Learning Objectives:

• Identify the characteristics of critical thinking for accounting education
• Analyze the impact of student assumptions on critical thinking development
• Determine the cognitive levels demonstrated in very short student writing
• Apply cognitive levels to Bloom’s taxonomy
• Select critical thinking learning activities for an accounting course
• Analyze educational design through discussion with other accounting educators
How Do Accountants Define Critical Thinking?

• Decision Making Skills
• Used With:
  • Accounting Technical Knowledge
  • Communication Skills
  • Other Professional Skills (Objectivity, Skepticism, Due Care, Continuous Improvement, Ethics, etc.)

See examples and discussion in Wolcott & Sargent, 2021, Critical Thinking in Accounting Education: Status and Call to Action, Journal of Accounting Education 56
Schema Theory, Cognitive Development, and Critical Thinking
Schema Theory

Schemas
• Abstract and dynamic representations of knowledge in the brain (subjects, events, places, procedures, persons, etc.)
• Based on past experiences
• Include expectations, inferences, and misconceptions
• Develop throughout life

See, for example:
• Schema_Theory_and_Concept_Formation.pdf (mit.edu)
Schema Theory and Student Learning

Student’s Prior Schemas

New Information
Intended learning (new knowledge, skills, attitudes, integration)

New Information Not “Learned”
Includes New Information for Which Student Has:
- Inadequate prior schemas
- Inability to make inferences
- Interfering misconceptions

Filtering and Transformation by the Student ➔ New Schemas

Wolcott and Sargent, AICPA webinar, October 21, 2022
KEY Beliefs That Hinder Progress

Stage 1: Confused Fact-Finder
- All problems are “black and white”
- The student’s job is to find the correct answer as provided by experts

Stage 2: Biased Jumper
- Open-ended problems cannot be solved by anyone, including “experts”
- It is sufficient to generate arguments to support one’s own position

Stage 3: Perpetual Analyzer
- Supporting one conclusion denies the legitimacy of other valid viewpoints

Stage 4: Pragmatic Performer
- Open-ended problems can be solved tentatively and pragmatically based on available information
- No generalized principles or procedures exist for further investigation/improvement

Adapted from AICPA Faculty Guide p. 9, Figure 4. This figure omits Stage 5, which is beyond entry-level expectations.

At Each Stage: Students will not develop higher-stage critical thinking skills until their schema changes ➔ Education needs to focus on knowledge, skills, AND beliefs.

Most Introductory & Many Intermediate Accounting Students
Most Students at Graduation
Entry Workplace Requirements

Wolcott and Sargent, AICPA webinar, October 21, 2022
Examples of Student Thinking: Seattle Sandwich Case
**Brief Business Description**

- Seattle Sandwich makes and sells 7 types of sandwiches to approximately 40 customers (lunch carts in or near downtown Seattle)

- **Key Personnel:**
  - Owner no longer involved in day-to-day operations; enjoys creating new ideas for the daily sandwich special and daily vegan wrap
  - Manager of operations
  - Manager of sales and marketing
  - Internal accountant

- Case scenarios involve budgeting and variances, including planning and operational issues

- Student plays the role of an accounting intern who is assisting in the development of next year’s budget

**Example: Case Question**

You are having difficulty deciding how to budget production labor costs. The production manager sets a weekly schedule for hourly workers, adjusting the schedule for changes in sales volumes. In addition, the manager can send workers home early if sales are lower than expected or production goes more quickly than usual. In previous budgets, hourly labor was treated as a variable cost. However, a certain number of workers is generally needed, and the manager is reluctant to send workers home early too often for fear of losing good employees. Accordingly, you are wondering whether hourly labor costs should be treated as a fixed cost in next year’s budget.
My idea would be to make it a variable cost and not change it. Since there is no set amount of time someone could be there they cannot be certain it would be a fixed cost. For this reason it would have to stay as a variable. No matter how much they can try to make certain set hours, it would be divided among several people instead of one. For this reason it would be hard to make it a fixed because it would involve several accounts as opposed to one set account.

Which Schema Does This Student Seem to Be Using?
My recommendation for next year’s budget is that hourly labor costs should be fixed, rather than the past variable. If there needs to be a certain number of workers to do the production, then schedule as many workers as needed and do send them home early if they run out of work to do. This might make some good employees that are needed angry and quit. To avoid this, schedule less workers in the already known slow days, rather than just sending someone home. Also, if next year’s budget is changed to fixed costs, the manager won’t have to keep figuring out different totals—but instead have the same numbers to work with every time. This would allow more time for improving the production.

Which Schema Does This Student Seem to Be Using?
Based on the information given, I would like to recommend that hourly labor costs be treated as a mixed cost.

I would recommend reviewing last year’s pattern of sales (the cost driver) in the budget and possibly time cards to figure as closely as possible the fixed hourly labor costs by narrowing down any hours that are repeated every week along with any seasonal hours that happen every year.

For an estimate of the variable cost, I recommend an average of all hours that did not remain constant.

Which Schema Does This Student Seem to Be Using?
## Critical Thinking Skills Rubric

<table>
<thead>
<tr>
<th>Component of Critical Thinking Model</th>
<th>Stage 1: Little/No Critical Thinking (Confused Fact-Finder)</th>
<th>Stage 2: Partial Critical Thinking (Biased Jumper)</th>
<th>Stage 3: Emergent Critical Thinking (Perpetual Analyzer)</th>
<th>Stage 4: Competent Critical Thinking (Pragmatic Performer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify</td>
<td>Recites purpose as given, or identifies an inappropriate problem</td>
<td>Identifies the clearly-evident problem</td>
<td>Identifies the main purpose</td>
<td>In addition to Stage 3: identifies important embedded, subsidiary problem(s)</td>
</tr>
<tr>
<td></td>
<td>Identifies the clearly-evident problem</td>
<td>Recognizes that the problem is open-ended/ambiguous</td>
<td>Identifies relevant stakeholders and their possible goals/preferences</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Identifies the clearly-evident problem</td>
<td>Recognizes that the problem is open-ended/ambiguous</td>
<td>Identifies relevant accounting knowledge, concepts and techniques</td>
<td></td>
</tr>
<tr>
<td>Anaylze</td>
<td>Applies calculations, definitions, or other “textbook” concepts</td>
<td>Applies and describes the effects of relevant calculations and/or concepts</td>
<td>Thoroughly and objectively applies and interprets relevant calculation(s) and concept(s)</td>
<td>Objectively analyzes the most important relevant information, implications, consequences and viewpoints</td>
</tr>
<tr>
<td></td>
<td>Presents irrelevant information</td>
<td>Partially analyzes alternatives, focusing on information supporting own viewpoint</td>
<td>Explores causes, stakeholder effects and interrelationships</td>
<td>Evaluates the quality of information and assumptions, and adapts interpretations (as needed)</td>
</tr>
<tr>
<td></td>
<td>Misinterprets calculation(s) and/or concept(s)</td>
<td>Discounts other viewpoint(s)</td>
<td>Questions the quality of information and assumptions</td>
<td>Summarizes the most important pros and cons of viable alternatives</td>
</tr>
<tr>
<td></td>
<td>Instead of a conclusion, provides facts, definitions, or other “authoritative” statements</td>
<td>Reaches a biased conclusion that is consistent with analyses</td>
<td>Thoroughly discusses the pros and cons of viable alternatives</td>
<td></td>
</tr>
<tr>
<td>Conclude</td>
<td>Reaches a biased conclusion that is consistent with analyses</td>
<td>Reaches no conclusion, or provides a conclusion with little or no justification</td>
<td>Identifies/develops appropriate criteria, and uses the criteria to reach convincing conclusion(s)</td>
<td>Identifies/develops appropriate criteria, and uses the criteria to reach convincing conclusion(s)</td>
</tr>
<tr>
<td></td>
<td>Instead of a conclusion, provides facts, definitions, or other “authoritative” statements</td>
<td>Reaches a biased conclusion that is consistent with analyses</td>
<td>If appropriate, provides value-added advice (e.g., identifies implementation issues)</td>
<td></td>
</tr>
</tbody>
</table>

AICPA Faculty Guide p. 36, Figure 20
Critical Thinking Development and Bloom’s Taxonomy
# Cognitive Development Stages and Bloom’s Taxonomy

<table>
<thead>
<tr>
<th>Revised Bloom’s Taxonomy (Anderson et al.,)</th>
<th>Stages Described in AICPA Faculty Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apply</strong>&lt;br&gt;Carry out or use a procedure in a given situation</td>
<td><strong>Stage 1</strong> Confused Fact-Finder&lt;br&gt;Carry out a well-defined procedure in a familiar setting</td>
</tr>
<tr>
<td><strong>Analyze</strong>&lt;br&gt;Break material into its constituent parts and determine how the parts relate to one another and to an overall structure or purpose</td>
<td><strong>Stage 2</strong> Biased Jumper&lt;br&gt;Distinguish between relevant and irrelevant information; focus on support for own viewpoint</td>
</tr>
<tr>
<td><strong>Evaluate</strong>&lt;br&gt;Make judgments based on criteria and standards</td>
<td><strong>Stage 1</strong> Confused Fact-Finder&lt;br&gt;Locate information and viewpoints in a well-defined problem</td>
</tr>
<tr>
<td><strong>Create</strong>&lt;br&gt;Put elements together to form a coherent or functional whole; reorganize elements into a new pattern or structure</td>
<td><strong>Stage 1</strong> Confused Fact-Finder&lt;br&gt;Reorganize procedures (e.g., rearrange a spreadsheet) when performing a well-defined task</td>
</tr>
</tbody>
</table>

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Critical Thinking
Learning Activities
Across the Curriculum
As explained by Jeff Thomson (Reding & Newman, 2017):

“Data analysis and critical thinking skills are interdependent. Data analysis requires you to think critically by probing, connecting disparate facts, synthesizing, etc. Likewise, critical thinking is enabled by thinking analytically and applying tools to help extract insights and actionable information from data. (p.1)”
Importance to the overall curriculum

• AIS concepts and the associated data analytics must be taught as part of the accounting curriculum (Borthick, 1996).

• Business and accounting schools need to teach data analytics to their students because it is a core business discipline (Vasarhelyi et al., 2017).

• It is crucial to teach accounting students the most commonly used business software, and those pieces of software cover multiple categories such as spreadsheets, databases, data visualization, and accounting/ERP (Dzuranin et al., 2018).

Standards driving data analytics into the curriculum

• PCAOB Auditing Standard (AS) 2305 – Analytical Procedures – “are an important part of the audit process and consist of evaluations of financial information made by a study of plausible relationships “

• AACSB Standard A5 - “Data analytics including, for example, statistical techniques, clustering, data management, modeling, analysis, text analysis, predictive analytics…”

• AACSB Business Standard 9 - accredited programs should “integrate current and emerging technologies, including the application of statistical tools and statistical techniques, data management, data analytics…..”
Main Types of Data Analytics for Accounting Courses

- **Descriptive**
  - Insight into information from the past
  - Standard reports
  - Basic spreadsheet functions
  - Example: vertical and horizontal analysis of financial statements

- **Diagnostic**
  - Understand why an event occurred
  - Identify potential root cause
  - Example: Use spreadsheet to identify potential sources of ergonomic risks within the work environment (Aqlan et al., 2020)

- **Predictive**
  - Information from descriptive and predictive analytics to build forecasts and scoring models
  - Develop models (e.g., to test for key control failures)
  - Example: Predict account balances for comparison with client accounting records

- **Prescriptive**
  - Recommend solutions
  - Show possible outcome of solutions

Adapted from Appelbaum et al., 2018

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Critical thinking learning activities

- **Microsoft Excel** - The business problems include questions on inventory tracking or determining the most profitable items per unit, and they could create a visual display to summarize data into useful information for managerial decision-making. (descriptive analytics)

- **MS Access** – Students create queries and reports to help assess the data. Questions to be answered could include a) what was the average amount billed per transaction, b) what was the average amount billed for each service type, and c) what was the average amount billed per client type. (descriptive analytics) and look at why there were differences throughout the period (diagnostic analytics).

- **Quickbooks** - The deliverables could include traditional financial statements, business reports (A/R aging, transactions lists, purchases by item detail, and inventory status), a summary of the data within the main reports (descriptive analytics), explanations of why key metrics changed (diagnostic analytics), produce forecasts of the income statement, statement of cash flows, and balance sheet for each of the next two years (predictive analytics), and using the data to help make suggestions on how to improve key metrics of the business (prescriptive analytics).

- **Tableau/Power BI** – Students could present views on sales and profits (descriptive analytics), assess what products may need to be priced differently or possibly discontinued (predictive analytics) and outline additional pricing and product line strategy decisions (prescriptive analytics).
Design an Assignment for Critical Thinking

Allow for Slow and Unstable Development Within and Across Courses

Many Opportunities to Practice

Open-Ended Problem

Questions for Multiple Stages

Support and Feedback

Student Responses by Stage

Add Information Including Uncertainties that Prevent Single Correct Answer(s)

Support Development, If Needed, for:
- Stage 2
- Stage 3
- Stage 4 (Maybe)

Summarize % of Students Who Perform Well on Questions for Each Stage

Such As:
- Critical Thinking Model
- Rubric

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Assignment Design: Complexity

<table>
<thead>
<tr>
<th>Component of Pathways Vision Model</th>
<th>Stage 1: The Confused Fact-Finder</th>
<th>Stage 2: The Biased Jumper</th>
<th>Stages 3 and 4: The Perpetual Analyzer The Pragmatic Performer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic Activity</td>
<td>Straightforward, easily understood events and circumstances</td>
<td>Moderate scope and interaction of events and circumstances</td>
<td>Realistic scope of activities that may be highly complex</td>
</tr>
<tr>
<td>Shades of Gray</td>
<td>A few sources of uncertainty</td>
<td>Multiple sources and degrees of uncertainty</td>
<td>Many sources and degrees of uncertainty</td>
</tr>
<tr>
<td>Accounting Judgments</td>
<td>Few accounting judgments</td>
<td>Several accounting judgments</td>
<td>Many accounting judgments</td>
</tr>
<tr>
<td>Useful Information</td>
<td>Information is either useful or not useful/irrelevant</td>
<td>Questions exist about the degree of information usefulness</td>
<td>Many questions exist about information usefulness</td>
</tr>
<tr>
<td>Good Decisions</td>
<td>Few stakeholders and uncomplicated decisions</td>
<td>Multiple stakeholders and decisions involving multiple factors</td>
<td>Many stakeholders with divergent interests and complex decisions</td>
</tr>
<tr>
<td>Consequences</td>
<td>Few consequences with clear-cut cause and effect relationships</td>
<td>Some uncertain cause and effect relationships</td>
<td>Many complex and uncertain cause and effect relationships</td>
</tr>
</tbody>
</table>