

**Measuring Critical Thinking...**  
**...As applied to the Data Detectives Game by Kay McLennan**

Critical thinking (and applied critical thinking or adaptive thinking) [in the Data Detectives Game] is measured by assessment. More specifically, the assessment of the successful/unsuccessful application of the needed critical thinking skill set to case study presented in the Data Detectives Game can be accomplished in a variety of ways (see below, with the preferred method of assessment in bold text).

- ❖ Students/trainees demonstrate their mastery of the application of the needed critical thinking skill set to the Data Detectives Game case study by the submission of a written essay.
- ❖ Students/trainees demonstrate their mastery of the application of the needed critical thinking skill set to the Data Detectives Game case study by their [graded] contributions to a class/group discussion (and the class/group discussion can be staged in the virtual world, online in a threaded text discussion in a learning management system platform, or face-to-face in a classroom setting).
- ❖ Students/trainees demonstrate their mastery of the application of the needed critical thinking skill set to the Data Detectives Game case study by their answers to a [graded] test. Note: If a [graded] test is used to assess students/trainees, given the need to evaluate the thought process behind the conclusions drawn, an essay or short answer test format is preferred. A self-grading multiple choice test format can be utilized in the assessment process but is the less preferred method of testing (in comparison to the option of an essay or short answer test).
- ❖ **Students/trainees demonstrate their mastery of the application of the needed critical thinking skill set to the Data Detectives Game case study by the combination of their [graded] contributions to a class/group discussion and their answers to a [graded] essay or short answer essay test.**

Looking specifically at how the above assessment is graded or scored, instructors/trainers use the rubric (and accompanying clue layer examples listed below).

### Critical Thinking Rubric Applicable to the Data Detectives Game\*

Critical Thinking Outcomes	<b>Unacceptable</b> (0-5 points per outcome)	<b>Marginal</b> (6-10 points per outcome)	<b>Proficient</b> (11-15 points per outcome)	<b>Exemplary</b> (16-20 points per outcome)	Score (0-20 per row)
<b>Identifies Key Factors Impacting Scenario</b>	Does not identify the key factors impacting the scenario (and/or does not recognize how some clues are irrelevant).	Identifies some of the key factors impacting the scenario (and/or only recognizes some of the instances when a clue is irrelevant).	Identifies most of the key factors impacting the scenario (and/or recognizes most of the instances when a clue is irrelevant to the analysis of the scenario).	Identifies all of the key factors impacting the scenario as well as recognizes nuances of the different factors.	
<b>Application of Relevant Analysis Tools (Re: Tutorials)</b>	Does not utilize the relevant analysis tools detailed in the tutorial materials.	Utilizes some of the relevant analysis tools detailed in the tutorial materials.	Utilizes most the relevant analysis tools detailed in the tutorial materials.	Utilizes all of the relevant analysis tools detailed in the tutorial materials as well as applies additional relevant analysis tools.	
<b>Awareness of Interrelationship of Factors</b>	Deals only with the clues presented and does not connect multiple clues together.	Demonstrates the ability to identify two layers of interrelated clues (see examples below).	Identifies examples of more than two layers of interrelated clues and/or the interrelationship of different categories of clues (see examples below).	Demonstrates the ability to identify four or more layers of interrelated clues as well as demonstrates the ability to see the interrelationship of different categories of clues.	
<b>Quality of Evidence, (Including the Introduction of New Relevant Evidence)</b>	Merely repeats clues or information provided, taking it as truth and/or denies evidence without adequate justification.	Examines some of the evidence and the source of evidence (to question accuracy, completeness, and relevance).	Examines most of the evidence and the source of evidence (to question accuracy, completeness, and relevance).	Examines all of the evidence as well as the sources of all evidence (to question accuracy, completeness, and relevance). In addition, introduces new relevant evidence.	
<b>Conclusion Drawn</b>	Fails to identify conclusions, implications, and/or consequences of the scenario presented.	Draws simplistic conclusion based on a partial or incomplete analysis of the clues presented. Misses some clues related to the veracity of findings.	Bases conclusion on most of the key factors presented as well as demonstrates an understanding of how to evaluate the veracity of the information presented.	Demonstrates an ability to weigh all of the evidence to present a well reasoned conclusion or even the preferred option of well supported alternative conclusions.	

\*Rubric scoring: Unacceptable = 0-25 points; Marginal = 26-50 points; Proficient = 51-75 points; and Exemplary = 75-100 points.

Rubric examples from the Data Detectives Game (re: identification of multiple layers of interrelated clues and/or the interrelationship of different categories of clues) include the following. Note: Instructors/trainers have access to additional "Deconstructing the Clues" analysis -- beyond the examples detailed below -- in pages 28-38 of Data Detectives Instructor Manual.

❖ Influence of the royals on New London citizens buying habits...

- Clue 'A' - Queen is characterized as "relevant to the modern age" (and by implication, likely to be in favor of the most modern technology including the introduction of Cloud Buds™ in the New London market) in the article entitled "Royal Sky Diving!" in the New London Gazette - Early Edition.
- Clue 'B' - The Queen's office quarters reveal only markedly outdated technology (in contrast to the impression "marketed" to the public -- that the Queen is "relevant to the modern age").
- Clue 'C' - The finding -- as detailed in "The Royal Factor" book clue -- that New Londoners are highly attentive to the monarchy (when it comes to demonstrating a propensity to emulate more of the style and behaviors of the royals -- even in comparison to the influence of other celebrities and/or public figures).
- Clue 'D' - The "news" item in the New London Gazette - Late Edition that revealed the royal identity of the author of "The Royal Factor" book. [In other words, the possible bias of the author.]
- Clue 'E' - The more detailed analysis of the "news" item in the New London Gazette - Late Edition that revealed the royal identity of the author of "The Royal Factor" book -- to note the name of the "news" item author as the "Gossip Girl." [In other words, is the so-called bias news or gossip?]

❖ Current state and outlook for the needed telecommunications infrastructure in New London (with the availability of a robust telecommunications infrastructure critical to the possible market expansion scenario under consideration)...

- Clue 'A' - With an industry rating of five through one stars (with five being the highest rating), New London's basis telecommunications systems are rated as three star or in the "Adequate" range. Still, while the basis telecommunications systems in New London are in the "Adequate" range, the reliability and security of the systems are rated as "Inadequate." [In other words, the telecommunications systems in New London are only marginally adequate.]

- Clue 'B' - Given the austerity measures in place in New London (as evidenced by the multiple position vacancies at the New London Ministry of Business Registration, New London Welcome Center, and New London Ministry of Statistics), significant near term investments in telecommunications infrastructure are unlikely.
- Clue 'C' - The different political party platforms concerning austerity measures and infrastructure spending.
- Clue 'D' - The malfunctions reported in the New London Gazette - Late Edition could be the result of bad equipment or inadequate existing telecommunications bandwidth.

Additionally, examples of the application of relevant analysis tools -- one each from the five different Data Detectives Game tutorials -- include the following.

- ❖ "A Closer Look at Statistics" - [Example of the limitation of "averages" when it comes to drawing conclusions...] The scenario presented includes your boss being under the impression that retail spaces rents for about \$45 a square foot (on average) and the new store you are evaluating needs at least 1,500 square feet (with accompanying salaries of \$10 per hour for the store manager and \$8 an hour for the assistant manager -- to run the store). In turn, while it looks like the much higher salaries the store manager and assistant store manager in New London will command could be a "deal breaker," as detailed on page 33 of the Data Detectives Instructor Manual, a closer examination of the data yields a much different picture.
- ❖ "A Closer Look at Graphs" - [Example of how graphs can distort data...] The economic data is presented in bar graphs that distort the data. That is, rather than just comparing the magnitude of the comparative data displayed, the bar graphs displayed in the New London Ministry of Statistics exaggerate the differences since each item is comparing "areas" instead of just "lengths" (read: the actual amount).
- ❖ "A Closer Look at Comparisons" - [Example of "Does the general principle really apply to both sides?"...] The Cloud Buds™ company is sponsoring the BILL-I-AM's and Paprika Spice's joint performances with the expectation that the sponsorship will contribute to building a customer base for the Cloud Buds™ MP3 players. However, to the extent "The Royal Factor" book is accurate, the expenditure may be in vein (since New Londoners -- unlike American consumers -- are not as influenced by musician celebrities).
- ❖ "A Closer Look at Generalizations" - [Examples of the requirements to be met (as part of an accurate generalization) -- a representative sample size, a big enough sample size, and a well studied sample...] "The Royal Factor" book is [allegedly] based on data concerning the style emulation tastes of New Londoners but not enough information is provided to evaluate these claims.
- ❖ "A Closer Look at Cause and Effect" - [Example of a violation of "the cause and effect happened"...] With the expectation that the sponsorship of the concerts by Cloud Buds™ will help build a following among future MP3 owners in New London, to the extent the majority of the MP3 owners are under 21 and the venue for the concert series is in pub with a minimum age limit of 21 years old, it is unlikely the "cause" (read: the celebrity endorsement) will even "effect" the target audience.



### Two In-World Choices for Assessments

- (1) The discussion area for discussion-based assessments, &
- (2) The testing center that is programmed to e-mail written assessment results to the instructor.