

## Implications for Critical Thinking Dispositions: Evidence from Freshmen in New Mexico

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### Introduction

The study of critical thinking is vast and overlaps a variety of fields including psychology, philosophy, education psychology, and human development. Kennedy, Fischer, and Ennis (1990) have provided a survey of the various aspects of research in critical thinking and have suggested areas that need further study. The aim of this research is to understand the factors that condition a student's *disposition* toward critical thinking. Regardless of their intellectual ability, a student exhibiting a positive disposition is showing a willingness to learn. On the other hand, it is unlikely for a student with a negative disposition to learn to think critically, even if the student is intellectually capable. We survey college freshmen as the measures of disposition will not have been influenced by college instruction. Moreover, such information would be very useful and timely when advising students in their choice of courses and possibly a discipline.

Whether or not critical thinking is subject specific continues to be a debate in the literature and has received relatively more attention. [See Ennis (1989, 1990) and McPeck (1990).] At a philosophical level, McPeck argues that *thinking* is always in the context of a subject and they cannot be separated. In contrast, Ennis takes a view that critical thinking abilities are transferable and hence we cannot uniquely map subjects with critical thinking skills. Ennis also argues that the notion of a '*subject*' does not lend itself as an empirical construct making it difficult to posit this issue in empirical terms. Instead of focusing on learnt behavior, this study attempts to empirically ascertain if there is a discernable disposition pattern among students who self-select into a discipline.

Among other influences, a student's disposition is conditioned by their intellectual ability, gender, socio-economic status and cultural backgrounds. Intellectual ability is a characteristic that influences the learning of critical thinking and there is some indication that students of all intellectual ability levels can benefit from critical thinking (Chance 1986; Nickerson, Perkins & Smith, 1985). Many prior studies on gender have examined the differences in ability rather than disposition (Edwards, 1950; Halpern, 1986). In this context, we find it important to understand if gender plays a role in determining disposition and to characterize the presence of any dominant attributes that affect disposition.

The socio-economic, cultural and ethnic influences depend on the demographic mix among the freshmen

in the two universities. Our sample is drawn from the 2006 incoming freshmen in Eastern New Mexico University (ENMU) located in Portales, New Mexico and New Mexico State University (NMSU) located in Las Cruces, New Mexico.<sup>1</sup> Portales is a rural community in north eastern New Mexico with a population of about 15,000. Las Cruces has a population of about 85,000 and is located 40 miles from El Paso, Texas. While geographically these cities are separated by about 300 miles, they are very similar in many ways and hence allow us to aggregate our results (See Appendix 1). Since, our sample predominantly consists of Anglo-Americans and Hispanics we examine the influence of these two ethnic backgrounds on the disposition towards critical thinking among incoming college freshmen.

We assess thinking dispositions through self-report of attitudes, opinions, beliefs and values by using the California Critical Thinking Dispositions Inventory (CCTDI), developed by Peter Facione and Noreen Facione (1992, 1997 and 2001).<sup>2</sup> CCTDI is a 75 item survey that allows students to respond to each item using a six-point Likert scale ranging from "strongly agree" to "strongly disagree." Based on students' responses to the items, the CCTDI provides a profile of seven critical thinking subscale dispositions: *truth seeking, open mindedness, analyticity, systematicity, self-confidence, inquisitiveness, and maturity*. With the exception of CCTDI, there is as yet no widely available instrument to assess thinking dispositions.

This paper is organized as follows. Section 2 presents the issues and the related literature. Section 3 discusses the survey instrument and sample. The main results are contained in Section 4. We make our concluding remarks in Section 5.

### Literature Survey and Hypothesis

#### *Critical Thinking and Subject Specificity*

McPeck (1990) argues that the pursuit of *thinking* is always in the context of a subject and any kind of thinking is dependent on the subject being thought about. At an intuitive level, it is easy to see that most disciplines involve some element of technique and expression. Disciplines such as Art, Music and Theatre conceivably work with more expression than Chemistry, Engineering or Business. Thus, a student majoring in Art or Music is more likely to engage in thinking and acting on different forms of expression than would Chemistry major. On the

other hand, a successful chemistry experiment does not depend on the theoretical skills or visual expression of the student performing the experiment. In this sense, unlike the Art student, the Chemistry student engages in critical thinking that does not require him or her to think about their expression.

Ennis (1990) criticizes McPeck (1990) for reifying the concept of *subject*. While one can accept that one cannot think about everything in general but must think about a topic, he argues that it is not the same as thinking within a discipline. Furthermore, Ennis (1990) contends that the notion of discipline specific critical thinking skills breaks down if such skills are transferable. Perkins (1987) enumerates three stages of critical thinking development: acquisition, making it automatic and transfer. Perkins suggests that without instruction in transfer, students will be less likely to be able to apply critical thinking skills to novel situations.

The debate on subject specificity centers on the definition of subject and the transferability of associated critical thinking skills. We focus our study on the disposition towards critical thinking and completely avoid the issue of transferability. In addition, we survey incoming freshmen to ascertain whether there is a systematic relation between their disposition and their self reported discipline as preference. The developmental stage of incoming freshmen only allows us to study their disposition and preferences and precedes any study related to acquisition and transferability of skills.

### Critical Thinking and Gender

Halpern (1986) finds that males outperform females in the area of quantitative and spatial abilities. Women outperform males in the area of verbal skills. Edwards (1950) found that women did better on judging and males did better on applying principles. On the other hand, several studies report no gender differences (Ennis, Millman, & Tomko, 1985; Hallam, 1979; Lehman, 1963). We examine gender differences that are dispositional rather than skills based. In fact, it will be very difficult to acquire the disposition of the opposite-gender. As a result, any observed differences are likely to remain even during the acquisition stage of development. We also examine at the sub-scale level to detect differences across gender.

### Purpose of This Study

This study has the following three objectives:

- a) To compare the overall level of disposition towards critical thinking among college freshmen in New Mexico with that of other undergraduates from around the world.
- b) To ascertain whether there are dominant dispositional attributes among students within a chosen discipline, and

- c) To determine whether there are differences in dispositional characteristics based on gender and ethnicity within the New Mexico context.

## Method

### Participants

We present the profile of the sample studied in this research in Table 1.

The overall sample consists of 96 freshmen from New Mexico State University (NMSU) and 123 freshmen from Eastern New Mexico University (ENMU).<sup>3</sup> The

Table 1<sup>1</sup>  
*Sample Profile*

		NMSU	ENMU
Gender	Males	41.67	55.04
	Females	58.33	44.96
Ethnicity	Anglo	36.90	55.67
	Hispanic	50.00	25.47
	Others	13.10	18.86
Discipline	Liberal Arts	26.04	33.87
	Business	16.67	13.71
	Science and Engineering	20.83	24.19
	Criminal Justice	22.92	2.42
	Others <sup>2</sup>	13.54	25.81
Size of Sample (number of students)		96	123

<sup>1</sup>This table presents the salient features of the profile of the students who volunteered demographic information. The figures in the table are percentages of total students participating in each university.

<sup>2</sup>We collected data on some students who preferred a discipline other than the four in the table. Since the sample was small, we did not analyze these student responses. The same applies to students who declared that they were undecided.

distribution of males and females in the two sub-samples are fairly even. Of the students who voluntarily reported their demographic details, 36.9% were of Anglo American origin and 50% were of Hispanic origin among the freshmen in NMSU. In comparison, 55.67% of the freshmen in ENMU were of Anglo American origin and 25.47% were Hispanics. All students were required to provide their preferred choice of discipline. We received a variety of responses but considered only those disciplines with a reasonably large sample size to facilitate drawing inferences. The disciplines we considered are Liberal Arts, Business, Science and Engineering and Criminal Justice. If the respondent was not sure about his or her preference, we asked them to write 'undeclared' and we classified them as 'Others' in Table 1. The relative proportion of students across various disciplines is approximately the same for both universities with the exception of Criminal Justice.

Since there were too few students in ENMU interested in Criminal Justice, we studied the responses only from NMSU and were unable to make any comparisons between the two universities.

### Measures

Good thinkers are not only skilled at making reasoned judgments, but are disposed to use their skills of analysis, inference, and evaluation. The consistent internal motivation to use one's critical thinking skills to solve problems and to make decisions is the target measured by the California Critical Thinking Disposition Inventory (CCTDI.) People may be positively, ambivalently, or negatively disposed on each of seven subscales of the overall disposition toward critical thinking. [See the Appendix 2 for details.] The CCTDI is designed for use with community college students, college and university undergraduate students, graduate and professional school students, adults, and working professionals. It is used nationally and internationally for program evaluation, professional development, training, student assessment, and as an element in application, admissions, and personnel evaluation processes. The questionnaire contains 75 Likert-style items with seven subscales. Respondents are asked to state the extent to which they agree or disagree with each of the 75 items. Agreement with an item indicates concordance with a recognized CT attribute, while disagreement represents opposition to the attribute. The scores for each of the seven subscales range from a possible minimum of 10 to a possible maximum of 60. Scores of 30 or below indicate a negative tendency towards that subscale; scores of 31–39 suggest ambivalence; scores of 40 or higher are evidence of a positive inclination and scores between 50 and 60 indicate a strong positive tendency. The CCTDI total score is the sum of the seven subscale scores and can range from 70 to 420; a total score of 280 or higher indicates a positive disposition toward critical thinking in Western samples (Facione & Facione, 1997).

## Results

### Overall Results

We pooled the sample from both these universities to understand the overall critical thinking disposition of incoming freshmen and the results are presented in Table 2. The overall score on the CCTDI survey is 281.21 with a statistically significant positive disposition towards *analyticity*, *self-confidence*, *inquisitiveness* and *maturity*. The students exhibited a significant negative disposition towards *truth seeking* and *systematicity*. Although not statistically significant, an overall score of 281.21 indicates a positive disposition towards critical thinking. These measures suggest that the group of incoming freshmen

in the two universities in New Mexico were attitudinally well prepared for pursuing higher education. Additionally, students exhibit very similar subscale dispositional traits across these universities. One conceivable reason for the relatively lower scores for *truth seeking* and *systematicity* might be a consequence of a lower emphasis on these attributes during their K-12 education.

The results in Table 2, along with the critical thinking disposition results from three studies that involve undergraduates from China, Australia and Lithuania are presented in Table 3. The Australian students have an overall score of 287.83 indicating a significant positive

Table 2  
*Critical Thinking Disposition Among Freshmen in New Mexico*

Disposition	OVERALL	NMSU	ENMU
Truth Seeking	34.64* (-13.00)	34.68* (-8.569)	34.61* (-9.742)
Open-Mindedness	40.01 (0.02)	40.82 (1.257)	39.37 (-1.075)
Analyticity	41.58* (4.05)	41.67* (2.618)	41.51* (3.102)
Systematicity	39.23** (-1.66)	39.51 (0.666)	39.02*** (-1.665)
Self-Confidence	41.15* (2.54)	41.06 (1.558)	41.22** (2.010)
Inquisitiveness	43.95* (7.71)	43.79* (5.179)	44.08* (5.711)
Maturity	40.65*** (1.29)	41.15 (1.553)	40.26 (0.377)
Total	281.21 (0.58)	282.68 (0.823)	280.07 (0.027)
Sample Size	229	96	123

This table presents mean values as computed by Insight Assessment. Numbers in parenthesis are t values using  $\mu_0=40$  for sub-scale dispositions and  $\mu_0=280$  for overall score. Scores of 30 or below indicate a negative tendency towards that subscale. Scores between 31 and 39 suggest ambivalence. Scores of 40 or higher are evidence of a positive inclination and scores between 50 and 60 indicate a strong positive tendency. \*, \*\*, \*\*\* indicates significance at .01, .05 and .10 levels.

disposition towards critical thinking. The overall scores of Chinese and Lithuanian students are in the range of deficiency. Interestingly, undergraduate students from each of the countries in Table 3 exhibit deficiency in *truth seeking* and a positive disposition with regard to *analyticity*, *self-confidence* and *inquisitiveness*. The students from New Mexico and Australia exhibited a relatively more positive disposition in being *open minded* and *mature*. One possible explanation for the overall lower scores from China and Lithuania could be the influence of a rigid educational environment.

### *Critical Thinking Disposition and Subject Specificity*

In this section, we present results pertaining to freshmen preferences for a discipline and their disposi-

Table 3  
*Results from the Use of the CCTDI Instrument Across Undergraduate Students from Australia, Lithuania and China*

	New Mexico	Chinese <sup>1</sup>	Australian <sup>1</sup>	Chinese <sup>2</sup>	Lithuanian <sup>3</sup>
Truthseeking	34.64	31.30	35.03	31.88	30.05
Open-minded	40.01	38.40	41.86	38.07	36.16
Analyticity	41.58	41.32	41.73	40.56	41.32
Systematicity	39.23	37.13	38.51	36.84	37.13
Confidence	41.15	40.27	40.74	38.30	40.27
Inquisitiveness	43.95	43.60	46.29	41.12	43.60
Maturity	40.65	36.34	43.57	36.97	36.34
Overall Score	281.21	268.36	287.73	264.70	273.80

<sup>1</sup>See Tiwari, A., Avery, A., & Patrick, Lai (2003).

<sup>2</sup>See Ip, W. Y., Lee, D. T. F., Lee, I. F. K., Chau, J. P.C., Wootton, Y. S. Y., & Chang, A. M. (2000).

<sup>3</sup>Rimieni, V. (2002).

tion towards critical thinking. The results are reported in Table 4. Students who prefer to major in Liberal Arts exhibit a positive disposition towards being *open minded*, *analytical*, *self-confident*, *inquisitive*, and *mature*. In comparison, students preferring any of the other three disciplines exhibit a positive disposition only towards being *inquisitive* with the exception of business majors who, in addition, have a positive disposition towards *self confidence*. Students in all disciplines have a negative disposition towards *truth seeking*. Our results indicate that in comparison to students in other disciplines, those preferring liberal arts have a more positive disposition overall and in many of the sub-scales. However, we do not detect a discernable relationship between disposition and discipline preference.

Since we are studying student dispositions and discipline preferences, one could ask whether students with a strong disposition make a conscious selection of their discipline based on their dispositional traits. We examine this question by focusing on the dispositional traits of the students scoring in the top quartile of each discipline. The results are presented in Table 5. Each row in Table 5 indicates the cross-section of dispositional scores for each sub-scale. We conducted a pair-wise, difference in means with unequal variances test and did not find any

significant differences in the scores across sub-scales and disciplines.<sup>4</sup>

Table 4  
*Critical Thinking Disposition and Student's Preferred Discipline*

	Liberal Arts	Business	Science/ Engineering	Criminal Justice
Truthseeking	35.56* (-6.35)	34.00* (-5.87)	33.83* (-6.43)	35.54* (-5.29)
Open-mindedness	41.64** (2.06)	38.09*** (-1.93)	38.44*** (-1.84)	40.42 (0.34)
Analyticity	42.76* (4.19)	41.32 (1.39)	41.23 (1.45)	41.45 (1.48)
Systematicity	39.62 (-0.49)	38.46 (-1.44)	39.79 (-0.22)	40.27 (0.17)
Self-Confidence	42.42* (3.05)	42.19* (3.08)	40.74 (0.88)	41.30 (1.02)
Inquisitiveness	45.94* (6.49)	43.15* (2.97)	43.57* (3.57)	43.91** (2.61)
Maturity	41.66*** (1.84)	38.67 (-1.01)	39.96 (-0.03)	41.62 (1.17)
Total	289.60* (2.74)	275.86 (-1.35)	277.59 (-0.57)	284.52 (0.66)
Sample Size	67	33	51	25

This table presents mean values as computed by Insight Assessment. Numbers in parenthesis are t values using  $\mu_0=40$  for sub-scale dispositions and  $\mu_0=280$  for overall score. Scores of 30 or below indicate a negative tendency towards that subscale. Scores between 31 and 39 suggest ambivalence. Scores of 40 or higher are evidence of a positive inclination and scores between 50 and 60 indicate a strong positive tendency. \*, \*\*, \*\*\* indicates significance at .01, .05 and .10 levels.

Table 5  
*Critical Thinking Disposition and Student's Preferred Discipline Top Quartile*

	Liberal Arts	Business	Science/ Engineering	Criminal Justice
Truthseeking	39.35	38.11	37.54	39.00
Open-mindedness	46.47	43.00	43.54	46.14
Analyticity	47.65	45.89	46.85	45.71
Systematicity	43.24	40.56	46.46	48.00
Self-Confidence	48.35	48.56	44.92	45.86
Inquisitiveness	52.18	50.00	50.31	50.57
Maturity	47.82	43.67	46.23	47.14
Total	325.06	309.78	315.85	322.43

This table presents mean values as computed by Insight Assessment. Numbers in parenthesis are t values using  $\mu_0=40$  for sub-scale dispositions and  $\mu_0=280$  for overall score. Scores of 30 or below indicate a negative tendency towards that subscale. Scores between 31 and 39 suggest ambivalence. Scores of 40 or higher are evidence of a positive inclination and scores between 50 and 60 indicate a strong positive tendency.

Further, Table 6 presents studies relating to other disciplines such as Environmental Health, Athletics and Nursing. The Environmental health students have the most positive disposition. However, even these students were negatively disposed towards *truth seeking*. Students across these disciplines have a very positive disposition towards being *inquisitive*. It seems that students are eager to learn but not to question what they are learning. This is a pervasive phenomenon across countries and across disciplines. It is difficult to say with confidence that there are systematic differences in individual dispositions across disciplines reported in the table above.

**Table 6**  
*Results from the Use of the CCTDI Instrument Across Undergraduate Disciplines Such as Athletics, Environmental Health, and Nursing*

	Athletic <sup>1</sup>	Environmental Health <sup>2</sup>	Nursing <sup>3</sup>
Truthseeking	35.10	38.00	31.88
Open-mindedness	40.73	46.40	38.07
Analyticity	43.72	45.20	40.56
Systematicity	41.13	40.30	36.84
Confidence	42.52	44.30	38.30
Inquisitiveness	45.59	47.10	41.12
Maturity	42.23	46.50	36.97
Overall Score	293.15	307.90	264.70

<sup>1</sup>Leaver-Dunn, D., Harrelson, G. L., Martin, M., & Watt, T. (2002).

<sup>2</sup>Guang, J., Bierma, T. J., Broadbear, J. T. (2004).

<sup>3</sup>Ip, W. Y., Lee, D. T. F., Lee, I.F. K., Chau, J. P. C., Wootton, Y. S. Y., & Chang, A. M. (2000).

**Critical Thinking Disposition and Gender Differences**

Halpern (1986) finds that males outperform females in the area of quantitative and spatial abilities. Women outperform males in the area of verbal skills. Edwards (1950) found that women did better on judging and males did better on applying principles. These findings address differences based on skills and not dispositional. From a dispositional standpoint, Halpern (1986) and Bem (1974) claim that males are and should be independent and competitive and females are and should be emotional and warm. Kennedy, Fischer, and Ennis (1990) point out that more research is needed before we can understand the influence of gender differences on critical thinking. We report our survey results in Table 7.

Male freshmen in our sample showed a deficiency in critical thinking disposition with an overall score of 278.98. In contrast, the sub-sample of female freshmen showed a significant positive disposition toward critical thinking with a score of 284.30. This result suggests

**Table 7**  
*Differences in Critical Thinking Disposition Across Gender*

Disposition	New Mexico	
	Male	Female
Truthseeking	34.39* (-8.17)	34.43* (-9.90)
Open-mindedness	39.64 (-0.48)	40.51 (0.88)
Analyticity	41.58* (2.45)	41.98* (3.84)
Systematicity	38.96*** (-1.46)	39.53 (-0.69)
Self-Confidence	40.97*** (1.35)	41.63* (2.54)
Inquisitiveness	43.96* (4.64)	44.44* (6.29)
Maturity	39.57 (-0.55)	41.78* (2.45)
Total	278.98 (-0.30)	284.30** (1.54)
Sample Size	95	98

This table presents mean values as computed by Insight Assessment. Numbers in parenthesis are t values using  $\mu_0=40$  for sub-scale dispositions and  $\mu_0=280$  for overall score. Scores of 30 or below indicate a negative tendency towards that subscale. Scores between 31 and 39 suggest ambivalence. Scores of 40 or higher are evidence of a positive inclination and scores between 50 and 60 indicate a strong positive tendency. \*, \*\*, \*\*\* indicates significance at .01, .05 and .10 levels.

that gender is likely to influence disposition. There were no significant differences between the genders in their disposition towards *truth seeking*, *open mindedness*, and *analyticity*. Relative to females, the males showed a significantly lower level of disposition towards being *self-confidence*, *systematic*, and *mature*. Based on our results however, it is difficult to conclude whether these documented differences in disposition across genders are sample specific or a result of a fundamental trait. We need further research in this area.

**Critical Thinking Disposition and Ethnic Differences**

Critical thinking disposition can be influenced by differences in ethnic background. The Hispanic students in New Mexico are typically first generation students with English as their second language. Of the students who self-reported their ethnic background 50% (25.47%) were Hispanic in NMSU and 36.9% (55.67%) were Anglo American. The overall dispositional results indicate that Anglo-Americans are marginally positively disposed toward thinking critically and the Hispanics show a marginally negative disposition. These results are presented in Table 8. The Anglo American group is more *self-confident*, *analytical* and *mature* relative to the Hispanics. There were no significant differences between the two groups for the other attributes.

### Conclusion

In this study, we compare the overall level of disposition towards critical thinking among college freshmen in New Mexico with that of other undergraduates from

Table 8

*Critical Thinking Disposition and Ethnic Background*

Disposition	New Mexico	
	Anglo American	Hispanic
Truthseeking	35.21* (-7.17)	33.12* (-9.18)
Open-mindedness	40.24 (0.36)	40.46 (0.65)
Analyticity	41.94** (3.34)	41.06 (1.55)
Systematicity	39.23 (-1.07)	39.01 (-1.16)
Self-Confidence	41.54*** (2.25)	40.73 (0.88)
Inquisitiveness	43.96** (4.86)	43.94** (4.52)
Maturity	41.46*** (1.87)	40.16 (0.18)
Total	283.59 (1.11)	278.47 (-0.43)
Sample Size	90	69

This table presents mean values as computed by Insight Assessment. Numbers in parenthesis are t values using  $\mu_0=40$  for sub-scale dispositions and  $\mu_0=280$  for overall score. Scores of 30 or below indicate a negative tendency towards that subscale. Scores between 31 and 39 suggest ambivalence. Scores of 40 or higher are evidence of a positive inclination and scores between 50 and 60 indicate a strong positive tendency. \*, \*\*, \*\*\* indicates significance at .01, .05, and .10.

around the world. We ascertain whether there are dominant dispositional attributes among students who prefer a certain discipline as their major, between genders and ethnicity.

We conducted the CCTDI test on a sample of 229 freshmen. Of these students, we could analyze gender and ethnic influences for only those who chose to self report their orientation. Consequently, we analyzed the influence of gender in a sample of 95 males and 98 females and ethnic influence among 90 Anglo Americans and 69 Hispanics. While these are large samples for statistical inference, we realize that it is debatable whether our results can be generalized. We present the main findings of our study.

We found that students have a negative disposition towards *truth seeking* and a positive disposition towards being *inquisitive*. This phenomenon is independent of gender, ethnicity, preferred discipline and country. It appears that K-12 schooling years encourages them to cultivate a sense of intellectual curiosity but is short on the evaluative aspect of critical thinking. Higher education can take the path of practice ('How' type questions.) or the path of inquiry ('Why' type questions). Since this dichotomy arises

later in college life, it may not be important to address *truth Seeking* during K-12.

In the case of subject specificity, we found that students preferring Liberal Arts as a major were positively disposed to think critically in many of the sub-scale categories. The students preferring other disciplines were relatively less disposed to think critically. We did not find a clear mapping from the subscales to the disciplines. Since, this result is based on dispositions rather than abilities; the issue of transferability does not arise. Hence, we add one more dimension to the literature by suggesting that perhaps, the CCTDI instrument can be calibrated by surveying professionals, faculty and other specialists in a discipline to obtain a benchmark. We anticipate such a benchmark to be useful for advising freshmen entering college.

Most of the prior research has focused on the influence of gender on the *ability* rather than *disposition* towards critical thinking. The exceptions we found were Halpern (1986) and Bem (1974) who claim that males are and should be independent and competitive and females are and should be emotional and warm. Kennedy, Fischer, and Ennis (1990) point out that more research is needed before we can understand the influence of gender differences on critical thinking. In the context of our study, we find that females were significantly better disposed to think critically. They are also attitudinally more positively oriented with regard to being *self-confident*, *systematic*, and *mature* than males.

Our results on ethnicity are localized to our sample as we found only Anglo Americans and Hispanics as the two dominant groups. We found that the former group is more positively disposed toward critical thinking. This may be due to the fact that most Hispanic freshmen are first generation college goers. We admit that a more extensive study is needed before we can generalize on ethnicity.

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### Footnotes

<sup>1</sup> This study was conducted under a grant from the Teaching Academy in Eastern New Mexico University. We were restricted from publishing any results from our study until recently.

<sup>2</sup> For a discussion of other approaches see Tishman and Andrade (2005) and Norris (2003).

<sup>3</sup> Our human subjects consent form did not permit us to collect demographic data. Hence, we are able to present data on only those students who volunteered this information.

<sup>4</sup> The t-statistics are not reported in Table 6. These can be furnished upon request.

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### Appendix 1

This appendix contains demographic data provided by the 2000 U.S. Census.

<b>Population</b>	<b>Portales</b>	<b>Las Cruces</b>
Total Population	11,131	74,267
Female	51.70%	51.50%
Male	48.30%	48.50%
18 years and over	73.70%	74.90%
65 years and over	12.20%	13.10%
Married Persons	53.60%	48.60%
Single Persons	46.40%	51.40%
Median Age	27.3	31.2
Average Family Size	3.1	3
<b>Ethnicity</b>		
White	71.20%	72.00%
Black or African American	2.40%	2.40%
Hispanic or Latino (of any race)	39.40%	53.90%
<b>Housing Characteristics</b>		
Total Housing Units	4,832	31,652
Median Home Cost	\$52,300	\$91,200
Number of Households	4,188	29,184
Persons per Household	2.49	2.46
<b>Economic Characteristics</b>		
Median Household Income	\$24,658	\$30,375
Per Capita Income	\$12,935	\$15,704
In Labor Force	60.10%	60.60%
Families below poverty level	488	3,145
<b>Education Characteristics</b>		
School Enrollment		
Elementary School Enrollment	1,232	8,652
High School Enrollment	563	4,056
College or Graduate School	2,109	10,495
<b>Educational Attainment Population 25 years and older</b>		
High School Graduate	21.20%	22.20%
Associates Degree	6.50%	6.50%
Bachelor's Degree	14.00%	16.30%
Graduate or Professional Degree	11.20%	12.10%



## Appendix 2

Description of the seven dispositions attributes based on the CCTDI Score Interpretation Document.

The **Truth seeking** scale (the **T** - scale) targets the disposition of being courageous when asking questions, eager to seek best knowledge in a given context, and honest in the pursuit of inquiry even if the findings do not support one's interests or one's preconceived opinions. The truth-seeker would rather pursue the truth than win the argument. This scale refines, focuses, and extends the Delphi characteristics "willingness to reconsider and revise one's views where honest reflection suggests that change is warranted," "reasonableness in selecting and applying criteria," and "flexibility in considering alternatives and opinions."

The **Open-mindedness** scale (the **O** - scale) targets the disposition of being open to and tolerant of the expression of divergent points of view with sensitivity to the possibility of one's own bias. The open-minded person respects the rights of others to hold differing opinions. This scale refines and focuses the Delphi characteristics of "understanding of the opinions of others," "open-mindedness regarding divergent world views."

The **Analyticity** scale (the **A** - scale) targets the disposition of being alert to potentially problematic situations, anticipating possible results or consequences, and prizing the application of reason and the use of evidence even if the problem at hand turns out to be challenging or difficult. The analytically inclined person is alert to potential difficulties, either conceptual or behavioral, and consistently looks to anticipatory intervention, reason-giving and fact-finding as effective ways to resolve matters. This scale is closely related to the Delphi characteristics of "alertness to opportunities to use CT," "trust in the processes of reasoned inquiry," "clarity in stating the question or concern," and "persistence though difficulties are encountered."

The **Systematicity** scale (the **S** -scale) targets the disposition toward organized, orderly, focused, and diligent inquiry. No particular kind of organization, e.g. linear or non-linear, is given priority on the CCTDI. The systematic person strives to approach specific issues, questions or problems in an orderly, focused, and diligent way, however that might be accomplished. The systematicity scale is closely related to the Delphi characteristics of using "orderliness in working with complexity," "diligence in seeking relevant information," and "care in focusing attention on the concern at hand."

The **CT Self-Confidence** (the **C** - scale) refers to the level of trust one places in one's own reasoning processes. CT self-confident persons trust themselves to make good judgments and believe that others trust them as well, since they believe others look to them to resolve problems, decide what to do, and bring reasonable closure to inquiry. The CT self-confidence scale starts with and extends the Delphi characteristic of "self-confidence in one's own ability to reason."

The **Inquisitiveness** scale (the **I** - scale) on the CCTDI measures one's of intellectual curiosity. The inquisitive person is one who values being well-informed, wants to know how things work, and values learning even if the immediate payoff is not directly evident. The inquisitiveness scale targets the Delphi characteristics of "inquisitiveness with regard to a wide range of issues," "concern to become and remain generally well-informed."

The **Maturity** scale (the **M** - scale) targets how disposed a person is to make reflective judgments, particularly under conditions of uncertainty. The maturity scale addresses *cognitive* maturity and *epistemic* development. CCTDI scoring gives preference to those disposed to approach problems, inquiry, and decision making with a sense that some problems are ill-structured, some situations admit of more than one plausible option, and many times judgments must be made based on standards, contexts and evidence which preclude certainty. The maturity scale refines and extends the Delphi findings. It includes and goes beyond the characteristics "fair-mindedness in appraising reasoning," "prudence in suspending, making or altering judgments," and "precision to the degree permitted by the subject and the circumstances."