



ASSESSMENT OF CRITICAL THINKING SKILLS IN PRINCIPLES OF MACROECONOMICS USING THE 21ST CENTURY BLOOM'S TAXONOMY MODEL

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Abstract:

Studies on critical thinking skills development with specific curriculum materials and instructional methods in economics are few and have been highly theoretical. This paper outlines the framework for developing the 21st Century Bloom's Taxonomy model across a four-year undergraduate curriculum, enabling students to master critical thinking skills through a clearly defined six-stage process. An example Country Report project from an undergraduate Principles of Macroeconomics course is presented to demonstrate a specific strategy for advancing and assessing critical thinking skills. A critical thinking assessment instrument is also presented to compare student and instructor evaluations from the Country Report assignment.

Keywords: Bloom's Taxonomy, critical thinking, assessment, economic education

1. Introduction

This paper presents a strategy for developing and assessing critical thinking skills through an assigned term-long project used in the undergraduate Principles of Macroeconomics class. The 21st Century Bloom's Taxonomy model (Bloom, et al. 1971 and 1974; Anderson and Krathwohl, 2001) has been implemented for guiding students' work via its six stages of critical thinking development. Bloom's framework provides a logical process for students to advance critical thinking skills from the most simple to the highest order cognitive skills. In 2001, Lorin Anderson and David Krathwohl proposed a revised framework for the original Bloom's Taxonomy model. In this revised model, *Knowledge* was replaced by *Remembering*, *Synthesis* by *Evaluating*, and *Evaluation* by *Creating* (Anderson and Krathwohl, 2001). This 21st Century Bloom's Taxonomy model (Figure 1) has been implemented in classroom activities to develop

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critical thinking skills within the Management undergraduate program at the U.S. Coast Guard Academy (USCGA).

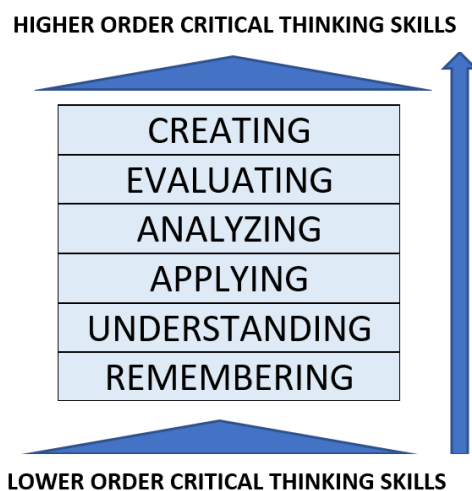


Figure 1: The 21st Century Bloom's Taxonomy Model
(Source: Anderson and Krathwohl (2001))

According to the model (Figure 1), critical thinking develops via a progression from lowest order to highest order thinking; *Remembering*, *Understanding*, *Applying*, *Analyzing*, *Evaluating*, and *Creating*. Moving upwards within the skills framework requires mastery of the previous skill. This mastery requires close facilitation from academic faculty to support and enable students to progressively develop the critical thinking skills (Springer and Borthick, 2004).

Over the years, a variety of instruments have been developed to advance and assess critical thinking skills progression (Ennis, 2008; Heinrich et al. 2015). According to Adams (1999), the most frequently used assessment instrument for critical thinking is the Watson-Glaser Critical Thinking Appraisal tool. Several years after Watson-Glaser's implantation, the California Critical Thinking Skills Test and the California Critical Thinking Disposition Inventory instruments were developed (Facione, et al., 2000 and et al., 2001) to provide indirect measures of critical thinking abilities. Huba and Freed (2000) developed rubric techniques to assess critical thinking and problem-solving abilities. Despite these nation-wide assessment techniques, little measurable progress has been made in developing in-class assessment tools for students' critical thinking abilities in business and economics education (Coleman et al., 2012). This paper contributes to the existing literature on development and assessment of critical thinking skills by providing a strategy for progressive advancement and monitoring of critical thinking skills mastery throughout the six stages using the 21st Century Bloom's Taxonomy.

2. Framework for Developing Critical Thinking Skills across Curriculum in a Four-Year Undergraduate Program

At the USCGA, the 21st Bloom's Taxonomy Model was adopted to advance critical thinking skills through the six stages of critical thinking development (*Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating*) starting from the freshman level and ending at the senior level within four years of undergraduate education. This model has been developed and linked to specific courses within the undergraduate curriculum of USCGA's Management Department as presented in Figure 2. In the freshman year, students develop and demonstrate the skills of *Remembering, Understanding, and Applying*. In the sophomore year, students must master *Analyzing*. During junior year, they generally master *Evaluating* and, finally, progress to the *Creating* skill by the end of their senior year.

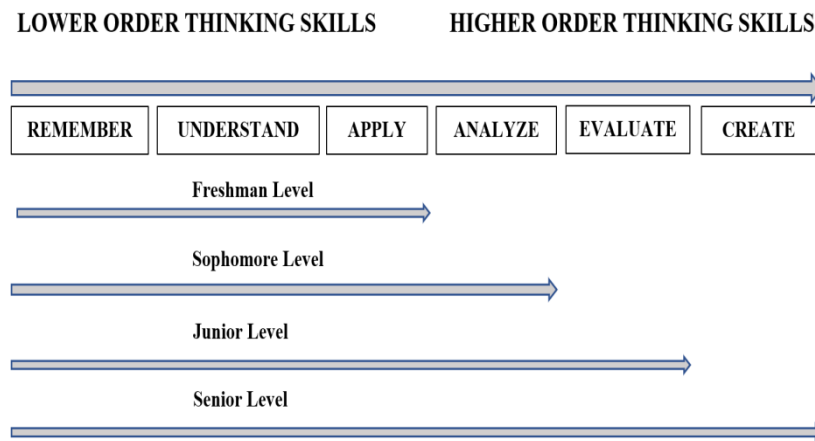


Figure 2: Critical Thinking Skills Process from Freshman Level to Senior Level
 (Source: Department of Management, USCGA (adopted and modified from Bloom's Taxonomy by P. Armstrong, Vanderbilt Center for Teaching, Vanderbilt University))

The process of critical thinking development requires a sequential process where students are guided through specific stages in selected courses throughout the Management curriculum (Table 1). Critical thinking development is achieved as students gain knowledge through experience and evaluation of their skills through numerous assignments and projects required over the six stages of the 21st Century Bloom's taxonomy model. Enabling students to clarify their reasoning through written reports and oral presentations further stimulates higher order critical thinking. The goal is to have at least one course per semester where assignments or projects target specific critical thinking skills. This pedagogical approach fosters critical thinking and motivates students to share and analyze their experiences and knowledge. An assessment process is used to ensure that every student is progressively advancing and that the critical thinking skills are both self-assessed and instructor-evaluated. Principles of Macroeconomics is the first in a series of Management courses where students are

assessed in specific stages of critical thinking using the 21st Century Bloom's Taxonomy, as highlighted in Table 1.

Table 1: Management Major – General Plan of Study

Fall Semester	Spring Semester
Fourth Class Year – Freshman Year	Fourth Class Year – Freshman Year
College Composition	History of the USCG
American Government	Cultural Perspectives
Calculus I	Computer Problem Solving
Principles of Fitness/Wellness I	Probability & Statistics
Swimming I	Personal Defense I
Chemistry I	Principles Fitness/Wellness II
Fundamentals of Navigation	Physics I
	Principles of Macroeconomics
Third Class Year – Sophomore Year	Third Class Year – Sophomore Year
Lifetime Sports I	Introduction to Cyber Technology
Lifetime Sports II	Morals and Ethics
Lab Science	Law
Ships & Maritime Systems	Professional Rescuer
Applications in Navigation Lab	Atmospheric & Maritime Science
Introduction to Business	Financial Accounting
Organizational Behavior & Leadership	Legal Environment of Business
Microeconomic Prin	
Second Class Year – Junior Year	Second Class Year – Junior Year
Maritime Watch Officer	Personal Defense II
Management Info Systems	Lifetime Sports III
Managerial Accounting	Marketing
Research Methods	Financial Management
Human Resource Management	Operations & Project Management
	Leadership/Organizational Development/Change
	Major Area Elective
First Class Year – Senior Year	First Class Year – Senior Year
SelTop 100 Ton Master	Global Studies
SelTop 100 Ton Lab	*Public Management Consulting (PMC)*
Strategic Management	Major Area Elective
PMC Prep	Major Area Elective
Major Area Elective	Free Elective
Free Elective	Physical Education
Physical Education	

* Courses that develop and assess critical thinking skills.

3. Framework to Advance Critical Thinking in Assignments

The process of critical thinking development in a report or project begins with reading the instructions to understand the nature of the tasks required. Completion of these specially designed assignments is expected to reinforce students' progression through one or more steps in the six-stage model. Each stage of the process is important to

achieve effective instruction and learning. Figure 3 illustrates questions that reflect the primary goal to be achieved at each stage of the critical thinking model. These questions can serve as a platform for the development of teaching approaches that foster critical thinking. Faculty also use specific tasks and prompts while structuring their projects and assignments. For example in stage one of critical thinking, instructors may use the following tasks: *define, duplicate, list, memorize, recall, repeat, and state*. Experience demonstrates that this model facilitates sequential advancement of critical thinking skills in an undergraduate Management education.

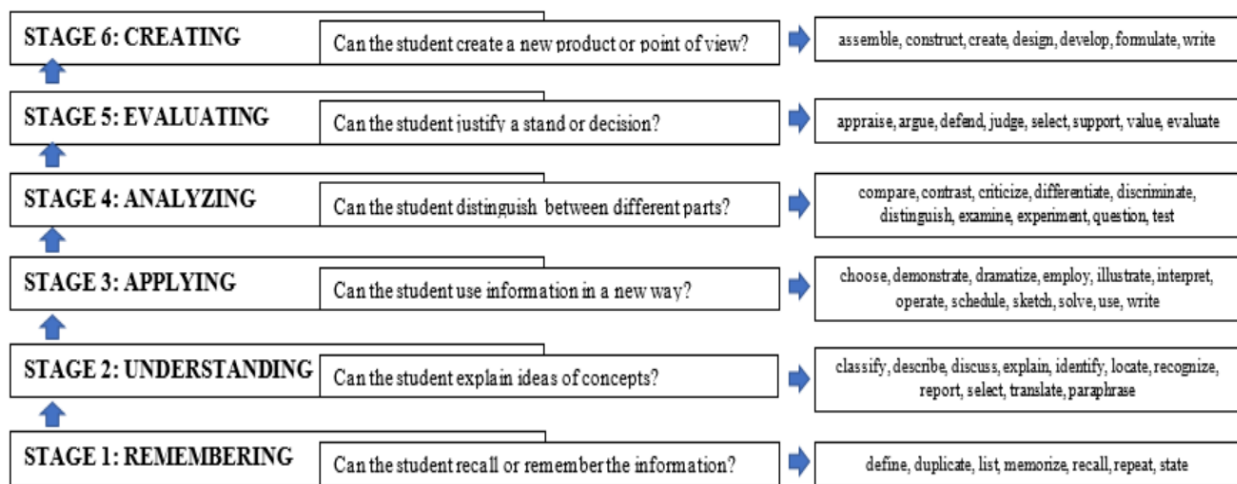


Figure 3: Development and Assessment of Critical Thinking Skills
 (Source: Department of Management, USCGA - adopted and modified from Bloom's Taxonomy by P. Armstrong, Vanderbilt Center for Teaching, Vanderbilt University)

4. Example of Instructional Approach to Advance Critical Thinking in Principles of Macroeconomics: A Country Report Project

Figure 4 represents the *Country Report* handout given to freshman students in the Principles of Macroeconomics course at USCGA. This project is assigned at the beginning of the course and is due during the last week of class. The questions posed to students elicit critical thinking at each stage of development. Given the freshman audience of this course, the focus is on developing and assessing: *Remembering, Understanding, and Applying*. A description of the fourth stage is also given so students can begin to understand and anticipate the subsequent critical thinking skill, *Analyzing*, that will be expected of them in their sophomore year.

5. Principles of Macroeconomics: Country Report Project

Stages of Completing Project Presentation	Questions To Be Answered
Stage 1: Remembering	What are the macroeconomics concepts that you plan to use while working on your country project? Please list and define them. Do you plan to use graphs? What are those graphs? How do they work in a context of your presentation? What do they illustrate?
Stage 2: Understanding	The second step is to evaluate your understanding of these concepts and graphs. Are they all valid economic concepts, graphs, or instruments to be used to evaluate a given country's economic performance? How would you use those selected concepts and graphs to explain the current events affecting economic performance of your country? What is the main purpose of using those concepts or graphs?
Stage 3: Applying	The third step is apply these graphs or concepts correctly. How would you use selected macroeconomics concepts, theories, and graphs to apply in your project? How would you show your understanding of those concepts in your project? Did you use the correct graphs and concepts to explain your points? What would result and what could be gained if you applied additional concepts or graphs?
Optional Step Stage 4: Analyzing	An optional step in this project is to think critically about what the macroeconomic concepts you applied mean for the given country. This step is not required for completion of this project. Why do you think selected concepts, graphs, theories are the best to be used, applied and analyzed? What inferences can you make on your country in a context of current events? What conclusions can you draw about your country after your applied selected concepts, theories, and graphs? How would you categorize each concept, theory, or graph: irrelevant, relevant, good, or outstanding to be applied in order to complete your project?

Figure 4: Principles of Macroeconomics: Country Report Project

Purpose: This assignment is designed to (1) increase your understanding of economic performance of a country; (2) familiarize you with the various sources of data and the problems encountered in economic research, and (3) give you an opportunity to contrast the abstract and theoretical analysis in this course with real-world observations.

Scope: You will focus your attention on a single country during this phase of your research. Use the theoretical analysis developed in class to collect data and information needed to complete this project. Begin working early and do not underestimate the time constraints imposed by this assignment as it cannot be completed adequately in the final week before it is due.

Assignment: You will complete a two-page written report and deliver a 10-minute (maximum) oral presentation that answers the questions above for a country of your choosing. You are expected to collect information relevant to domestic economic indicators of your country. Do not limit your collection to one year but include as many years as there are available for your country. Data must be collected on the appropriate

items/categories and for a period of time sufficient to give an accurate economic representation of the country. The information you collect should include, but not be limited to: summary of the extent of country's resources, technology base, trading partners, export and import commodities, measure of the overall level and importance of domestic production, economic performance, international trade, tariffs and other trade restrictions, measures and extent of trade balances and flows, and significant political or cultural economic influences. Please notice you do not have to include all the above information but select information and collect the data that is relevant to your project and that will enable the best application of class concepts and/or analysis of economic trends. (Source: Principles of Macroeconomics, USCGA)

5. Assessment of Learning Outcomes

After students complete their written reports and deliver their presentations, they are asked to complete a self-evaluation of their critical thinking skills. After students complete their self-evaluations, the instructor conducts his evaluation of students' critical thinking skills progress.

Bloom's Taxonomy Level (revised)	Objectives	Critical Thinking Skills Characteristics	Learner's Self-evaluation	Teacher's Evaluation
			Developing (D) Competent (C) Exemplary (E) (Circle one for each stage)	
Level 1 Remembering	Can the student recall or remember the information?	Define, Duplicate, List, State, Repeat, Memorize, Recall	D C E	D C E
Level 2 Understanding	Can the student explain ideas or concepts?	Classify, Describe, Discuss, Explain, Identify, Locate, Recognize, Report, Select, Translate, Paraphrase	D C E	D C E
Level 3 Applying	Can the student use information in a new way?	Choose, Demonstrate, Write, Employ, Illustrate, Solve, Operate, Schedule, Sketch, Dramatise, Interpret, Use	D C E	D C E
Level 4 Analyzing	Can the student distinguish between different parts?	Appraise, Compare, Contrast, Criticize, Differentiate, Test, Discriminate, Distinguish, Examine, Experiment, Question	D C E	D C E
Level 5 Evaluating	Can the student justify a stand or decision?	Appraise, Argue, Defend, Judge, Select, Support, Value, Evaluate	D C E	D C E
Level 6 Creating	Can the student create a new product or point of view?	Assemble, Construct, Create, Design, Develop, Write, Formulate	D C E	D C E

Figure 5: Assessment Instrument for Development of Critical Thinking Skills Across All Designated Courses in Management Department
 (Source: Department of Management, USCGA (adopted and modified from Bloom's Taxonomy by P. Armstrong, Vanderbilt Center for Teaching, Vanderbilt University))

Figure 5 illustrates the assessment instrument developed and used sequentially in all designated courses in Management department at USCGA. Those courses include Principles of Macroeconomics, Organizational Behavior and Leadership, Managerial Accounting, Public Management Consulting, and a Major Area Elective, as illustrated in Table 1.

Principles of Macroeconomics is a freshman level course at USCGA. To align the project's critical thinking skills development with the goals of the department, the minimum expectation for all students in the course is to demonstrate the first three stages of critical thinking. Within the assignment prompt, students are also asked questions to elicit thinking in stage four as an optional further step. For example, students are asked: *What inferences can you make on your country in a context of current events? What conclusions can you draw about your country after your applied selected concepts, theories, and graphs?* The purpose of this is to introduce students to the next critical thinking stage, as they will be expected to develop and master it the following year. Given the clear focus of this assignment on the first three to four stages, the last two stages of the 21st Century Bloom's Taxonomy (*Evaluating* and *Creating*) are not included in the provided assessment. Although, the assessments provide useful feedback, they are not incorporated into the project's grade received by each student. Students understand that the self-assessment and teacher's assessments are used to monitor and evaluate their critical thinking skills advancement; it is not considered as a grading tool.

As illustrated in Figure 5, the assessment used at USCGA places students into one of three categories for each stage of critical thinking progression: *developing*, *competent*, and *exemplary*. This approach mirrors the language used in the communications skill's assessment completed annually for each student in the Management major. The goal is that students are either *competent* or *exemplary* for each critical thinking skill expected of their year group. For example, all freshman students should be *competent* or *exemplary* in critical thinking levels one through three by the end of the Principles of Macroeconomics course. Any students found to be *developing* in a skill expected of them should have a conversation with the faculty member and/or their academic advisor to determine a strategy to further progress that skill. Each individual progression is carefully traced and the students are provided with the instructor's feedback progressively to make sure that all students advance. If a student does not progress, extra assignments can be used to allow the student to catch up and be ready for the next academic year.

The assessment and feedback process is a key part of critical thinking development. With assignments tailored to target specific critical thinking stages, instructors can then evaluate students based on these benchmarks and compare the self-evaluation with the teacher's evaluation. In addition to using the assessment for individual student development, the instrument can also be used for assessment of critical thinking skills progression across the major. When conducted across multiple courses taught by multiple faculty members, this assessment provides a sample large enough to evaluate the strengths and weaknesses of critical thinking advancement across the curriculum. It also allows students and their academic advisors to track

development of critical thinking skills as the student progresses through the major. The feedback on skills development can include a meeting with a faculty member or a simple e-mail with comments regarding deficient areas. Additionally, the faculty members note where the students' self-evaluations are significantly different from the teacher's evaluation. If those differences are substantial, students are informed of where they under or over self-assessed relative to instructor's evaluation. As stated earlier, the faculty are also responsible for tracking these assessments to make final decisions whether students are adequately progressing.

6. Initial Assessment Results and Observations

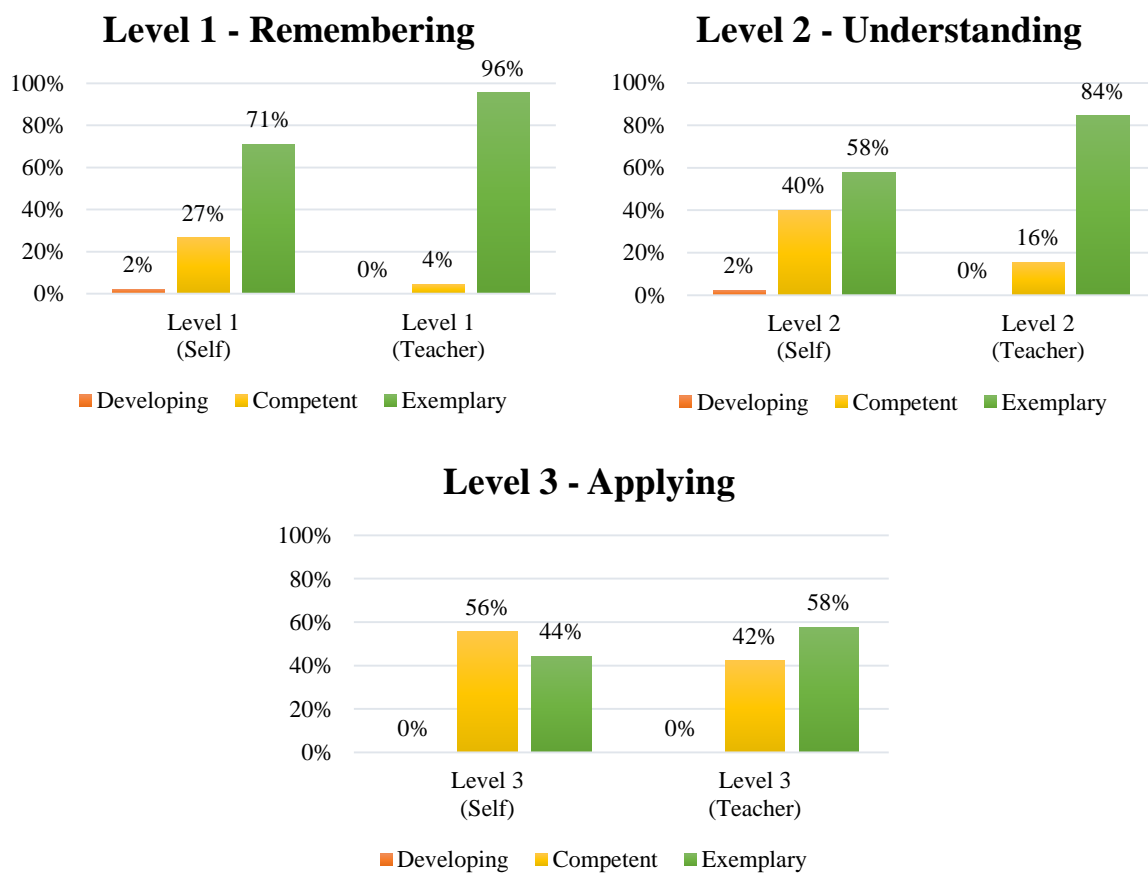


Figure 6: Fall 2018 Principles of Macroeconomics Assessment Results

The first semester of using this critical thinking assessment was in fall 2018 with 45 students enrolled in Principles of Macroeconomics. Figure 6 represents the students' self-assessments and teacher's evaluations for the first three critical thinking levels in each assessment category: *developing*, *competent*, and *exemplary*.

7. 21st Century Bloom's Taxonomy Levels 1-3

With this initial small sample size, it is difficult to make many overall observations, but there are still a few noteworthy trends in the data collected. The primary observation is

that no students were recorded by the instructor as *developing* for any of the first three levels measured. This aligns with the goal of having no freshmen students in the *developing* category for these three levels. In addition, students seemed to evaluate themselves lower than their teachers evaluated them. This is particularly true for levels one and two, where the teacher evaluated over 20% more of the students as *exemplary* when compared to students' self-evaluations.

Additional analysis will be conducted on the results from the subsequent semesters for courses across the curriculum. These assessments from a variety of courses are necessary to make conclusions and recommendations about the success of advancing critical thinking skills across all four years in the Management major. The long-term goal is to extend critical thinking development in other courses across all majors, to include core courses and required upper division courses. This will allow the CGA to deliver a comprehensive process for development and assessment of critical thinking skills.

8. Conclusions

This paper uses an example of a Country Report project in the undergraduate Macroeconomics course to demonstrate a strategy for advancing and assessing critical thinking skills. The 21st Century Bloom's Taxonomy model was adopted across a four-year curriculum in the Management Department at USCGA. This strategy allows students to master critical thinking skills through a specifically designed six-stage process. The paper also presents an assessment instrument of critical thinking skills development where students' self-evaluation and instructor's evaluations are progressively measured and compared across a variety of courses. The goal is to provide an opportunity to develop critical thinking and integrate the student self-assessment and the faculty assessment into specifically designed assignments and projects in one or two courses per semester. While not every course includes the formal assessment process, instruction across all courses in the Management department is based on advancing critical thinking using the 21st Century Bloom's Taxonomy model.

The results of an initial assessment in the Principles of Macroeconomics course are presented to illustrate the process that has been successfully developed and implemented to achieve the learning objectives and assurance of learning goals for the Management Department's AACSB accreditation. These initial results demonstrate success in enabling students to master the expected critical thinking skills for their year group. The results also illustrate a trend of lower students' self-evaluations compared to the teacher's evaluations, particularly for the lower order critical thinking skills.

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