changing dissimilar to similar fractions by finding the LCD of a set of fractions (*referring to 4E*). The LCD of two or more fractions is the least common multiple of the denominators. Such is used to transform dissimilar to similar fractions (*referring to 4F*). At this stage, the learners should be guided in using the basic division and multiplication processes, i.e. when dissimilar fractions like 2/3 and 3/5 are changed to similar fractions, the learners will use 15 as the LCD and this will be divided by the denominator 3 and the quotient will then be multiplied by 2 resulting to 10/15. Hence, using the same method, 3/5 will be transformed to 9/15. With this multi-step process, the learners will visualize then that 2/3 and 3/5 are the same as 10/15 and 9/15. This leads the learners to order fractions written in different forms from least to greatest and vice versa (*referring to 4G*). Hence, the pupils will arrange the given set of fractions in this order: 3/5, 2/3, as the correct sequence.

Grade 5 – Lesson: Orders Dissimilar Fractions Written in Different Forms from Least to Greatest and vice versa (*referring to 5E*)

After a certain phase of development and acquisition of basic skills namely: identifying fractions involving regions and sets (*referring to 4A*), and identifying the different kinds of fraction (*referring to 4B and C*), the learners are ready to tackle bigger numbers and different forms of fractions. This requirement is essential in enhancing the learners' skills in changing improper fraction to mixed numbers and vice versa (*referring to 5A*). This too, is important in comparing fractions and mixed numbers by using the cross product method (*referring to 5B*).

Comparison of fractions, say 4/6 and 3/7, can be best attained by employing the cross product method. With this step, one numerator of a fraction and one denominator of another fraction are multiplied, specifically, 4 and 7 and 3 and 6 are paired off to get the cross product. Hence, 4 and 7 gives a product of 28, while 3 and 6, is 18. Since 28 (as placed on top of 4/6 as part of the step in cross multiplication) is bigger than

18 (also placed on top of 3/7), therefore the learners will say that 4/6 > 3/7. This method can also be enhanced by finding and applying the LCD of two or more fractions (*referring to 4E as a review and to 5C as reinforcement*).

This particular lesson or skill requires a thorough review of a similar lesson given previously in grade 4. Gradually, dissimilar fractions involving denominators with 1 or 2 digits, i.e. 5 /6, 2/9, 3/11, 7/10, 5/13, and the like, may now be used to demonstrate how dissimilar fractions vary in shapes (referring to semi-concrete stage). Requisite to this process is the extensive recall of the concept of least common multiple which is essential in finding the least common denominator of two or more fractions (*referring to 5C*). At this stage, the learners are well equipped with the basic concepts of number theory wherein the crucial concept of LCM is enhanced.

With the initial background in changing dissimilar to similar fractions obtained from Grade 4 (*referring to 4F*), the learners are now ready to explore finding the LCD with at least a 2-digit denominator. A smooth take off in finding the LCD of a set of fractions is intensively relevant to changing dissimilar to similar fractions (*referring to 5D*). Through this, the learners will have a clear idea on how to transform fractions like 1/6, 4/15, 2/3, and 7/30 to similar fractions. By procedure, the learners will find the LCM of 6, 15, 3, and 30 which is actually 30. 30 serves now as the least common denominator or the LCD. Through a step-by-step procedure, the learners will divide 30 by the denominator 6 of the first fraction, and its quotient, which is 5, will be multiplied by the numerator 1, being the numerator of the first fraction. This gives an equivalent result of 5/30 [1/6 = 5/30]. Further transforming the remaining fractions by using the same steps would yield 8/30, 20/30, 7/30. Hence, when 1/6, 4/15, 2/3, and 7/30 are arranged from least to greatest, this will translate to 1/6, 7/30, 4/15, and 2/3.With a clear execution of each step based on the example provided, the learners will eventually apply the easiest step to arrange dissimilar fractions from greatest to least or vice versa (*referring to 5E*) with ease and self-fulfillment.

Grade 6 – Lesson: Orders Fractions in Simple and Mixed Forms in Ascending and Descending Order Using Different Methods (*referring to 6D*)

Developmental review of the past lesson is necessary since the lesson is an extension and at the same time expansion of related skills taken in grade 5. To make it challenging for the more mature learners, preparation of a good variety of fractions needs to be done to make the activity more challenging and more interesting. Variation of activities from simple to complex is a must for a group of dynamic learners having different needs, interest, and motivation.

After a through assessment on the basic concepts of the different kinds of fractions including the skill in converting mixed numbers to improper fractions and vice versa (*referring to 6A*), the learners are expected to manifest mastery in comparing fractions (*referring to 6B*). This particular skill must be properly mastered prior to acquiring the skill in finding the LCD, which has been intensively introduced in Grades 4 and 5. Both are important and necessary to order fractions in simple and mixed forms in ascending or descending order using different methods (*referring to 6D*).

The same procedures used in the previous level will be employed in ordering fractions using different kinds and forms. The main focus in this level is for the learners to acquire proficiency in arranging different fractions in sequential order.

Proposed Validation of the Progress Map

A longitudinal study of Grades 1 to 6 students, using the CEM Mathematics Diagnostic Test results, will be undertaken to verify the sequential development of skills within a particular grade level and across grade levels as described in the progress map. Item responses may be analyzed to determine patterns or trends in the acquisition of skills. Interviews of students and teachers may be conducted to establish confirmatory evidence. Students may be probed on their understanding of concepts and solutions to problems. The teachers may contribute their actual classroom observations on how their students' learning of the subject matches the theoretical framework of the progress map.

For the next three years, we have concrete plans to extend the study to secondary level mathematics as well as to other academic subjects in order to complete the series for the basic education curriculum progress maps. A related three-year study on non-cognitive factors that affect mathematics learning is now in progress, where we hope the results could help us explain some of our initial findings from the largely cognitive-based research we have started.

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Mrs. Ma. Angeles A. Sampang works under the Achievement/Diagnostic Tests Unit of the CEM Test Development Division which currently maintains over 50 diagnostic tests in the four core subject areas of English, Mathematics, Science, and Filipino. She is currently the Unit Head and has been in service for over 27 years. She holds a Master of Science degree in Educational Measurement and Evaluation which she acquired from the De La Salle University-Manila.

Mr. Jason V. Moseros also works in the Achievement/Diagnostic Test Unit under the supervision of Mrs. Sampang. He holds the position Test Development Assistant IV and has been with CEM for more than 5 years.

APPENDIX

Development of the Mathematics Test

The development of the mathematics test starts with the preparation of the test specifications which delimits the achievement area and the behavioral objectives to be tested, the number of questions to be included, and the types of items to be used for each level. These specifications are aligned with the 2002 Basic Education Curriculum of the country's education department. CEM works with subject area experts to review various syllabi, textbooks, and the current curriculum for scope and sequence. After thoroughly discussing the test specifications with the consultant(s), CEM contacts other subject area experts to write test items based on the final specifications.

The consultants who prepare the test specifications for a particular grade level also act as reviewers of the items for the same grade level, and revise them if necessary. The test items are evaluated in terms of format, matching with the specific learning competencies, accuracy, and appropriateness.

Two to three equivalent forms for each grade level measuring the same skill and ability are assembled. These forms are then pretested to determine the appropriateness of the test items for the intended grade level, the statistical characteristics of each item, the clarity of directions and the adequacy of the time allotments.

Pretest results are used in determining acceptability of the items—through the process of item analysis. Items are evaluated based on their statistical characteristics, such as level of difficulty, level of discrimination, and effectiveness of distracters. Test items with good statistical characteristics are accepted and selected for the final form. Item selection for the final copy of the test is guided by the test specifications to assure balanced coverage of the contents and skills to be measured. The final form is then administered to a sample of schools. The data from this administration is used for establishing norms and in determining test reliability and validity.

Development of Norms

A sampling scheme was used in the selection of the norm groups of the Grades 1 to 6 Mathematics Tests. Schools in the country were classified into high, middle, and low categories based on their performances in previous nationally administered tests. Schools were then selected in order to get the desired representative sample across the three major islands in the country—Luzon, Visayas, and Mindanao. The resulting norm group had a performance profile which approximated a normal distribution: 68% for the middle group and 16 % for both high and low groups, with the school as the basic sampling unit.

During the last two months of school year 2004-2005, the Elementary Mathematics Tests for grades 1 to 6 were administered to representative samples of grades 1 to 6 students from 20 participating elementary schools. The selected samples for norming across the different grade levels had equal proportions of male and female examinees.

Table 1 presents the distribution of the norm sample according to geographic location. Though each grade level test was administered to the same number of schools, the number of examinees varied across the grade levels—with Grade 1 (N = 1,192) having the most number of examinees, closely followed by Grade 2 (N = 1,186), Grade 5 (N = 1,177), and Grade 4 (N = 1,168). Grades 3 and 6 had the least number of examinees with 1,105 and 1,018, respectively. With regard to geographic representation, the Luzon area, in all grade levels, had the greatest number of examinees while the Visayas area had the least.

Table 1
Percentage of the Elementary Mathematics Tests Norm Groups According to Geographic Location

	Norm Groups					
Location	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
Luzon	46%	46%	49%	50%	50%	41%
Visayas	20%	21%	21%	19%	21%	24%
Mindanao	33%	33%	30%	31%	29%	35%

Test Scores

The Center for Educational Measurement's (CEM) Mathematics Achievement/Diagnostic Tests give both criterion-referenced and norm-referenced information. The criterion-referenced scores generate information on the strengths of students in specific content areas (e.g. Whole Numbers, Fractions, Decimals, etc.) and cognitive skills (e.g. Knowledge, Computation, Comprehension, and Application). The norm-referenced scores, on the other hand, yield information on the comparison of a student or a school's performance with the norm group's performance on the same tests. The scores for each area and skill are expressed in percent correct, while the score on the whole test, called the overall score, is expressed in percent correct, standard score, percentile rank, and quality index.

PUBLICATION GUIDELINES

The Center for Educational Measurement, Inc. (CEM) has always recognized the efforts undertaken individually or collectively by the teachers, principals, or guidance counselors, particularly in the areas of educational measurement, assessment, and evaluation.

It is the intent of CEM to support these efforts by inviting schools to submit articles or research papers to our official publications, the *Philippine Journal of Educational Measurement* (PJEM) and *The CEM Standard.* However, to facilitate publication of papers in printed form, we request the authors to adhere to the guidelines detailed below.

A. The Philippine Journal of Educational Measurement

Description

The *Philippine Journal of Educational Measurement* (PJEM), a refereed journal, is published annually by the Center for Educational Measurement, Inc. The journal aims to contribute to a better understanding of the system of measurement in the field of education across all levels—basic to higher education—in the Philippines. As such, the journal contains empirical and nonempirical reports such as theoretical studies; research studies; evaluation studies; specialized reviews; essays; reflective inquiry; critical book reviews; commentaries related to educational testing, measurement, assessment, and evaluation; and research on substantive, innovative, and methodological issues.

Article Content

The PJEM welcomes contributions from teachers, researchers, measurement theorists, school administrators, policy-makers, and other key stakeholders across all levels. All articles are accepted on the basis that they are original materials, have not been previously published, and are not currently under consideration for publication elsewhere. Articles may fall into the following categories:

1. *Theoretical Studies*. These are studies concerned with the development of theory in the analysis of measurement in order to enhance the understanding of measurement processes.

2. *Evaluation Studies*. These are studies that assess the extent of implementation and impact of a specific program or project and usually emphasize needs assessment and/or ongoing feedback to program implementers.

3. *Research Studies*. These are studies that typically use data derived from qualitative or quantitative methods or both, including but not limited to, experiments, case studies, surveys, philosophical investigations, and historical studies, to yield new information, to focus on specific projects or settings, or to synthesize emerging patterns.

4. *Specialized Reviews*. These are articles aimed at critically relating issues, comparisons, and analyses to the application of educational measurement and models in the educational process, but well founded in the existing literature. Reviews focused on research, theory, methodology, theme, theoretical contributions, critiques, and instructional techniques are accepted.

5. *Book Reviews*. These are articles critically evaluating the strengths and weaknesses of a book relevant to the scope of PJEM. Books reviewed must be within two (2) years of its publication date.

6. *Commentaries*. These are articles that critically analyze any of the following: (1) policy trends related to educational measurement, (2) relationship between research and evaluation, and (3) connections between research, policy, and practice.

7. *Critiques of Articles*. Constructive comments on articles previously published in PJEM are accepted. It is encouraged that these should stimulate discussions and present ideas or alternatives in print. Authors will be invited to respond to the critique made on their article before publication. When possible, the critique and the response will be published at the same time.

Preparation of Manuscripts

Authors are encouraged to prepare manuscripts following the Publication Manual of the American Psychological Association (APA) 5th edition. Manuscripts, including the Abstract and References, should be typed double-spaced on clean short 8½ by 11 inch white bond papers with a margin of one inch on all four sides, using 12-point Times New Roman font and justified to the left margins only. Page numbers should be placed at the center-bottom of the page. Notes, if applicable, are grouped in one section at the end of the article.

If the manuscript is based on a thesis or dissertation, a funded research project, or a paper presented at a conference (whether local or international), a footnote on the cover sheet should provide the relevant facts, including the thesis or dissertation adviser or the organization sponsoring the project or conference.

1. *Author Identification.* Since the review process is blind, the first page should indicate the title of the article, full name(s) of author(s), particulars of present position(s)/institutional affiliation(s), e-mail address(es), phone and fax number(s), and any information of special relevance. Identity of the author(s) should appear only on this page.

2. *Abstracts and Keywords.* All manuscripts must include abstracts of 120 words or less. An abstract is a complete, condensed summary of the article and not a description nor an introduction to the article. In addition, supply four to five keywords/phrases that characterize the content of the paper, which can be used for indexing purposes.

3. *Length of Articles.* Manuscripts for theoretical studies, evaluation studies, research studies, and specialized reviews should not exceed 50 pages. Book reviews, commentaries, and critiques of articles should not exceed five pages.

4. *Language.* Manuscripts written in English and Filipino are accepted. However, an English title should be submitted if the manuscript is written in Filipino.

5. *Tables.* Each table should be presented on separate pages and not in the body of the text. It should include a caption and presented in the order in which they appear in the text. As such, they should be given sequential Arabic numbers (i.e., Table 1, etc.), and should be in Microsoft Word (.doc) format. When preparing tables in Microsoft Word, be sure to use the table feature of the program. Furthermore, equations should be generated directly in the text file using the equation feature of Microsoft Word. Importing equations into the text file from a different word processing or graphic applications is discouraged.

6. *Figures.* Illustrations, such as diagrams, drawings, graphs, maps, and photographs, are considered as figures and should be designated as 'Figure 1,' 'Figure 2,' etc., and in sequential Arabic numbers. The text document should not contain the figures but

rather are submitted on separate pages at the end of the manuscript and should be in Tagged Image File Format (TIFF) at a minimum of 600 dpi resolutions. Figure captions should be typed on a separate page, not on the figures, and presented in the order in which they appear in the text.

Since authors know best what they want to show in a figure, they should crop their own figures, leaving only essential materials. If necessary, figures can be rotated 90 degrees and printed sideways. Photocopies of figures are not acceptable.

7. *References*. References cited in the text document must appear in the reference list at the end of the article. Authors must check that reference details are correct, complete, and in accord with the citations in the text. Authors are responsible for all information in their reference list. The Publication Manual of the American Psychological Association (APA) should be consulted in preparing the reference list. In particular, the use of its fifth edition is highly preferred.

Submission of Manuscripts

Interested contributors must submit the following: (1) one clear printed version of the manuscript, and (2) an electronic copy which may be sent as e-mail attachment to cemresearch@cem-inc.org.ph or on a CD-RW containing the appropriate files.

The electronic copy should follow the style guidelines indicated above (with appropriately placed notes on where to insert the tables and figures in the text). In particular, the following sections of the manuscripts should be submitted as separate files: (1) the title of the article and the abstract, (2) the main text, (3) tables, (4) figures, and (5) references. Appendices are not encouraged but may be allowed if considered necessary to facilitate understanding of the manuscript content. Moreover, authors should submit their figures and tables as camera-ready copies, using a laser-printed computer output, at the maximum dimensions given below.

	Dimensions (in cm)	
Paper Orientation	Width	Height
Portrait	6.75	9.00
Landscape	9.00	6.75

The minimum acceptable height for a letter or number in a camera-ready figure is about 3 mm or about 9 points. However, it is always better to use larger characters since the Editor may decide to reduce a figure.

Author(s) will be notified in case there is a problem with the electronic files. The printed version of the manuscript, CD-RW copy, and a cover letter should be addressed to:

The Research Division
Center for Educational Measurement, Inc.
24th Floor, Cityland Pasong Tamo Tower
2210 Chino Roces Avenue, Makati City

The Editor will acknowledge receipt of all contributions. The review process is greatly facilitated when manuscripts are submitted in the proper form.

Editorial Procedures

All manuscripts undergo preliminary screening by the Editorial Staff. They determine whether or not to reject the submission outright. If the manuscript fails to meet the Journal's technical and stylistic requirements, it is returned to the author for revision before forwarding it to at least two Editorial Consultants for their review. Since the review process is blind, articles sent for review are anonymous. Review is normally completed within three months of the submission, and a comment sheet is provided to facilitate the review. Reviewed manuscripts are generally returned to the authors with specific comments from the Editorial Consultants. Authors may be advised to resubmit their manuscripts to include editorial changes or to submit to an affiliate journal.

The Editor reserves the right to make editorial changes of nonsubstantive nature. Once the final version of the paper has been accepted, authors cannot make further changes to the text. Proofs will be sent to the author(s) if there is sufficient time to do so. These should be corrected and returned to the Editor within seven days to facilitate printing.

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Copies and Honoraria

Authors whose manuscripts are chosen for publication receive a modest honorarium after the article is printed. Additionally, authors receive two complimentary copies of the PJEM issue in which their article appears.

B. The CEM Standard

Description

The CEM Standard is a newsletter that aims to provide a forum for documentation of experiences and best practices at the school and classroom levels, which have direct application for teachers, guidance counselors, and school administrators. The newsletter also addresses issues, questions, and concerns about educational testing and assessment.

Article Content

Articles submitted in The CEM Standard may run from 15 to 50 pages and may fall into the following categories:

1. *Reflective Documentation.* These are narratives or documentation of experiences and/or best practices in the school setting, which reflect the assumptions, importance, and relationship of educational measurement in the teaching-learning process or in school administration.

2. *Essays.* These are short articles that discuss new knowledge or provide insight on the field of educational measurement.

Submission of Manuscripts and Editorial Procedures

The preparation, submission, and editorial procedures followed for processing and reviewing a manuscript submitted for consideration to The CEM Standard is essentially the same as for the PJEM. Thus, the review process may also take up to three months.

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