

# The Computer as an Aid to Teaching Critical Thinking

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## Introduction

Recent conversations with Kognito Solutions<sup>1</sup> have, amongst other things, been about the use of the computer as an aid in teaching critical thinking skills. In particular, the specific situation under discussion was the application of fact-based, hypothesis-driven reasoning to case studies.

## Fact-Based Hypothesis-Driven Thinking

This approach to thinking is summarized in the following diagram.<sup>2</sup>

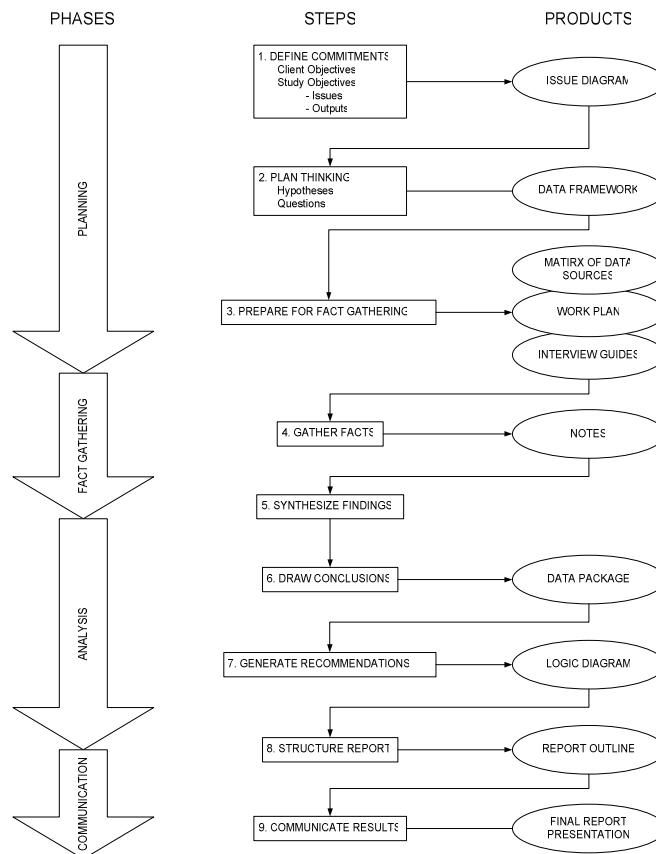


Figure 1 Fact-Based Hypothesis-Driven Thinking

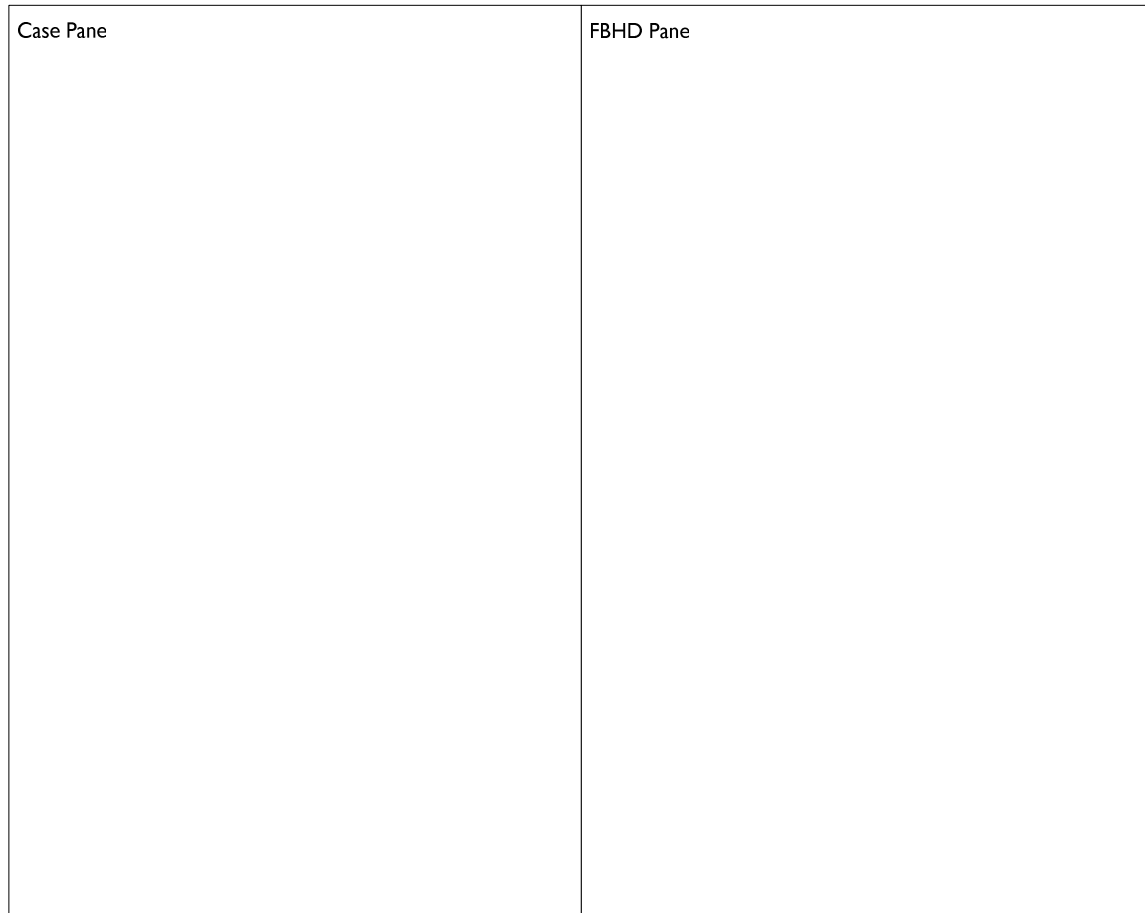
<sup>1</sup> [www.kognito.net](http://www.kognito.net). Special thanks to Jenelle Boucher, Ralph Vacca, and Ron Goldman.

<sup>2</sup> PDN, Consulting Problem Solving. The Professional Development Network, 1990.

Case studies are represented by the Harvard Business School approach, but could be characterized as any statement. For example, in a recent course the case was presented as "Your objective is to draw conclusions regarding the impact short sea shipping is likely to have on existing intermodal freight transportation."<sup>3</sup>

## **Concept**

The concept is that a computer screen is divided into two panes.



**Figure 2 Panes**

The left pane (Case Pane) contains all information about the case under consideration.

The right pane (FBHD Pane; fact-based hypothesis-driven) contains all the information related to use of the fact-based hypothesis-driven approach to critical thinking.

## **Talking the Talk**

Launching the Critical Thinking Teaching Assistant (CTTA) produces the following screen.

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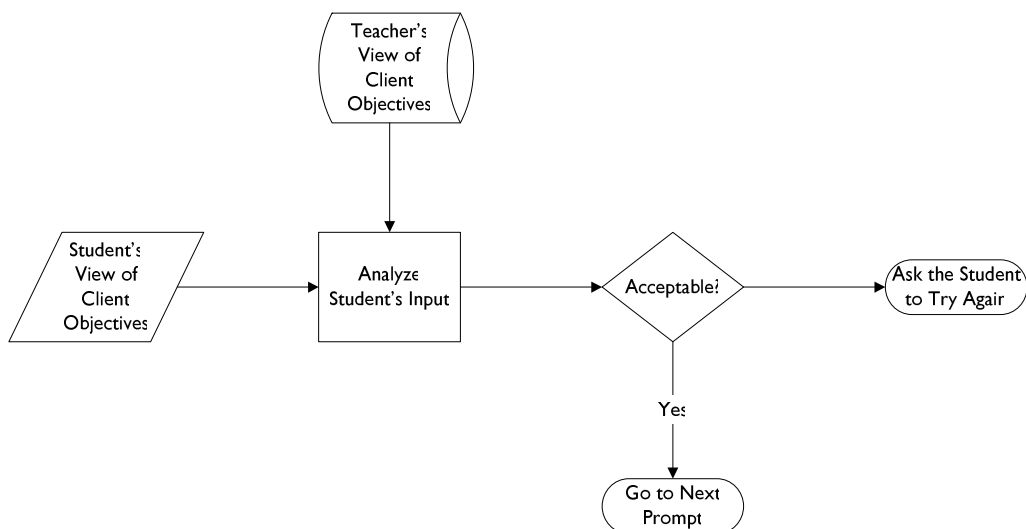
<sup>3</sup> TMGT 8360 Intermodal Freight Transportation, Fall 2004, Maritime College

<p>Case Pane</p> <p>Dave,</p> <p>As you know, we've been giving considerable thought to the question of what, exactly we are proposing to build for your client institutions: the Banks, Utilities, etc. Outlined below is the current state of our thinking, primarily from the production side. While it frames many of the critical questions, and begins to give shape to the answers, it is by no means the final word.</p> <p>For one, it is not yet fully in sync with the marketing strategies which we are also developing for you. Normally I would not want to give this to you until I had had the opportunity to review and further develop it with Skip and Scott, but I know that you are under some deadline pressure to incorporate some of this thinking into your response to KMS.</p> <p>For another, there are aspects to this, most notably with respect to outside content, which will have cost consequences: to your company, your client accounts, or both. Obviously you'll want to act with a measure of caution, so as not to commit to something which will cost you money, without your being able to bill it back to your clients.</p> <p>As well, there may be some technology issues. The full measure of functionality which is practical to offer via the Net.Commerce infrastructure which Viaduct will be implementing is, as yet, somewhat unclear to us.</p> <p>Of course, the beauty of the web is that so many things can be done in so many different ways, and the choices made will have consequences on other choices. Perhaps one of the most</p>	<p>FBHD Pane</p> <p>What are the clients objectives? Enter your response in the box below.</p> <div style="border: 1px solid black; height: 70px; width: 100%;"></div>
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**Figure 3 Opening Screen**

The student would write a few lines describing his view of the client's objectives in the box within the FBHD Pane.

Upon submission of this input the following takes place.



**Figure 4 Analysis and Feedback**

There is an analytical engine of some sort that compares the student's view of the client's objectives to the teacher's view. If acceptable, the student's answer would be placed in the FBHD Pane, the prompt for the objective changes, the input box removed, and a new prompt shown. Perhaps it would look something like this.

<p>Case Pane</p> <p>Dave,</p> <p>As you know, we've been giving considerable thought to the question of what, exactly we are proposing to build for your client institutions: the Banks, Utilities, etc. Outlined below is the current state of our thinking, primarily from the production side. While it frames many of the critical questions, and begins to give shape to the answers, it is by no means the final word.</p> <p>For one, it is not yet fully in sync with the marketing strategies which we are also developing for you. Normally I would not want to give this to you until I had had the opportunity to review and further develop it with Skip and Scott, but I know that you are under some deadline pressure to incorporate some of this thinking into your response to KMS.</p> <p>For another, there are aspects to this, most notably with respect to outside content, which will have cost consequences: to your company, your client accounts, or both. Obviously you'll want to act with a measure of caution, so as not to commit to something which will cost you money, without your being able to bill it back to your clients.</p> <p>As well, there may be some technology issues. The full measure of functionality which is practical to offer via the Net.Commerce infrastructure which Viaduct will be implementing is, as yet, somewhat unclear to us.</p> <p>Of course, the beauty of the web is that so many things can be done in so many different ways, and the choices made will have consequences on other choices. Perhaps one of the most</p>	<p>FBHD Pane</p> <p><u>Client's Objectives</u></p> <p>Build functional system that met client institutional needs and align with our marketing plan</p> <p>What are the issues that are addressed in this case?</p> <div style="border: 1px solid black; height: 60px; width: 100%;"></div>
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**Figure 5 Client's Objective Accepted**

Suppose the student's input was unacceptable. We might change the opening prompt from

"What are the client's objectives? Enter your response in the box below."

to

"Your answer is not quite what was expected. Please reread the case, change your input, and try again."

Suppose the student's second try is still short of the mark. The prompt could be changed to

"You are still missing some important elements of the client's objectives. Please look at the case again. Those words that are important to describing the client's objective have been highlighted. Please pay special attention to these. Try one again making sure you have given proper consideration to these words in your answer."

The analytical engine is collecting information on the student's interaction in order to help the teacher focus on those students who truly need help. For example:

- I. Number of students providing an acceptable answer on the first, second, and third requests.
  - a. There's a sub-point here. If we find the numbers at for the second or third requests are unexpectedly high, then we out to examine how the teacher has prepared (Teacher's

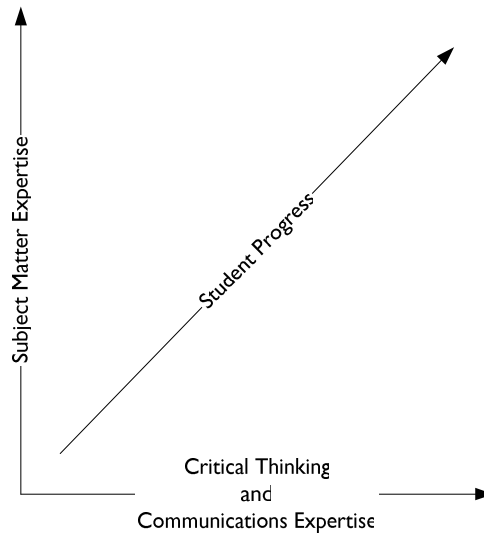
View of Client Objectives in Figure 4 Analysis and Feedback on page 3). Or perhaps the case is difficult to understand.

2. Some analysis of grammar and syntax can also take place. We should never ignore an opportunity to improve the communications skills of our students (or ourselves, for that matter).
3. Perhaps there is also some notion of measuring the time the student is involved with the system. Is the person taking longer than we expected? Less than we expected? What are the implications?

One keeps cycling between the student's input, the analysis and feedback, ultimately ending with the FBHD Pane containing the student's accepted answers to the key elements of fact-based hypothesis-driven as summarized in Figure 1 Fact-Based Hypothesis-Driven Thinking on page 1.

## Closing Thoughts

### *Why?*



**Figure 6 The Objective**

It seems to me that our objective as teachers is to improve the student's expertise (i.e., knowledge and skills) in the subject matter, and in critical thinking and communications. If CTTA can have a measurable, positive impact on achieving this objective, then it seems to me it ought to be used.

It provides an environment where the students who are fast and good can be fast and good. This frees more of the teacher's resource to focus on those students who really need personalized attention. Perhaps it is possible to deliver a higher quality learning experience and to also deliver it at lower resource levels.

The amount of education of all kinds delivered via the distance learning concept continues to grow. CTTA fits within that context.

CTTA allows one to take advantage of expertise that might be otherwise difficult to get into the classroom.

### *Why Not?*

CTTA represents a change in pedagogy. Teachers must make a significant initial commitment to capture their ideas regarding critical thinking and how it can be assessed. The development of the analytical engine and the database upon which it depends may be no small task.

Teachers may feel disenfranchised. They may look upon this as their brain being squashed into a box and develop resentment.

CTTA can not discern. It is a system and like all systems will eventually be understood by the students. Some of these students may find ways to bend the system to their advantage.

### ***What Next?***

The idea needs to be vetted in the education community. Those doing the vetting need to have a penchant for new ideas.

If it passes, then a prototype should be built and deployed in a more or less controlled environment. This environment should, however, be a real class.

Learn from the initial experience.

Relaunch and relearn. Then relaunch and relearn.

### **Coda**

I first heard about Symbiotic DSS from the late Prof. Marvin Manheim, then at MIT and later at Northwestern University. CTTA is an example of Symbiotic DSS, taking the best of the person and the best of the machine to create a quality output that would be difficult for the person or the machine to produce alone.

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