

## **Annex 1-2. Report on Standardized Tests on Critical Thinking**

We have selected two standardized tests to measure critical thinking among our students at INCAE Business School: the California Critical Thinking Skills Tests (CCTST) and California Critical Thinking Disposition Inventory Test (CCTDI).

They were administered for the first time to a group of 65 students at the Montefresco Campus in Managua on June 8<sup>th</sup>, 2009. All the students participating in these tests were first-year students. Since this group of students had just joined the program 3 months earlier, the results of these tests will be used as a (*before-the-program*) reference with which we will compare results of future tests given to students right before they leave our program.

### **Results of CCTST**

The CCTST is made of 34 multiple choice questions ranging in difficulty and complexity. According to Insight Assessment, the company that sells them, these items “broadly represent reasoning ability required to succeed in those educational and workplace settings skill in thoughtfully forming a judgment regarding what to believe or what to do is a prerequisite.” The tests are scored on five different scales: Analysis, Inference, Evaluation, Inductive Reasoning, and Total Critical Thinking Score. The following description of the scale is taken directly from the description of these scales available at the <http://www.insightassessment.com/Scales%20CCTST.html>.

The first three CCTST scales draw together the core skills identified in the expert consensus exposition of Critical Thinking articulated in *The APA Delphi Report*.

**Analysis** as used on the CCTST has a dual meaning. First it means "to comprehend and express the meaning or significance of a wide variety of experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures or criteria," which includes the sub skills of categorization, decoding significance, and clarifying meaning. Analysis on the CCTST also means "to identify the intended and actual inferential relationships among statements, questions, concepts, descriptions or other forms of representation intended to express beliefs, judgments, experiences, reasons, information or opinions," which includes the sub skills of examining ideas, detecting arguments, and analyzing arguments into their component elements.

**Evaluation** as used on the CCTST has a dual meaning. First it means "to assess the credibility of statements or other representations which are accounts or descriptions of a person's perception, experience, situation, judgment, belief or opinion; and to assess the logical strength of the actual or intended inferential relationships among statements, descriptions, questions, or other forms of representations," which includes the sub skills of assessing claims and assessing arguments. Evaluation on

the CCTST also means "to state the results of one's reasoning; to justify that reasoning in terms of the evidential, conceptual, methodological, criteriological and contextual considerations upon which one's results were based; and to present one's reasoning in the form of cogent arguments" which includes the sub skills of stating results, justifying procedures, and presenting arguments.

**Inference** as used on the CCTST means "to identify and secure elements needed to draw reasonable conclusions; to form conjectures and hypotheses, to consider relevant information and to educe the consequences flowing from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation," which includes the sub skills of querying evidence, conjecturing alternatives, and drawing conclusions.

Together, these three scales form a full representation of the core CT skills, understanding, of course, that the meta-cognitive skill of self-monitoring and self-correcting one's own thinking, while being exercised as one takes the CCTST, cannot be readily accessed apart from the operation of the other skills.

## **SCALES FOR INDUCTIVE AND DEDUCTIVE REASONING**

The two other sub tests on the CCTST follow the more traditional conceptualization of reasoning which divides the realm into inductive and deductive reasoning. It is worth noting that the labels "inductive" and "deductive" have become notoriously ambiguous as a result of important differences in what they denote in different disciplines. Concern about this ambiguity explains why the words "deduction" and "induction" appear nowhere in the CCTST items. Following the lead of contemporary logicians, the CCTST grounds its concept of the deductive vs. inductive distinction on the basis of the purported logical strength of the inference. In view of the continued use of this particular distinction, the CCTST offers these final two sub scales.

**Deductive Reasoning** as used in the CCTST sub scale means the assumed truth of the premises purportedly necessitates the truth of the conclusion. Not only do traditional syllogisms fall within this category, but algebraic, geometric, and set theoretical proofs in mathematics (including "mathematical induction") also represent paradigm examples of deductive reasoning. Instantiation of universalized propositions is deductive, as are inferences based such principles as transitivity, reflexivity and identity. For valid deductive arguments, it is not logically possible for the conclusion to be false and all the premises true.

**Inductive Reasoning** as used in the CCTST sub scale means an argument's conclusion is purportedly warranted, but not necessitated, by the assumed truth of its premises. Scientific confirmation and experimental disconfirmation are examples of inductive reasoning. The day to day inferences which lead us to infer that in familiar situations things are most likely to occur or to have been caused as we have come to expect are inductions. Statistical inferences are inductive even if the inference is the prediction of an extremely probable specific (rain today) based on general principles (meteorological laws) and a given set of observations. Inference used to inform judgment by reference to perceived similarities or applications of examples, precedents, or relevant cases, such as is typical of legal reasoning, is inductive. Also inductive is that common and powerfully persuasive-even if logically suspicious-tool of everyday dialogue, analogical reasoning. In the case of a strong

inductive argument it is unlikely or improbable that the conclusion would actually be false and all the premises true, but it is logically possible that it might.

**Critical Thinking Skills Total Score:** The total score indicates one's overall reasoning or critical thinking skill level. The total is the sum of the scores in analysis, inference, and evaluation, which are core skills in critical thinking. We use these skills in both inductive reasoning and deductive reasoning.

The following table reports the scores obtained by our students.

	Analysis	Inference	Evaluation	Deduction	Induction	Total
Min	1	3	0	3	0	7
1 Quartile	3	5	2	6	3	12
Median	4	6	4	8	5	14
<b>Mean</b>	<b>3.8</b>	<b>6.2</b>	<b>4</b>	<b>7.6</b>	<b>4.9</b>	<b>14.1</b>
3 Quartile	5	7	6	9	6	16
Max	7	9	9	12	10	21

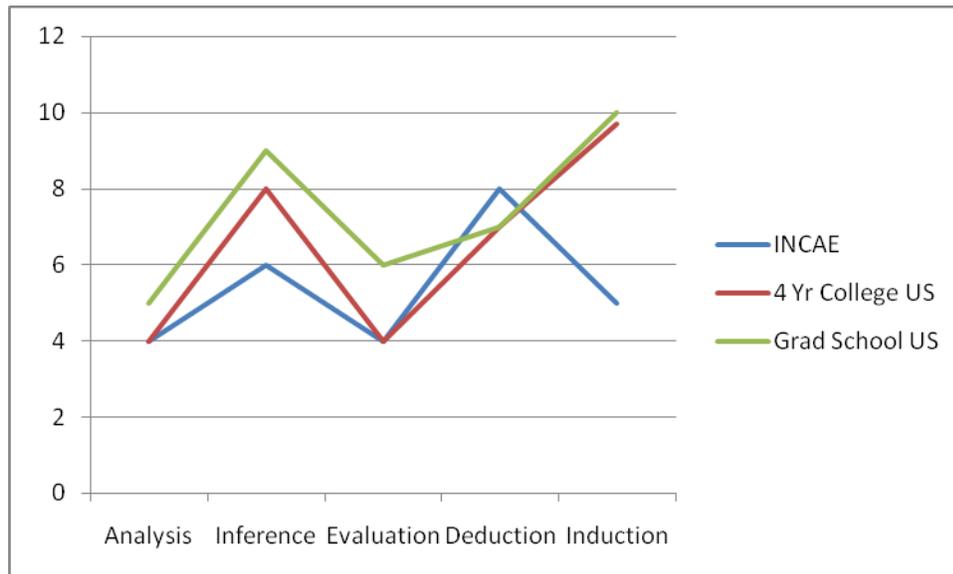
These results can be compared to 2 different benchmarks provided in the CCTST Manual: the performance of 4-Year College United States National Norm and the Graduate Student United States National Norm. These benchmarks are reported below:

<b>4 Yr College United States National Norms: CCTST</b>									
<b>Analysis</b>	<b>%</b>	<b>Inference</b>	<b>%</b>	<b>Evaluation</b>	<b>%</b>	<b>Deductive Reasoning</b>	<b>%</b>	<b>Inductive Reasoning</b>	<b>%</b>
<b>3</b>	<b>25</b>	<b>6</b>	<b>25</b>	<b>3</b>	<b>25</b>	<b>5</b>	<b>25</b>	<b>7</b>	<b>25</b>
<b>4</b>	<b>50</b>	<b>8</b>	<b>50</b>	<b>4</b>	<b>50</b>	<b>7</b>	<b>50</b>	<b>10</b>	<b>50</b>
<b>6</b>	<b>75</b>	<b>10</b>	<b>75</b>	<b>6</b>	<b>75</b>	<b>9</b>	<b>75</b>	<b>12</b>	<b>75</b>
<b>7</b>	<b>99</b>	<b>14</b>	<b>99</b>	<b>10</b>	<b>99</b>	<b>15</b>	<b>99</b>	<b>16</b>	<b>99</b>

**Graduate Student United States National Norms: CCTST**

<b>Analysis</b>	<b>%</b>	<b>Inference</b>	<b>%</b>	<b>Evaluation</b>	<b>%</b>	<b>Deductive Reasoning</b>	<b>%</b>	<b>Inductive Reasoning</b>	<b>%</b>
<b>3</b>	<b>25</b>	<b>6</b>	<b>25</b>	<b>3</b>	<b>25</b>	<b>5</b>	<b>25</b>	<b>7</b>	<b>25</b>
<b>5</b>	<b>50</b>	<b>9</b>	<b>50</b>	<b>6</b>	<b>50</b>	<b>7</b>	<b>50</b>	<b>10</b>	<b>50</b>
<b>6</b>	<b>75</b>	<b>12</b>	<b>75</b>	<b>8</b>	<b>75</b>	<b>11</b>	<b>75</b>	<b>13</b>	<b>75</b>
<b>7</b>	<b>99</b>	<b>16</b>	<b>99</b>	<b>11</b>	<b>99</b>	<b>17</b>	<b>99</b>	<b>17</b>	<b>99</b>

The following graph compares the medians for the 3 groups:



Entering students at INCAE as a group should be directly comparable to 4-year College Graduates in the United States (a student is required to have a Bachelor’s Degree to be admitted). However, our students score considerably lower in Inference (6 vs 8 points) and Induction (5 vs 10 points). On the bright side, they score better in the Deduction scale. With the exception of Deduction, a graduate student in the United States scores uniformly higher than an entering student at INCAE.

**Results of CCTDI**

The CCTDI is designed to be a tool for surveying the dispositional aspects of critical thinking. The respondents of the tests are asked to express agreement or disagreement with “75 statements expressing beliefs, values, attitudes, and intentions that relate to the reflective formation of reasoned

judgements". The tests are scored on 7 different scales: truthseeking, open-mindedness, analyticity, systematicity, critical thinking self-confidence, inquisitiveness and maturity of judgement. The following description of the scale is taken from <http://www.insightassessment.com/Scales%20CCTDI.html>.

**Truthseeking:** Truthseeking is the habit of always desiring the best possible understanding of any given situation; it is following reasons and evidence where ever they may lead, even if they lead one to question cherished beliefs. Truth-seekers ask hard, sometimes even frightening questions; they do not ignore relevant details; they strive not to let bias or preconception color their search for knowledge and truth. The opposite of truthseeking is bias which ignores good reasons and relevant evidence in order not to have to face difficult ideas.

**Open-mindedness:** Open-mindedness is the tendency to allow others to voice views with which one may not agree. Open-minded people act with tolerance toward the opinions of others, knowing that often we all hold beliefs which make sense only from our own perspectives. Open-mindedness, as used here, is important for harmony in a pluralistic and complex society where people approach issues from different religious, political, social, family, cultural, and personal backgrounds. The opposite of open-mindedness is closed-mindedness and intolerance for the ideas of others.

**Analyticity:** Analyticity is the tendency to be alert to what happens next. This is the habit of striving to anticipate both the good and the bad potential consequences or outcomes of situations, choices, proposals, and plans. The opposite of analyticity is being heedless of consequences, not attending to what happens next when one makes choices or accepts ideas uncritically.

**Systematicity:** Systematicity is the tendency or habit of striving to approach problems in a disciplined, orderly, and systematic way. The habit of being disorganized is the opposite characteristic to systematicity. The person who is strong in systematicity may or may not actually know or use a given strategy or any particular pattern in problem solving, but they have the mental desire and tendency to approach questions and issues in such an organized way.

**Critical Thinking Self-Confidence:** The tendency to trust the use of reason and reflective thinking to solve problems is reasoning self-confidence. This habit can apply to individuals or to groups; as can the other dispositional characteristics measured by the CCTDI. We as a family, team, office, community, or society can have the habit of being trustful of reasoned judgment as the means of solving our problems and reaching our goals. The opposite is the tendency to be mistrustful of reason, to consistently devalue or be hostile to the use of careful reason and reflection as a means to solving problems or discovering what to do or what to believe.

**Inquisitiveness:** Inquisitiveness is intellectual curiosity. It is the tendency to want to know things, even if they are not immediately or obviously useful at the moment. It is being curious and eager to acquire new knowledge and to learn the explanations for things even when the applications of that new learning is not immediately apparent. The opposite of inquisitiveness is indifference.

**Maturity of Judgment:** Cognitive maturity is the tendency to see problems as complex, rather than black and white. It is the habit of making a judgment in a timely way, not prematurely, and not with undue delay. It is the tendency of standing firm in one's judgment when there is reason to do so, but changing one's mind when that is the appropriate thing to do. It is prudence in making, suspending, or revising judgment. It is being aware that multiple solutions may be acceptable while appreciating the need to reach closure in certain circumstances even in the absence of complete knowledge. The opposite, cognitive immaturity, is characterized by being imprudent, black-and-white thinking, failing to come to closure in a timely way, stubbornly refusing to change one's mind when reasons and evidence would indicate one is mistaken, or foolishly revising one's opinions willy-nilly without substantial reason for doing so.

The following table reports the results for our group of students:

Scale	Median	% below 40	% above 50
Truth-seeking	39.17	53%	0%
Open-mindedness	45.00	14%	4%
Analyticity	47.73	0%	31%
Systematicity	44.55	17%	9%
Self-Confidence	48.89	4%	31%
Inquisitiveness	50.00	1.5%	46%
Cognitive Maturity	46.00	17%	15%
Total	322	1.6%*	8%**

\*Less than 280; \*\* Greater than 350.

No distribution is provided by Insight Assessment for U.S. Students in either 4-year programs or Graduate Programs. However, the following guidelines for interpretation are provided:

- Each scale ranges from 10 up to 60.
- Scale scores from 30 down to 10 indicate an increasingly negative disposition

- Scale scores from 40 to 60 indicate increasingly positive disposition
- Scale scores between 30 and 40 indicate ambivalence toward the disposition, i.e. no clear expression of either a positive or a negative disposition.

Although the CCTDI Manual explicitly warns that following tables for the U.S. students should not be interpreted as norms, it is interesting to copy them here:

### **Comparative Cut Score Table**

#### **Percentages Below Scale Score of 40**

<b>Scale</b>	<b>Undergraduate</b>	<b>Graduate</b>
Truth-Seeking	60%	26%
Open-Mindedness	15%	9%
Analyticity	23%	15%
Systematicity	44%	26%
Confidence	25%	6%
Inquisitiveness	14%	1%
Maturity	17%	12%

#### **Percentages Below Overall Score of 280**

CCTDI Total	22%	3%
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### **Comparative Target Score Table**

#### **Percentages Above Scale Score of 50**

<b>Scale</b>	<b>Undergraduate</b>	<b>Graduate</b>
Truth-Seeking	2%	12%
Open-Mindedness	28%	35%
Analyticity	16%	29%
Systematicity	11%	21%
Confidence	19%	47%
Inquisitiveness	41%	68%
Maturity	29%	38%

#### **Percentages Above Overall Score of 350**

CCTDI Total	6%	12%
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