EUROPEAN ACADEMIC RESEARCH
Vol. II, Issue 3/ June 2014

Impact Factor: 3.1 (UIF)
DRJI Value: 5.9 (B+)

ISSN 2286-4822
www.euacademic.org

Establishing the Local Norms of the CEU-Lopez Critical Thinking Test

MARCOS Y. LOPEZ
ERLINA R. MENDOZA
Malolos Campus
Centro Escolar University-Philippines
ROSANA D. LUCERO
Mendiola Campus
Centro Escolar University-Philippines
ARLENE S. OPINA
Makati Campus
Centro Escolar University-Philippines

Abstract:

This study establishes the local norms of The CEU-Lopez Critical Thinking Test. A total of 2,800 students from the three campuses (Malolos, Mendiola, Makati) of Centro Escolar University (CEU) were chosen randomly as samples used to establish the local norms of the said test. Three types of local norms were constructed: university, year level, and program types (science and non-science). Percentile ranks along with Z-scores were computed from which the norms are most commonly computed. T-test of independent means and ANOVA were employed to determine if there is significant difference in the means of program type, high school type, gender, year levels, campus location, and socio-economic statuses (SES) as some factors to consider in constructing local norms. It is found that only program types and year levels have significant difference in their means. Hence, separate local norms were established for these two factors along with university norms. Six verbal interpretations were used for score interpretation, such as: unreflective thinker, challenged thinker, beginning thinker, practicing thinker, advanced thinker, and master thinker. These were based on the stages of critical thinking development formulated by Paul and Elder.

Key words: local norms; critical thinking; test; tertiary level

Introduction

The CEU-Lopez Critical Thinking Test (Lopez, 2012) is a multi-aspect general knowledge critical thinking test. It consists of 87 items which can be taken for about 90-minute period by students who belong to tertiary level regardless of courses and specializations they pursue. The said test consists of five dimensions: deduction, credibility judgment, observation report judgment, assumption .identification, induction, and meaning and fallacies. It is a multiple-choice type of test with three options for each item. There is one definite correct answer for every item. The topics included in the test do not call for any special knowledge of any particular discipline or school subject. The construct of the test was based on the theoretically funded conception of critical thinking of Ennis (1987, 1996, 2011a, 2011b) who defines critical thinking as reasonable reflective thinking focused on deciding what to believe or do. Ennis' theory of critical thinking consists of two main components, such as, abilities and dispositions. However, the test just focused on directly testing the abilities of critical thinking based on concept of Ennis.

The said test has not been normed yet; hence, for a start, local norms were established to determine how an individual CEU student ranks in comparison to his peers (Fry, 1974) when it comes to critical thinking. Local norms are often more appropriate than broad national norms in a number of testing purposes, such as comparison of a student's relative achievement in various subjects, the prediction of subsequent job performance or college achievement, or the measurement of a learner's progress over time (Anastasi, 1988). There are cases that it is desirable to compare students with local norms. If a target group of students markedly deviate from those in the published norms of a certain test on such characteristics as scholastic aptitude, educational experience, or cultural

background, comparison with a local group may be more meaningful. (Linn & Gronlund, 1995). Teachers as well as researchers may be more interested in determining how well a student ranks in comparison with other local students than in knowing the national comparison (Chew, Kesler, & Sudduth). Norms can be defined as percentiles or standard score conversions derived from a distribution of scores by an identified group of people. These score conversions enable one to make statements about an individual's performance in comparison to a particular group in which an individual is either a member or to a group in which one seeks membership (Elliott & Bretzing, 1980). The groups employed in the local norms are more narrowly defined than national norms (Anastasi, 1988). Thus, a certain school, college, or university may develop test norms for its own student population. In this study, the boundary for local includes the entire school system of Centro Escolar University (CEU) which pertains to three campuses: Malolos, Mendiola, and Makati. The utility value of establishing and using local norms of a test has been substantiated repeatedly in the test and research literature (Anastasi, 1988; Chew et al., 1984; Cronbach, 1984; Elliott & Bretzing, 1980; Fry, 1974; Linn & Gronlund, 1995; Lyman, 1998).

This study deals with establishing the local norms of *The CEU-Lopez Critical Thinking Test* with the following statement of purposes:

1. To determine the local norms of *The CEU-Lopez Critical thinking Test* in terms of:
    a. University norms
    b. Year level norms
    c. Science vs. non-science norms
2. To determine if some demographical characteristics are significant factors to consider to establish local norms for critical thinking, namely:
    a. Year level

b. Program type (science and non-science)
c. Campus location (Malolos, Mendiola, Makati)
d. High school type (private vs public)
e. Socio-economic status (SES)
f. Gender

3. To establish verbal description as score interpretation of test results

Methodology

As previously stated, this study deals with establishing the local norms of *The CEU-Lopez Critical Thinking Test*. Students from Centro Escolar University in three campuses were the target examinees. A total of 2,800 students from different year levels, ages, program types, courses, CEU campuses, high school types, socio-economic statuses (SES), and genders took the test.

Below is the frequency table of number of students for each year level. The samples were randomly chosen from all CEU campuses and courses they were enrolled in.

Table 1: Frequency of number of examinees for year levels

	Frequency	Percent
First Year	600	21.4
Second Year	600	21.4
Third Year	600	21.4
Fourth Year	600	21.4
Fifth Year	200	7.1
Sixth Year	200	7.1
Total	2,800	100

It is desirable to have scores for 200 or more students to construct local norms of certain test. Percentile ranks can be computed for a small group of students, but the results are more stable for larger groups. In larger school systems, it is not necessary to use all of the test scores. One-half or one-tenth or some other appropriate fraction can be used, making sure that

the portion used is selected randomly and that at least 200 scores are used for the construction of local norms (Chew et al., 1984). This is the basis used for the number of students chosen randomly to establish local norms of *The CEU-Lopez Critical Thinking Test*. A total of 2,800 students were randomly selected which comprised 13 percent of the total population of three CEU campuses.

Below are phases on how the study was conducted.

Phase 1: Test administration

The CEU-Lopez Critical Thinking Test was administered in the first semester of school year 2013-2014. The test administration started in the month of July and ended in October. All CEU campuses were represented. Students were chosen randomly from a total population of 22,289 students enrolled in the said semester in the three campuses of CEU.

The students took the test for about 90 minutes with pencil and scantron sheet being provided to them. Before answering the main part of the test, they were asked to answer some questions that have bearing on their profile regarding year level, age, course, program type, campus location, type of high school they graduated, socio-economic status, and gender.

For fear that they might not take the test seriously, the examiners told them that the results of the test would be considered one of the factors in determining their retention in their curricular program.

Phase 2: Checking of scantron and data recording

A total of 2,800 scantron sheets were machine scored. Microsoft excel was used to record the answers of the examinees for each item of the test as well as their individual profile like year level, age, program type, course, CEU campus, high school type, SES, and gender.

Phase 3: Data analysis

After checking the test, the results were subjected to Statistical Package for the Social Sciences (SPSS) version 20 to compute the local norms of the test along with the profile of the examinees. Z scores and percentile ranks were computed. T-test of independent means was computed to determine if there is significant difference in the means of program type (science and non-science), high school type (private and public), and gender (male and female). The analysis of variance (ANOVA) was computed to determine if there is significant difference in the means of year levels (first to sixth year), campus location (Malolos, Mendiola, and Makati), and self-estimated socio-economic statuses (low, middle, and high). Line graph was also used for clear presentation of difference in mean scores of factors computed through ANOVA.

To determine the SES level of the examinees, the proposed definition of middle-income class by Philippine National Statistical Coordination Board (NSCB) was adopted. Virola, Encarnacion, Balamban, Addawe, Viernes, and Pascasio (2010) said that for year 2010, middle-income class consists of families whose annual income ranges from Php 256,554 to Php 1,738,211. This means that an annual income lower than Phh 256,554 and higher than Php 1,738,211 is considered low-income class and high-income class, respectively. No definition was provided beyond 2010 regarding the annual income of a low, middle, and high-income class from NSCB. The then Secretary General of said agency was Dr. Romulo A. Virola, The said income range was the sole basis for examinees to determine for themselves if they belong to low, middle, or high income-class. Other socio-economic characteristics to determine further the socio-economic level of a Filipino family based on the NSCB like housing type and other properties were no longer considered.

Phase 4: Adaptation of stages of critical development as verbal interpretation of scores

The six stages of critical thinking development conceptualized by Paul & Elder (2001) were adapted. These said stages served as verbal interpretation of scores for future examinees who will take the test. These stages of critical thinking development are unreflective thinker, challenged thinker, beginning thinker, practicing thinker, advanced thinker, and master thinker.

Below is the description of the six stages of critical thinking development. The characteristics of the description are based on the critical thinking concept of Ennis (1987,1996, 2011a, 2011b) and the content of *The CEU-Lopez Critical Thinking Test.*

Characteristics of Unreflective Thinker (UT)

An unreflective thinker has no clear conception of what critical thinking entails. He could hardly determine if assumptions are justified and conclusions logically drawn. At this stage, the individual could hardly make sense of the arguments and propositions he encounters. He has no clear idea as regards criteria and principles that can be used in judging the credibility of sources, deductions, inductions, and definitions. By and large, this individual has no clear notion on the application of critical thinking principles and criteria in order to evaluate an argument or proposition he encounters. Hence, this individual has difficulty thinking reflectively in evaluating arguments and other propositions he may encounter.

Characteristics of Challenged Thinker (CT)

A challenged thinker becomes initially aware of questionable and illogically drawn assumptions and conclusions made. He begins to recognize that there are inferences that do not follow from the evidence. This is the stage in which an individual is becoming aware that there must have criteria and principles that one should use in evaluating the arguments or

propositions offered; however, he has vague idea on those critical thinking principles and criteria that can be applied in evaluation of arguments and other propositions he encounters. Hence, this individual is challenged to learn these principles and criteria of critical thinking that can be applied in evaluating arguments and other propositions encountered.

Characteristics of Beginning Thinker (BT)

A beginning thinker starts to evaluate the logic of arguments and propositions he encounters. He begins to identify unjustifiable conclusions and assumptions, misused words, and incredible statements in an argument or proposition although this individual is not able to identify the flaws in all arguments and propositions he may encounter. He begins to recognize not only that there are principles, criteria, or standards for the evaluation of arguments and propositions but also the need to apply them and begin using them deliberately in thinking. Since this is a beginning stage, he does it with difficulty and uncomfortability for this is the stage that an individual just begins learning how to deliberately and consciously apply critical thinking criteria and principles in evaluating arguments and other propositions encountered. Hence, prolonged engagement in argument evaluation is needed to do the argument evaluation with ease and comfortability. This is the stage that an individual has a beginning understanding of the necessary role of these critical thinking principles and criteria in evaluation of arguments and other propositions.

Characteristics of Practicing Thinker (PT)

A practicing thinker regularly and habitually recognizes that improvement in critical thinking requires constant practice in applying critical thinking criteria and principles. In this stage, one recognizes the need to adopt some regimen of practice in deducing and inducing an argument, judging credibility of sources, identifying assumptions, and judging definitions

encountered. He deliberately practices using explicit critical thinking criteria and principles in evaluating arguments and other propositions. He does this argument evaluation with certainty and comfortability especially with the application of not so sophisticated critical thinking criteria and principles. However, application of some highly sophisticated and complex critical thinking criteria and principles in evaluation of arguments and propositions is done with certain degree of difficulty, uneasiness, and uncertainty.

Characteristics of Advanced Thinker (AT)

An advanced thinker can systematically identify and clearly analyze the problems in an argument and routinely figure out the logic of arguments. He insightfully articulates the strengths and weaknesses in an argument. He applies clearly, logically, and explicitly the least and most sophisticated critical thinking criteria and principles in judging deduction, definition of terms, credibility of statements, induction, and identifying assumptions. He does these things with clarity, comfortability, and relative ease. However, mastery on how to evaluate arguments and propositions using critical thinking principles and criteria is not completely achieved yet for the application of critical thinking principles and criteria in evaluation of arguments is not applied at a consistently high level. This is the stage that an individual consciously and continually strives to reach mastery level in evaluating arguments and propositions he encounters.

Characteristics of Master Thinker (MT)

A master thinker has full grasp of critical thinking criteria and principles in judging all the arguments and propositions he encounters. This means that he deeply internalizes these critical thinking principles and criteria. Applying these critical thinking principles and criteria is intuitive and habitual to a master thinker. Master thinker consistently, effectively,

systematically, and insightfully critique the arguments and statements he encounters. He consistently and deliberately monitors his own arguments as well as other's arguments by using the said critical thinking criteria and principles. This individual has reached the level of knowing full well how to use consistently, deliberately, and accurately the critical thinking principles and criteria in evaluation of arguments and propositions. In sum, a master thinker applies with high-level of consistency, accuracy, clarity, precision, and ease the most as well as the least sophisticated and complex critical thinking criteria and principles in evaluating arguments and propositions.

Results of the Study

The tables and figures that show results of computed norms and other factors related to this study are presented below.

Table 2: University norms for total scores of the test

Range of Scores	Z-Scores	Range of Percentile Rank	Verbal Description
44 above	2.13 above	98.34 above	Master Thinker
37-43	1.081-1.981	85.99-97.61	Advanced Thinker
30-36	0.031-0.931	51.2-82.38	Practicing Thinker
24-29	(-)0.87-(-)0.12	19.22-45.22	Beginning Thinker
17-23	(-)1.92-(-)1.02	2.74-15.39	Challenged Thinker
11-16	(-)2.82-(-)2.07	(-)1-1.92	Unreflective Thinker

Table 2 shows the range of scores, z-scores, range of percentile rank, and verbal description of the university norms. As shown in table, a score of 44 and above can be considered master thinker and score between11-16 is considered unreflective thinker. The university norms are based on the raw scores of 2,800 examinees who belong to three campuses of CEU.

Table 3: University norms for each aspect of critical thinking

Aspects of CT	UT	CT	BT	PT	AT	MT	Mean	SD
Deduction	4-below	5-6	7-9	10-11	12-13	14 above	6.86	2.22
Credibility	0	1-2	3-4	5-9	10-12	13 above	6.49	2.57
Assumption	0-1	2-3	4-6	7-9	10-11	12 above	6.48	2.72
Induction	0-1	2-3	4-5	6-7	8-9	10 above	3.50	1.97
Meaning	0-1	2-4	5-6	7-8	9-11	12 above	6.49	2.33
Total score	16 below	17-23	24-29	30-36	37-43	44 above	29.79	6.67

Table 3 shows the range of scores for each aspect of critical thinking with verbal description for every range of scores. It shows that CEU students obtained the highest and lowest mean in deduction and induction items, respectively.

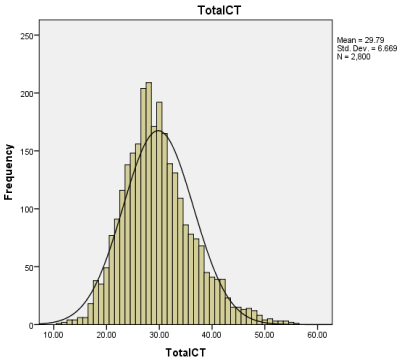

Figure 1: Normal curve for the total score of critical thinking of university norms

This figure presents the frequency of the number of students and their corresponding scores in the total items of the test. A total of 2,800 students is reflected in the figure with overall mean score of 29.79 out of 87 total items of the test with a corresponding verbal description of beginning thinker as indicated in table 2. The students are from all campuses of CEU (Malolos, Mendiola, Makati) representing all year levels and courses.

Year Level Norms

Table 4: Year 1-Beginning level norms for total scores of the test

Range of Scores	Z-Scores	Range of Percentile Rank	Verbal Description
38 above	2.005 and above	97.72 and above	Master Thinker
33-37	1.124-1.829	90.32-96.64	Advanced Thinker
27-32	0.067-0.948	52.79-82.89	Practicing Thinker
21-26	(-)0.814-(-)0.109	20.90-45.62	Beginning Thinker
16-20	(-)1.871-(-)1.167	3.07-12.10	Challenged Thinker
15 below	(-)2.752-(-)2.048	(-)1-2.02	Unreflective Thinker

Table 4 shows the local norms for year level 1 or beginning level. A score of 38 and above is considered master thinker and a score of 15 and below is considered unreflective thinker.

Table 5: Year level norms for first year for each aspect of critical thinking

Aspects of CT	UT	CT	BT	PT	AT	MT	Mean	SD
Deduction	1	2-4	5-6	7-8	9-10	11 above	6.18	2.131
Credibility	0	1-3	4-5	6-7	8-10	11 above	5.51	2.358
Assumption	0	1-3	4-5	6-8	9-10	11 above	5.76	2.561
Induction	0	1	2-3	4-5	6	7 above	3.29	1.732
Meaning	0-1	2-3	4-5	6-7	8-9	10 above	5.87	2.053
Total score	Below 15	16-20	21-26	27-32	33-37	38 above	26.62	5.675

Table 5 shows that CEU first year college students obtained the highest mean in deduction items with a mean score of 6.18 and lowest mean in induction with a mean score of 3.29.

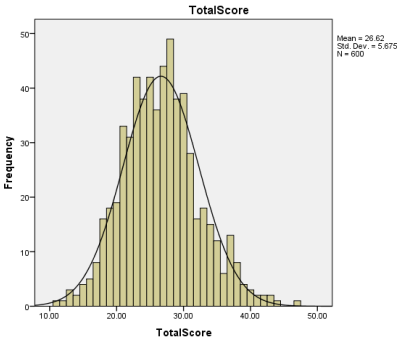

Figure 2: Normal curve for the total score of critical thinking for first year norms

This figure presents the frequency of the number of students who belong to beginning level and their corresponding scores in the total items of the test. A total of 600 first year students from all campuses and courses of CEU is reflected in the figure. The computed overall mean score for this year level is 26.62 out of 87 total items of the test with a corresponding verbal description of beginning thinker as indicated in table 4.

Table 6: Year levels 2 and 3-Intermediate level norms for total scores of the test

Range of Scores	Z-Scores	Range of Percentile Rank	Verbal Description
42 above	2.133 and above	98.34 and above	Master Thinker
36-41	1.125-1.965	87.08-97.72	Advanced Thinker
30-35	0.118-0.958	54.78-83.15	Practicing Thinker
24-29	(-)0.890-(-)0.050	18.67-48.01	Beginning Thinker
18-23	(-)1.898-(-)1.058	2.87-14.46	Challenged Thinker
12-17	(-)2.906-(-)2.066	(-)1-1.92	Unreflective Thinker

Table 6 shows the local norms for year levels 2 and 3 or what is called intermediate level. A score of 42 and above is considered master thinker and a range of scores between12-17 is considered unreflective thinker.

Table 7: Intermediate level norms for each aspect of critical thinking

Aspects of CT	UT	CT	BT	PT	AT	MT	Mean	SD
Deduction	1-2	3-4	5-6	7-9	10-11	12 above	6.88	2.178
Credibility	0-1	2-3	4-6	7-8	9-11	12 above	6.32	2.444
Assumption	0	1-3	4-6	7-8	9-11	12 above	6.32	2.644
Induction		0-1	2-3	4-5	6-7	8 above	3.42	1.915
Meaning	0-1	2-4	5-6	7-8	9-10	11 above	6.36	2.201
Total score	12-17	18-23	24-29	30-35	36-41	42 above	29.30	5.593

Table 7 shows that CEU students who belong to intermediate level obtained the highest mean score in deduction and lowest in induction with a mean score of 6.88 and 3.42, respectively.

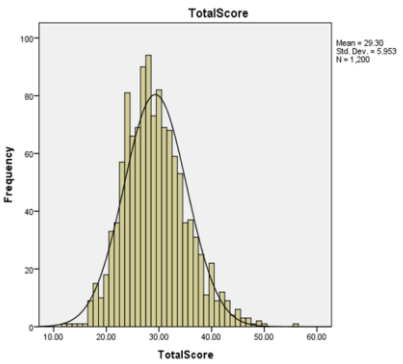

Figure 3: Normal curve of critical thinking for intermediate level norms

The figure presents the frequency of the number of students who belong to intermediate level and their corresponding scores in the total items of the test. A total of 1,200 students from all campuses and courses of CEU is reflected in this figure. The computed overall mean score for intermediate level is 29.30 out of 87 total items of the test with a corresponding verbal description of beginning thinker as indicated in table 6.

Table 8: Year levels 4, 5, and 6- Terminal level norms for total scores of the test

Range of Scores	Z-Scores	Range of Percentile Rank	Verbal Description
48 above	2.218 and above	98.68 and above	Master Thinker
40-47	1.090-2.077	86.21-98.12	Advanced Thinker
33-39	0.103-0.949	53.98-82.89	Practicing Thinker
26-32	(-)0.884-(-)0.038	18.94-48.40	Beginning Thinker
19-25	(-)1.871-(-)1.025	3.07-15.15	Challenged Thinker
Below 18	(-)2.576-(-)2.012	(-)1- 2.22	Unreflective Thinker

Table 8 shows the local norms for year levels 4, 5, and 6 or terminal level. A score of 48 and above is considered master thinker and a score of 18 and below can be considered unreflective thinker.

Table 9: Year level norms for graduating students for each aspect of critical thinking

Aspects of CT	UT	CT	BT	PT	AT	MT	Mean	SD
Deduction	0-2	3-4	5-7	8-9	10-11	12 above	7.18	2.246
Credibility	0-2	3-4	5-7	8-9	10-12	13 above	7.27	2.596
Assumption	0-1	2-4	5-7	8-9	10-12	13 above	7.12	2.748
Induction		0-1	2-3	4-5	6-8	9 above	3.72	2.142
Meaning	0-1	2-4	5-6	7-9	10-12	13 above	7.00	2.526
Total score	Below 18	19-25	26-32	33-39	40-47	48	32.27	7.092

Table 9 shows that graduating students of CEU got the highest mean score in credibility which is 7.27 and lowest in induction items with a mean score of 3.72. The credibility mean score is followed by deduction with a mean score of 7.18.

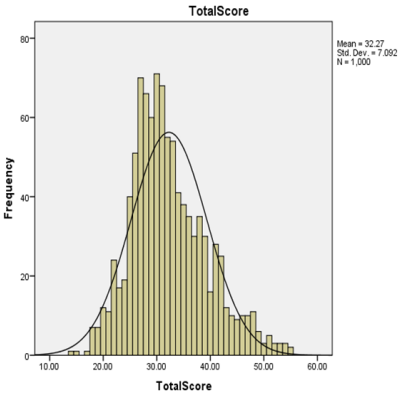

Figure 4: Normal curve of critical thinking for terminal level norms

This figure presents the frequency of the number of students who belong to terminal level and their corresponding scores in the total items of the test. A total of 1,000 students from all campuses and courses of CEU is reflected in the figure. The computed overall mean score for terminal level is 32.27 out of 87 total items of the test with a corresponding verbal description of beginning thinker as indicated in table 8.

Norms for Science vs. Non-Science

Table 10: Science norms for total scores of the test

Range of Scores	Z-Scores	Range of Percentile Rank	Verbal Description
45 above	2.140 and above	98.38 and above	Master Thinker
38-44	1.086- 1.989	86.21- 97.67	Advanced Thinker
31-37	0.032- 0.935	51.20- 82.64	Practicing thinker
25-30	(-)0.872- (-)0.119	19.22- 45.22	Beginning Thinker
18-24	(-)1.926- (-)1.022	2.68- 15.39	Challenged Thinker
17 below	(-)2.076	(-)1- 1.88	Unreflective Thinker

Table 10 shows the local norms for students who are enrolled in science-related courses in three CEU campuses in all year levels. A student that obtains a score of 45 and above is considered master thinker whereas a student who obtains a score of 17 and below is considered unreflective thinker.

Table 11: Science norms for each aspect of critical thinking

Aspects of CT	UT	CT	BT	PT	AT	MT	Mean	SD
Deduction	1-2	3-4	5-6	7-9	10-11	12 above	6.98	2.220
Credibility	0-1	2-4	5-6	7-9	10-11	12 above	6.72	2.522
Assumption	0-1	2-4	5-6	7-9	10-12	13 above	6.80	2.735
Induction		0-1	2-3	4-5	6-7	8 above	3.52	2.051
Meaning	0-2	3-4	5-6	7-9	10-11	12 above	6.78	2.314
Total	17 below	18-24	25-30	31-37	38-44	45 above	30.79	6.641

Table 11 above shows that CEU students who are enrolled in science-related courses obtained the highest mean score which is 6.98 in deduction items. Their lowest mean score among the aspect of critical thinking is induction which is 3.52.

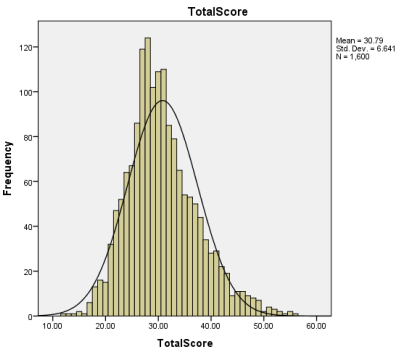

Figure 5: Normal curve of critical thinking for science norms

This figure presents the frequency of the number of students who belong to science-related courses and their scores in the total items of the test. A total of 1,600 students enrolled in the said courses from all CEU campuses and year levels is reflected in the figure. The computed overall mean score for this group is

30.79 out of 87 total items of the test with a corresponding verbal description of beginning thinker as indicated in table 10.

Table 12: Norms for non-science students

Range of Scores	Z-Scores	Range of Percentile Rank	Verbal Description
42 above	2.093 and above	98.17 and above	Master Thinker
35-41	1.012- 1.939	84.38- 97.38	Advanced Thinker
29-34	0.085- 0.857	53.59- 80.51	Practicing Thinker
22-28	(-)0.996- (-)0.070	15.87- 47.21	Beginning Thinker
16-21	(-)1.923- (-)1.151	2.74- 10.51	Challenged Thinker
Below 15	(-)2.696- (-)2.078	1.88	Unreflective Thinker

Table 12 shows the local norms for students who are enrolled in non-science related courses in three CEU campuses in all year levels. A student who obtains a score of 42 and above is considered master thinker and a student who obtains a score of 15 and below is considered unreflective thinker.

Table 13: Non-science norms for each aspect of critical thinking

Aspects of CT	UT	CT	BT	PT	AT	MT	Mean	SD
Deduction	1-2	3-4	5-6	7-8	9-11	12 above	6.64	2.211
Credibility	0	1-3	4-6	7-8	9-11	12 above	6.17	2.592
Assumption	0	1-3	4-6	7-8	9-11	12 above	6.07	2.648
Induction		0-1	2-3	4-5	6-7	8 above	3.47	1.856
Meaning	1	2-3	4-6	7-8	9-10	11 above	6.09	2.299
Total score	Below 15	16-21	22-28	29-34	35-41	42 above	28.45	6.473

Table 13 shows that CEU students who are enrolled in non-science related courses obtained the highest mean score of 6.64 in deduction aspect. They obtained the lowest mean score which is 3.47 in induction items.

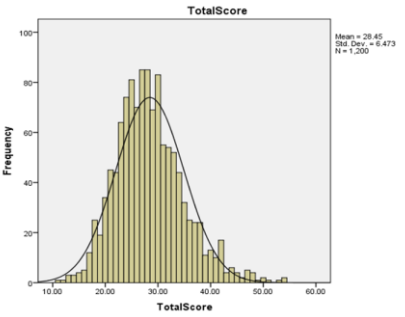

Figure 6: Normal curve of critical thinking for non-science

This figure presents the frequency of the number of students who belong to non-science-related courses and their corresponding scores in the total items of the test. A total of 1,200 students enrolled in the said courses from all CEU campuses and year levels is reflected in the figure. The computed overall mean score for this group is 28.45 out of 87 total items of the test with a corresponding verbal description of beginning thinker as indicated in table 12.

Table 14: Comparison of means among campuses

Campuses	N	Mean	Standard Deviation
Malolos	374	29.5802	6.48386
Mendiola	2021	29.8872	6.66386
Makati	405	29.4889	6.86597
Total	2800	29.7886	6.66937

Table 14 shows the three campuses of CEU, namely: Malolos, Mendiola, and Makati with total samples for each campus, means, and standard deviation. Mendiola campus has the highest mean which is 29.8872 followed by Malolos (29.5802) and Makati (29.4889), respectively.

Table 15: ANOVA for three CEU campuses

Source of variance	Sum of squares	Degrees of freedom	Mean square	F
Between groups	72.263	2	36.131	.812
Within groups	124428.572	2797	44.486	

Total	124500.834	2799		

F.05=2.99 F.01=4.60

Table 15 shows that there is no significant mean difference between groups and within groups of the three campuses of CEU. The computed F value is .812 which is lower than critical F values at .05 and .01 levels. This means that null hypothesis must be accepted.

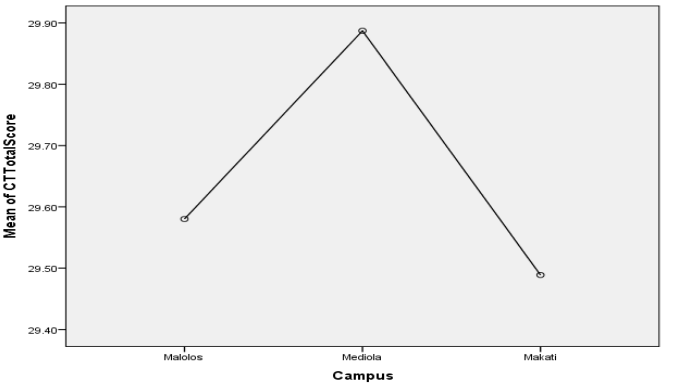

Figure 7: Means of three CEU campuses

Figure 7 shows the mean score of the three campuses of CEU.in which Mendiola campus has the highest mean score followed by Malolos and Makati campuses, respectively. However, their mean differences are not significant.

Table 16: Comparison of means according to SES

Socio-economic status	N	Mean	Standard deviation
Low	52	30.7500	6.79929
Middle	2,716	29.7865	6.66765
High	32	28.4063	6.55429
Total		29.7886	6.66937

Table 16 shows the socio-economic status of CEU students. It is classified into three levels, such as high, middle, and low. It also shows the total number of students who belong to certain SES level along with mean and standard deviation.

Table 17: ANOVA for SES

Source of variance	Sum of squares	Degrees of freedom	Mean square	F
Between groups	109.224	2	54.612	1.228
Within groups	124391.610	2797	44.473	
Total	124500.834	2799		

F.05=2.99 F.01=4.60

Table 17 shows that there is no significant difference between groups and within groups of students that belong to the three levels of socio-economic status. The computed F value is 1.228 which is lower than critical values of F at .05 and .01. This means, the null hypothesis must be accepted.

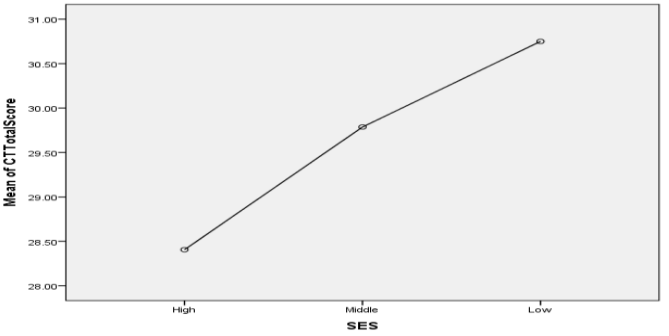

Figure 8: Means of low, middle, and high SES

The figure above shows the mean scores of the students who belong to different levels of socio-economic status. Students who belong to low socio-economic status have the highest mean score followed by middle and high socio-economic status, respectively.

Table 18: Comparison of means by year level

Year levels	N	Mean	Standard Deviation
First year	600	26.6183	5.67506
Second year	600	29.3283	5.46507
Third year	600	29.2800	6.40833
Fourth year	600	31.6950	7.24634
Fifth year	200	33.4300	6.94017
Sixth year	200	32.8450	6.59991
Total	2800	29.7886	6.66937

Table 18 shows the mean scores of different year levels along with the total number of students for every year level and standard deviation. Further, the table shows that mean score of fifth year is higher than that of sixth year. The same is true with second year and third year in which the mean score of the former is higher than that of the latter.

Table 19: ANOVA for year levels

Source of variance	Sum of squares	Degrees of freedom	Mean square	F
Between groups	13013.588	5		65.227
Within groups	111487.277	2794	2602.712	
Total	124500.843	2799	39.902	

F.05=2.99 F.01=4.60

Table 19 above shows that there is significant difference in mean scores between groups and within groups of students who belong to different year levels. The computed F value is 65.227 which is higher than critical values of F at .05 and .01. This means that null hypothesis must be rejected.

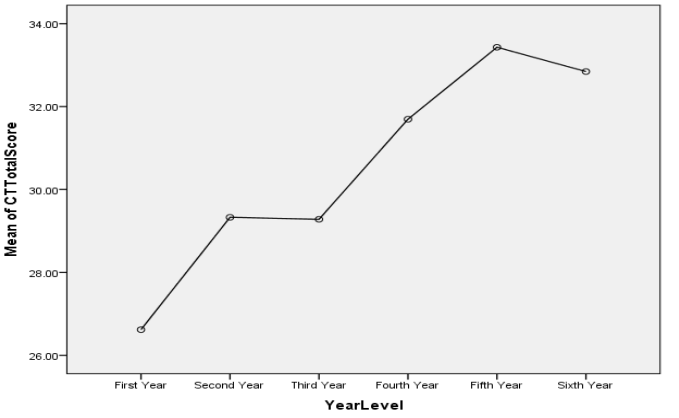

Figure 9: Mean scores of year levels for the total items of test

The line graph above shows the mean score of every year level regardless of campus and program types. It shows that first

year level having the lowest mean score and fifth and sixth year levels having the highest mean scores.

Table 20: Comparison of means between high school types

High school types	N	Mean	Standard deviation
Private	2511	29.7965	6.67340
Public	289	29.7197	6.64536

Table 20 shows the high school types where students of CEU completed their secondary education. High school types are classified into two: private and public. This also shows the mean scores and standard deviation.

Table 21: T- test for high school types

CT total score	t	df
Equal variances assumed	.185	2798

T.01=2.576

Table 21 shows that there is no significant difference regarding the mean scores between students who graduated from private school and students who graduated from public school. The computed T value is .185 which is lower than critical values of T at .01. This means that the null hypothesis must be accepted.

Table 22: Comparison of means between genders

Gender	N	Mean	Standard deviation
Male	778	29.3033	6.65286
Female	2022	29.9753	6.66795

Table 22 above shows the total number of students, mean scores, and standard deviation between male and female students of CEU.

Table 23: *T-test for genders*

	t	df
Deduction	-1.232	2798
Credibility	-.009	2798
Assumption	-5.633	2798

Induction	1.303	2798
Meaning	-.083	2798
Total score	-2.390	2798

T.01=2.576

Table 23 shows that there is no significant difference in the mean scores between male and female students. The computed T value in the total score is -2.392 which is lower than critical values of T at .01. This means that null hypothesis must be accepted. However, male and female students differ significantly in one aspect of critical thinking test which is assumption identification with a computed T value of -5.633 which is greater than critical values of T at .01.

Table 24: Comparison of means between program types

Program types	N	Mean	Standard deviation
Science program	1600	30.7894	6.64145
Non-science program	1200	28.4542	6.47259

Table 24 shows the two program types in which CEU students are enrolled. These program types are science and non-science. It also shows the mean scores of each program type as well as the total number of samples and standard deviation.

Table 25: T-test for program types

	t	df
CT total score	9.308	2798

T.01=2.576

Table 25 shows the computed t value which is 9.308 which is greater than the critical values of T at .01. This means that science and non-science programs have significant difference in their mean scores.

Discussion

This study deals with establishing the local norms of *The CEU-Lopez Critical Thinking Test.* Based on the analysis of data, three norms were established, namely: university, year level, and program type.

As presented in table 15, there is no significant difference in the mean scores between and among the three campuses (Malolos, Mendiola, and Makati) of CEU. The computed F value is .812 which is lower than critical values of F both at .05 (2.99) and .01(4.60) levels. This means that the null hypothesis that there is no significant difference between and among the means of the three campuses of CEU must be accepted. The computed mean scores for Malolos, Mendiola, and Makati were 29.5802, 29.8872, and 29.4889, respectively, with Mendiola having the highest mean followed by Malolos and Makati. The computed total mean score for the three campuses is 29.7886. This non-significance of mean scores of the three campuses as shown in table resulted in establishing a single norms for the entire system of CEU.

CEU Manila has the biggest number of samples for it is the campus that has the biggest number of enrolees (15,247) followed by Makati (4,218) and Malolos (2,824), respectively. A total of 2,800 students was randomly selected for norming samples which comprised 13 percent of the total population of CEU campuses.

As has been noted in table 19, there is a significant difference in the mean scores between and among year levels. This is based on the computed F value that is 65.227 which is higher than the critical values of F both at .05 (2.99) and .01 (4.60). This means that the null hypothesis that there is no significant difference between and among year levels must be rejected and alternative hypothesis that there is significant difference in mean scores between and among year levels must be accepted. The data showed that as year level goes higher, the

critical thinking of the students increases too. This resulted in formulating three norms for year levels, namely: beginning, intermediate, and terminal. The beginning level pertains to first year tertiary students, intermediate level for second and third year, and terminal for graduating students. There are courses that can be completed in four, five, and six years' time. Hence, the last three levels are fused as one and called as such. The computed total mean score for all year levels is 29.7886 or 29.79 which is reflected also in figure 1. The said mean score represents the average score of the entire CEU system in all year levels and student types.

It is interesting to note that difference in mean scores between fifth year (33.4300) and sixth year (32.8450) is not significant for their computed T value is 0.86 which is lower than critical values of T at .01 level. Similarly, mean score of second year (29.3283) is higher than that of third year (29.2800) but their difference is not also significant with a computed T value of 0.14 which is lower than critical value of T at .01 level. Hence, fifth year and sixth year are year levels considered with the highest mean scores among year levels. Since, mean scores between second year and third year levels have no significant difference, their local norms were combined as one which is labelled as intermediate level, a level between beginning and terminal. .

It can be assumed that age and year levels go together to a certain extent. As students reach higher levels in education and are getting older at the same time, their critical thinking increases.

As regards program type, CEU students are classified into science and non-science students. Students classified as science are enrolled in medical-related courses offered at CEU such as Pharmacy, Nursing, Medical Technology, Psychology, Dentistry, Biology, Nutrition and Dietetics, Cosmetic Science, and Optometry. The rest of the courses are classified as non-science such as Business Administration programs, Tourism

Management, Hotel and Restaurant Management, Mass Communication, Education, Accountancy, Social Work, Political Science, Information Technology, Computer Science, and Computer Engineering.

As was previously stated in table 24, the total mean scores for science and non-science are 30.7894 and 28.542, respectively. The computed T value is 9.308 which is greater than the critical values of T both at .05 (1.960) and .01 (2.576) levels. This means that the null hypothesis that there is no significant difference in mean scores between science and non-science must be rejected and alternative hypothesis must be accepted. This means that there is significant difference in mean scores between science and non-science. Hence, separate norms were established for both groups.

As regards other factors, high school types are classified into private school and public school. Table 21 shows that there is no significant difference in mean scores between private and public schools. The computed T value is .185 which is lower than critical values of T both at .05 (1.960) and .01 (2.576) levels. This means that the null hypothesis must be accepted. Thus, there were no norms established for high school types. Also, as shown in table 20, CEU students are predominantly graduates of private high schools.

Socio-economic status is classified into low, middle, and high with mean scores of 30.7500, 29.7865, and 28.4063 as shown in table 16. This is a self-estimated report of the examinees regarding the annual income of their family. As previously stated, other socio-economic factors such as types of housing and other properties were not taken into consideration. As shown in table 17, the computed F value for SES is 1.228 which is lower than critical values of F at .05 (2.99) and .01 (4.60) levels. This means that the null hypothesis which is there is no significant difference in mean scores between and among SES levels must be accepted. Hence, there were no norms established for each level of SES. Also, as presented in table 16,

CEU students predominantly belong to middle-income class of Philippine society.

In relation to the preceding paragraph, Ennis (2009) found that critical thinking has low positive correlations with socio-economic status which means that the higher the level of SES a group of individuals the better critical thinkers they are. But this statement of Ennis was not confirmed nor disconfirmed by this study for the mean scores of the three groups are not significantly different though the low SES has the highest mean score followed by middle and high.

Lastly, gender is classified as male and female. As shown in table 22, the mean scores for male and female are 29.3033 and 29.9753, respectively. The computed T value for gender is -2.390 which is lower than critical values of T at .01 (-2.576). This means that the null hypothesis that there is no significant difference in mean scores between genders must be accepted. Hence, there were no norms established for each gender. This is in accord with the research findings of Ennis (2009) that males and females are essentially equal in critical thinking ability, that there was no indication of superiority of one gender over the other. Though among less mature students, girls might have an edge. Further, Ennis (2009, p.89) stated that it is possible that girls are a bit more advanced in critical thinking in grades four to twelve, as they are in many mental activities, and that boys catch up in college and above. Also, as shown in the same table, female students outnumber male students.

The six stages of development of critical thinking by Paul and Elder (2001) were adapted as verbal interpretation for test scores. These stages are unreflective thinker, challenged thinker, beginning thinker, practicing thinker, advanced thinker, and master thinker, that is, the lowest stage being the unreflective thinker and the highest stage being the master thinker.

By and large, among the six factors that were looked into as factors to consider in constructing local norms, only mean scores of program types and year levels have significant difference. Consequently, two local norms for program types (science and non-science) and three local norms for year levels (beginning, intermediate, terminal) were constructed. Since there is no significant difference in mean scores between and among CEU campuses, only one local norms for the entire university system was established; that is, there are no separate norms constructed for every campus.

Conclusion

Based on the findings above, It can be concluded that geographical location of a school has no bearing on the critical thinking ability of CEU students. This is shown in the data that the mean scores of students in all CEU campuses do not have significant difference. Students who are enrolled in science-related courses are better critical thinkers than students enrolled in non-science students. Critical thinking ability of students increases as they get older or stay longer in school and as they progress in their academic year level. Thus, there is a positive correlation between year levels and critical thinking. In relation to the two preceding statements, it can also be concluded that the education provided by CEU enhances to a certain extent the critical thinking prowess of individuals for the longer students stay in CEU the higher their critical thinking becomes.

Moreover, the type of high school where students graduated from cannot be a significant factor or predictor to consider that students from certain secondary schools are better critical thinkers than those of the other secondary academic institutions. This is also the same with socio-economic status and gender in which they have no bearing on critical thinking ability of the tertiary students.

Noticeably, among the five dimensions of *The CEU-Lopez Critical Thinking Test,* induction has the lowest mean

score consistently in all classifications of local norms established for this study. Thus, it can be concluded that it is the dimension of the test that CEU students found the most difficult. Additionally, students seemingly found the test difficult for majority of them obtained a score much lower than 50 percent of the total number of test items which is 87.

Recommendation

Three local norms were established in this study: university, year level, and program types (science and non-science). It can be recommended that University norms can be used if CEU researchers and psychometricians want to determine how certain students rank in comparison with the whole population of CEU system regarding their critical thinking ability based on provided percentile ranks and verbal score interpretations.

As regards year level norms, researchers and psychometricians can use those norms if they want to determine how an individual student in a certain year level to which that individual belongs ranks in comparison with his/her peers when it comes to their critical thinking ability based on the provided percentile ranks and verbal score interpretations.

Concerning program type norms, *The CEU-Lopez Critical Thinking Test* can be used for CEU college admission test. The university can set a cut-off score as one of the admission requirements for incoming freshmen in enrolling in science-related courses. Hence, the provided science norms can be used by the CEU admission program office for ranges of scores and percentile ranks between science and non-science in five dimensions of the test are different from each other in which the former has higher range of scores than that of the latter.

The provided local norms of the test can be used by other educational institutions that have similar academic setup. It can also be recommended that other educational institutions

that are interested to use *The CEU-Lopez Critical Thinking Test* but have academic setup entirely different from CEU can establish their own norms for their institutional use, be it research or other academic and non-academic purposes.

Moreover, the test can be utilized for assessment purposes in determining the strengths and weaknesses of the tertiary students on critical thinking that can lead to the revision of the curriculum for general education and professional subjects. Also, it can be used as qualifying test for courses that require board examinations.

Finally, as an assessment instrument, the said test and its local norms could be utilized as basis for comparison between control group and experimental group in an experimental research. Thus, the test with its score interpretation can be used in an exploratory pre-test-post-test design, providing educated guesses about the effects of the infusion of critical thinking into a curriculum.

References

Chew, A.L., Kesler, B, & Sudduth, D.H. 1984. "A practical example of how to establish local norms." *The Reading Teacher* 38 (2): 160-163.

Cronbach, L.J. 1984. *Essentials of psychological testing*. 4th ed. New York, NY: Harper & Row Publishers, Inc.

Elliott, S.N., & Bretzing, B.H. 1980. "Using and updating local norms." *Psychology in the Schools* 17: 196-201.

Ennis, R.H. 1987. "A taxonomy of critical thinking dispositions and abilities." In *Teaching thinking skills*: *Theory and practice,* edited by J.B. Baron & R.J. Sternberg, 9-26. New York: W.H. Freeman.

Ennis, R.H. 1996. *Critical thinking*. Upper Saddle River, NJ: Prentice Hall.

Ennis, R.H. 2009. "Investigating and assessing multiple-choice critical thinking tests." In *Critical thinking education and assessment: Can higher order thinking be tested?,* ed. J. Sobocan and L. Groarke, 75-97. Canada: The University of Western Ontario.

Ennis. R.H. 2011a. "Critical thinking: Reflection and perspective Part I." *INQUIRY: Critical Thinking across the Disciplines* 26(1): 4-18.

Ennis, R.H. 2011b. "Critical thinking: Reflection and perspective Part II." *INQUIRY: Critical Thinking across the Disciplines* 26 (2): 5-19.

Facione, P., & Gittens, C.A. 2013. *Think critically*. Upper Saddle River, NJ: Pearson Education, Inc.

Fry, E. 1974. "It's easy to make local norms." *Journal of Reading* 18: 241-243.

Linn, R.L., & Gronlund, N.E. 1995. *Measurement and assessment in teaching*. 7th ed. Englewood Cliffs, NJ: Prentice Hall, Inc.

Lopez, M.Y. 2012. *The CEU-Lopez Critical Thinking Test.* Research and Evaluation Office, Centro Escolar University, Manila.

Lopez, M.Y. 2012. *The CEU-Lopez Critical Thinking Test Manual*. Research and Evaluation Office, Centro Escolar University, Manila.

Lopez, M.Y. & Asilo, M.V. 2012. *Development and validation of The CEU-Lopez Critical Thinking Test* (accepted for international publication)

Lyman, H.B. 1998. *Test scores and what they mean*. 6th ed. Englewood Cliffs, NJ: Prentice Hall.

Norris, S.P. & Ennis, R.H. 1989. *Evaluating critical thinking*. Pacific Grove, CA: Midwest Publications.

Virola, R.A., Encarnacion, J.O., Balamban, B.B., Addawe, M.B., Viernes, M., & Pascasio, M.C. 2010, October. "The Pinoy

middle-income class is shrinking: Its impact on income and expenditure patterns." Paper presented at the Eleventh National Convention on Statistics, EDSA Shangri-La Hotel, Manila. Papers retrieved from www.nscb.gov.ph/ncs/11thNCS/papers/invited%20papers/ips-08/01_Pinoy%20Mid-Income%20Class%20is%20Shrinking_Virola_et_al.pdf

Paul, R. & Elder, L. 2001. *Critical thinking: Tools for taking charge of your learning and your life*. Upper Saddle River, NJ: Prentice Hall.

MARCOS Y. LOPEZ holds a degree in Doctor of Philosophy in Linguistics from Philippine Normal University-Manila. He is an Associate Professor at Centro Escolar University-Malolos where he teaches Communication Skills and Literature to students of College of Management and Technology. His research interest is critical thinking in relation to English Language Teaching and Assessment.
Email: mylopez28@gmail.com

ERLINA R. MENDOZA is currently pursuing her Doctor of Philosophy in Mathematics Education at Centro Escolar University-Manila. She is an Assistant Professor at Centro Escolar University-Malolos where she teaches Algebra and Statistics to students of College of Education, Liberal Arts, and Science. Her research interest is learning assessment on numeracy.
Email: maroon751998@yahoo.com

ROSANA D. LUCERO has a Doctor of Philosophy in Southeast Asian Studies which she earned from Centro Escolar University-Manila. She teaches Communication Skills and Literature to tertiary students of said university. Her research interest is Literature in relation to History.
Email: rosanadlucero@yahoo.com

ARLENE S. OPINA holds a Doctor of Philosophy in Curriculum and Supervision from Centro Escolar University-Manila where is she is presently the Head of Department of International Languages. She is a certified trainer/reviewer in TESOL, ADEPT, and TOEFL. Her research interests include Blended/Online Learning, Critical Thinking, and Task-Based Language Teaching.
Email: arlene5162@yahoo.com