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Thinking critically: A look at students' critiques of a research article

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ABSTRACT

The ability to reason, analyse, and evaluate issues critically is a valued skill, and ranks highly in the list of attributes expected of graduates. Much has been written about the importance and application of critical thinking in various domains, but studies on the actual manifestation of such skills in students' writing have attracted only modest interest. Even less has been written about critiques in relation to critical thinking. This study sought to investigate the form and nature of issues raised by 119 second-year biology undergraduates in their critiques of the introduction section of a research article. The study revealed that the vast majority of students tended to raise *surface* issues in their critiques, focusing on visible textual features such as rhetorical structure and language-related issues. The minority who raised *depth* issues addressed the arguments used in the reading and their significance. In light of the skewed results, a two-stage process — involving (1) summary writing, and (2) the use of evaluative criteria and the Toulmin model as an overarching framework — is recommended to enhance the teaching of critical thinking within the curriculum. This study offers a glimpse into the outcomes of critical thinking, as represented by the students' critiques. It provides a bottom-up approach to our understanding of the issues raised by students in a task centred on critical thinking, and so focuses our attention on specific areas for further consideration or remediation.

Keywords: critical thinking, critique, Toulmin model, student writing

INTRODUCTION

The notion of critical thinking (CT) has a long and rich tradition. The adjective “critical” in CT is of particular importance. Taken from Latin “criticus”, it carries the sense of “discerning or discriminating thought characterised by careful analysis and judgment” (Cooper & Patton, 2010, p. 2). The ability to analyse and evaluate is highly valued and admired. Indeed, so essential are CT skills at the tertiary level that many universities have instituted various programmes based on CT pedagogy, “a guiding educational philosophy for many teachers, academic programs, and educational institutions throughout much of the Anglo-American world and beyond” (McGuire, 2007, p. 225).

Many writers are in agreement that CT is best viewed along the lines of a two-stage process (e.g., Shepelak, Curry-Jackson, & Moore, 1992), as follows:

The first stage, *critical reasoning*, requires one to understand a text well enough to assess it. The second stage, *creative reasoning*, requires one to create a new, logically defensible text, whether oral or written, related to the original one. In short, critical thinking means more than simply comprehending a text well enough to summarise it or agree or disagree with it. It requires ... not merely ‘knowledge-telling’ but ‘knowledge-transforming.’ (Dobson & Feak, 2001, p. 186)

The need to equip students with such skills is an obvious one. Not only are CT skills desired in the education setting, they are also much sought after by employers. In a 2010 report released by Hart Research Associates, 81% of the 302 employers surveyed felt that universities should place greater emphasis on CT skills. Such skills, in fact, were ranked second in the list of desired learning outcomes, only eight percentage points behind communication skills. The relative importance of CT skills is similarly reflected in a number of other surveys (Schoeff Jr., 2007; Sennyah, 2008; Peckham, 2010).

The importance of equipping students with CT skills has led to a surge in research studies on various pedagogies to help students across different educational levels and settings to develop their ability to reason, analyse, and evaluate issues in a thoughtful and rational manner (e.g., Halvorsen, 2005; Balcaen, 2010; Wang & Woo, 2010). The theory underlying such studies is social constructivism, where learners are encouraged to be actively involved in their own learning process through interaction with others and self reflection (O'Donnell, Reeve, & Smith, 2011). Classroom activities basically involve two stages. The first, *internalisation*, occurs when learners are introduced to the basic ideas or background information related to the topic of discussion. This first stage is crucial to CT since it will be extremely difficult for students to form judgements on issues they know little about. In his work involving Japanese undergraduates, Stapleton (2001) found that content familiarity helped students to include significantly more arguments, evidence, and

refutations in their writing as compared to students writing on an unfamiliar topic.

The second stage, *application*, occurs when students begin to think more critically about what they have internalised in the first stage. Balcaen (2010) suggests four principles to guide instructors in the design of application-type activities:

- (a) Regularly posing questions and designing assignments making concepts and background knowledge problematic.
- (b) Creating ongoing opportunities to engage in critical and cooperative dialogue — confer, inquire, debate and critique — that is key to creating a community of critically thoughtful thinkers.
- (c) Employing self- and peer-evaluation as ways of involving students in critical inquiry.
- (d) Instructor modelling good critical thinking practices. (p. 58)

A survey of the literature reveals numerous suggestions on activities that exhibit these principles. Halvorsen (2005), for instance, advocates the use of debates, where students are driven to consider multiple aspects related to the topic, or problem-solving tasks, where students work in groups to define the problem, examine its causes, and propose workable solutions. In another study, Wang and Woo (2010) report success in the use of online reflections among lower-secondary Singaporean students as a means to encourage CT. The

students in their study were asked to write reflections using weblogs on assigned history-related topics. The researchers found that even the simplest act of writing an online reflection without any peer or instructor interaction promoted CT to some extent. They explain:

It seems that the asynchronous nature of the weblog allows more time for students to reflect and refer to other resources before they post their writing. Also, the possibility of a post to be viewed and commented by a large population might make students put more effort in their thinking and writing. (Wang & Woo, 2010, p. 548)

While these studies have been insightful, few have focused on the *expression* of CT in student writing. The need to include this aspect is a crucial one as it offers us a glimpse into their instinctive tendencies in relation to CT tasks. Such tendencies may or may not concur with the instructors' expectations, and it is precisely for this reason that instructors should be aware of, and sensitive to, these tendencies. This will help to avoid any discrepancies or, at the very least, prevent them from worsening over time.

This paper presents the findings of a rhetorical analysis of critiques written by undergraduates for an assignment centred on CT. Student critiques are particularly insightful as they require a careful attempt at analysis and evaluation on the part of the writer, and are therefore valuable in highlighting important CT issues from a student-centred perspective. Further, a search

through various databases (e.g., Arts and Humanities Citation Index, Linguistics and Language Behavior Abstracts, MLA International Bibliography) revealed a dearth of CT studies involving student critiques, which may seem surprising, given their potential to inform educators and CT advocates alike on students' interpretation of CT tasks.

Specifically, this study explores the form and nature of the issues raised by the students in their critiques, and what these imply about their typical approach towards CT tasks. It is hoped that such a study will serve as a general guide on areas in student writing that may need particular attention and, crucially, also as a prompter to educators to design materials and teaching methodologies to help students avoid possible pitfalls in CT tasks.

OVERVIEW OF CRITICAL THINKING

As a term that is used so pervasively, particularly in education, it is perhaps surprising that a clear definition of CT has remained elusive. Existing descriptions, including the one presented in the opening paragraph of this paper, tend to be worded in general terms. At its most rudimentary, CT has been viewed as “reasonable, reflective thinking” (Ennis, 1992, p. 22). This simple description, however, glosses over the myriad aspects of what can be included under “reasonable” and “reflective” thinking. Ennis (1993) lists as many as ten traits that characterise CT. These include the ability to:

- a. judge the credibility of sources;
- b. identify conclusions, reasons, and assumptions;

- c. judge the quality of arguments;
- d. develop a position on an issue;
- e. ask appropriate questions of clarification;
- f. plan experiments and assess methodologies;
- g. define terms appropriate for the context;
- h. keep oneself well informed;
- i. remain open-minded to opposing views; and
- j. draw warranted and balanced conclusions.

In like manner, Facione (2010) regards CT as a set of cognitive skills — interpretation, analysis, evaluation, inference, explanation, and self-regulation (p. 5) — that shape one's *critical spirit*, defined as “a probing inquisitiveness, a keenness of mind, a zealous dedication to reason, and a hunger or eagerness for reliable information” (p. 9). The approaches undertaken to assess CT have also demonstrated a similar reliance on a set of interpretive and cognitive skills (e.g., Garrison, 1992; Newman, Webb, & Cochrane, 1995).

While these diverse skills illustrate the complexity of CT, it remains to be seen how they are manifested in actual student writing, and the extent to which certain aspects tend to be selected over other aspects. Further, as the labels used in several of the frameworks are worded generally, the specific characteristics pertaining to the corpus may be obscured. For instance, according to Newman, Webb, and Cochrane (1995), the raising of important points or issues is a marker of CT. In the context of student critiques, though, what form or forms would this take to clearly demonstrate CT? The tendency in

many frameworks has been to focus on the *arguments* or *claims* raised in the writing. Less emphasis is placed on the rhetorical *structure* of the same piece of writing, and how that might affect the reading process and, consequently, the clarity of the points conveyed. Specific characteristics such as these will go some way to help educators help students address areas of weakness and build on their strengths.

METHODOLOGY

Corpus and participants

The corpus was a collection of critiques written by 119 second-year biology undergraduates enrolled in an academic-writing course at a local university. The demographic details of the students are given in Table 1. The majority were ethnically Chinese, and all students were between 19 and 23 years of age.

Table 1: Demographic details of students

Gender Ethnicity	Male	Female	<i>Total</i>
Chinese	45	59	104
Malay	3	4	7
Indian	1	7	8

<i>Total</i>	49	70	119
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The academic-writing course, lasting a semester of 12 weeks, was mandatory for all science students at the university, and was aimed at familiarizing them with the conventions of academic writing, and equipping them with the skills to write papers appropriate for academic purposes. Consent was sought from the students to include their critiques in the study.

One of the skills reinforced during the course was that of critical and logical reasoning. A lecture was dedicated to the topic, and students were led to see the importance of forming arguments and how logical fallacies could be avoided. In face-to-face classes during the semester, the students were also actively encouraged to assess and discuss the strengths and weaknesses of the articles read for that week. As a skill that required honing, CT did not come easily to some of the students at first. The initial sessions were somewhat awkward and, for many of the students, there was a heavy reliance on instructor input. Over the course of the semester, however, many of the students gradually warmed up to the practice and the discussions became livelier and more spontaneous.

The critiques written by the students were a graded assignment for the course. The students were asked to read the introduction section of a research article by Deng and She (2005), titled “Introductions in Biomedical Research Articles” (hereafter “Biomed-Intro”), and comment on the strengths and weaknesses of the section. The rubrics for the assignment are given in Table 2.

Table 2: Rubrics for the critique assignment

Task

You are required to write a 350-word critique on the Introduction of the article entitled “Introductions in Biomedical Research Articles” for this assignment.

While reading the article, you may want to use some of the following questions to guide your thinking and build the foundation for critical inquiry:

- Who is the intended audience? Is the text appropriate for the audience?
- What is the purpose/main point of the article? Is it expressed clearly?
- What research questions are being addressed in the article? Are these specific or too general, realistic or too ambitious?
- Are the author's arguments valid or plausible based on the evidence? Why or why not?
- Are there any important assumptions or biases underlying the article?
- Does the research make an original contribution to the field? Why or why not?
- What arguments does the author use to support the main point? Are these arguments clear and consistent?
- What kind of evidence does the author use to support his arguments? Is there sufficient evidence for the arguments? How good is the evidence?

- Are the sources upon which this article is based reliable? Are they well integrated and accurately referenced?
- Is the text well-organized, clear and easy to read?
- Is the language and style appropriate?

The questions in the rubrics were designed by the teaching team to offer students some guidance on the range of issues that they could write on. The students were also given clear instructions on how they should organise their critiques, as shown in Table 3.

Table 3: Instructions concerning the structure of the critique

Structure of the Critique

Write your critique in standard essay form as follows:

Introduction: Introduce the article by stating the name of the author, title, and source along with the date of publication. Provide a one- or two-sentence summary of the article and your thesis statement.

Body: Write 2 or 3 paragraphs to support your thesis statement. Develop these paragraphs based on your responses to the selected guiding questions. Each

body paragraph should include three elements: your point, evidence from the article, and explanation of why the evidence supports your point.

Conclusion: Summarize your main points, restate your thesis statement, and discuss the success or failure of the author to convince the reader. Indicate the significance/impact of the article.

As a short assignment, the students were encouraged to include not more than two major points in their critique. They were informed that the emphasis of the assignment was not on the number of points they could raise, but on their ability to substantiate their points with evidence from the text and argumentation.

Analytical approach

The approach undertaken here is one of 'discovery'; it seeks to find out what is *there* in the critiques. Unlike studies on the assessment of CT using rubrics such as those proposed by Newman, Webb, and Cochrane (1995), there is no comparable model available to capture the range of issues raised by students in CT tasks. The only way such a model can be formed is by looking through the critiques and classifying the issues raised in broad terms. A pilot run of the analysis was carried out using 10 sample critiques to get a preliminary sense of the range of issues raised by the students. Owing to the

word limit and the clear instructions provided to the students on the structure of their critiques (see Tables 1 and 2), identifying the key issues raised by the students was a relatively straightforward exercise. This eased the analysis as it allowed these key issues to be quickly picked out without having to wade through a lengthy or poorly structured text.

It became quickly apparent that many of the sample critiques focused on surface issues, concerning primarily (1) the rhetorical organisation of Biomed-Intro, where the students compared it with what they learnt in the course about how introduction sections of research articles are typically organised (based on Swales's "Create-a-Research-Space" model; see Swales, 1990), and (2) the good use of references to support many of the claims by the authors of Biomed-Intro. Only one critique addressed the apparent contradiction in the authors' arguments.

This preliminary list of categories was expanded in the actual analysis. The points raised in each critique were carefully compared to the categories in the existing list, and new categories were added only when necessary. Following the initial observations made during the pilot run of the analysis, all the categories were broadly divided into two groups — (1) *surface* issues, concerning the organisation of information, language features, etc., and (2) *depth* issues, concerning argumentation, impact on the reader, etc. The former, that is to say, covers points directed at the visible features of the text, whereas the latter covers points related to analysis and evaluation.

The full list of categories, with brief explanatory notes, is given in Table 4.

Table 4: Categories of issues raised in the corpus

Depth issues	
Argumentation	The strategies used in the writing, including the hypothesis or hypotheses underlying the general approach
Impact on reader	The ability of the writing to persuade the reader or provoke further thought
Surface issues	
Structure	The way the content is organised; the flow of ideas in the text
Evidence	The use of in-text citations and supporting evidence
Explanation	Statements defining or clarifying the meanings of terms or concepts
Clarity	The use of a clear writing style
Hedging	The presence of explicit markers in the text to minimise the strength of claims
Other language features	The use of miscellaneous language features,

e.g., verbs

The frequency distribution of the above categories and the implications of this distribution are discussed in the next section.

FINDINGS AND DISCUSSION

General observations

As compared to the assignment rubrics in Table 2, the categories in Table 4 show an interesting tendency among the students to write about surface issues. The questions posed in Table 2 were intended to guide the students in their writing. The majority of these questions centred on depth issues, reflective of the interpretive, analytical nature of CT skills (e.g., Facione & Facione, 2009). By contrast, the categories in Table 4 have largely to do with surface issues. The differences are summarised in Table 5.

Table 5: Comparison of the assignment rubrics and category of issues raised in the corpus

Assignment rubrics (Table 2)		Category of issues (Table 4)	
D	1. Who is the intended audience?	1.	Argumentation
	Is the text appropriate for the audience?	2.	Impact on reader

-
2. What is the purpose/main point of the article? Is it expressed clearly?
 3. What research questions are being addressed in the article? Are these specific or too general, realistic or too ambitious?
 4. Are the author's arguments valid or plausible based on the evidence? Why or why not?
 5. Are there any important assumptions or biases underlying the article?
 6. Does the research make an original contribution to the field? Why or why not?
 7. What arguments does the author use to support the main point? Are these arguments clear and consistent?

author use to support his	2. Evidence
arguments? Is there sufficient	3. Explanation
evidence for the arguments?	4. Clarity
How good is the evidence?	5. Hedging
2. Are the sources upon which	6. Other language features
this article is based reliable?	
Are they well integrated and	
accurately referenced?	
3. Is the text well-organized, clear	
and easy to read?	
4. Is the language and style	
appropriate?	

(*Legend:* S = surface issues; D = depth issues)

The frequency distribution of the categories in Table 6 brings this tendency into sharp focus.

Table 6: Frequency distribution of categories

Depth issues	Frequency
Argumentation	39
Impact on reader	5
	44
Surface issues	Frequency

Structure	85	
Evidence	64	
Explanation	25	204
Clarity	11	
Hedging	13	
Other language features	6	
Total		248

Comparing the frequency figures of the two groups of issues, surface issues dominated the students' critiques. There were 204 instances of surface issues, amounting to 82.26% of the total number. Of the surface issues raised in the critiques, those pertaining to the structure of Biomed-Intro (41.67%) and the presence of in-text citations (31.37%) formed the bulk of the issues raised, with those related to the explanations/definitions of concepts coming in a distant third (12.25%). As regards depth issues, students elected to focus on the argumentation strategies employed in Biomed-Intro (88.64%).

This lopsided propensity to raise surface issues is even more marked when we consider the number of students who included depth issues in their writing. Of the 119 students, only one student's critique contained solely depth issues. The rest of the students addressed a mix of surface and depth issues in their critiques (40, 33.61%) or only surface issues (78, 65.55%).

Surface issues

The surface issues in Tables 3 and 5 may be further sub-divided into two smaller groups — those related to the generic features of academic writing (i.e., Structure, Evidence), and those related to the actual use of language itself (i.e., Explanation, Clarity, Hedging, Other language features).

As regards the features of the genre of academic writing, we have already seen in Table 6 that rhetorical structure was one of two main surface issues raised by the students (the other being the presence of in-text citations). In the main, the students commented on the effectiveness of arranging the content in Biomed-Intro from general to specific concerns. Many of them noted that the general background in the first few paragraphs of Biomed-Intro helped them to contextualise the authors' specific research objectives at the end of the section. A representative sample of the students' assessment of the general-to-specific organisation employed in the reading is shown below in (1):

- (1) Swales's CARS model is systematically conducted in the introduction of this article. In the first paragraph, the author established the territory by stating the importance of research articles to researchers — "research articles are ... past twenty years". Then he reviewed the previous studies in related fields — "it should not be surprising ... of this genre", which provides readers background information on the present study in detail. In the second paragraph, the author extended the background knowledge of CARS model to indicate that there is a gap in previous studies — "However, relatively little research ...

alone". He pointed out that these findings "need for more in-depth study of this genre in specific disciplines". This part successfully shows the necessity and importance of the present study to the readers and is known as "establishing a niche". Finally, the purpose and value of the present research is outlined—"the present study will examine ... Biomedical Science", which fulfills the last move, occupying the niche.

It is not difficult to see why the rhetorical structure of Biomed-Intro was favoured by many of the students. As a course on academic writing, the students were taught the typical structures, among other features, of the various sections of a research report. During the weekly classes, the students also analysed the format and content of various research articles, and so have come to look out for these features a natural part of their critical inquiry.

The other issue raised by numerous students in their critiques — the use of in-text citations — was another feature that was covered, and emphasised, in the course. The need to support all claims with evidence or references to external sources, and the issue of ethics in research work were impressed upon the students throughout the course. The problem of plagiarism received special attention; students were cautioned against copying material from external sources without credit. It is small wonder, then, that numerous students included the use of in-text citations in Biomed-Intro in their critiques. Many

found the authors' extensive use of citations to back up their claims and observations impressive:

- (2) Attention is drawn to the fact that the reliability of this introduction is enhanced with the extensive use of citations as the bulk of the sources used are found in the introduction. In addition, the origins of the references are mostly from published journals which had been subjected to rounds of critiques by experienced panels instead of unreliable websites which may harbor bias and inaccuracy.

Moving away from generic features to the use of language, a wider range of issues were raised, although they numbered far fewer than the former. But like the former, the language-related issues tended to take a factual and less interpretive tone, which is atypical of CT. This is reflected in the examples below:

- (3) The first mention of the CARS model is made in paragraph 2. Only the brief introduction of its full name, its creator Swales (line 8), and how extensively it had been studied by individuals of different cultures and disciplines (line 11 & 15) is stated. However, no further elaboration is made to explain what the CARS model describes or does, or the significance of testing its application on introduction writing in biomedical studies. (*Category: Explanation*)

- (4) The paragraphing is not clear. They should put all those related in the paragraph in the same paragraph so it is easier for the reader to read. The reader can briefly read and generalize what the paragraph talks about. *(Category: Clarity)*
- (5) The strength of this article is the incorporation of hedging such as 'perhaps' in "The most studied aspect of the research article genre is 'perhaps' the introduction (Samraj, 2002)" and 'probably' in "One of the best known studies in this respect is 'probably' conducted by Swales (1981, 1990)". These instances of hedging lessen the impact of expression and increase the degree of accuracy, bringing the meaning across more precisely. *(Category: Hedging)*
- (6) The language and style is appropriate, where the authors present their argument in simple present and present perfect tense. Good use of hedging is observed, for example, the use of "perhaps", "probably", "relatively" in the second paragraph. However, some bias comments are also identified, such as "It should not be surprising" in the first paragraph. It would be preferred if the authors could phrase them in a more neutral approach. *(Categories: Other language features, Hedging)*

As can be observed from these examples, there was little attempt at *critical* evaluation. The language features were merely pointed out, accompanied in some cases by a cryptic statement or two about their effects on the reader. The lack of elaboration can be troubling. In (4), for instance, it is not clear which specific paragraphs the student found objectionable. In (6), we are also not told exactly why the use of “present and present perfect tense” is considered appropriate.

Depth issues

Comparatively, the depth issues raised in the critiques contained more personal, evaluative comments. They addressed not merely the soundness of the arguments in Biomed-Intro, but also the significance of the research effort as a whole.

(7) Furthermore, the main motivation to focus on biomedical articles is flawed. Contrary to the authors' claim that it is an emerging field, biomedical research is actually already an established field in the form of experimental medicine. Therefore, there is little to distinguish this work from earlier works, which already established the key finding of the presence of disciplinary variation, referenced in this article.

(Category: Argumentation)

(8) It is difficult to appreciate the supposed impact of this paper on biomedical researchers — there are indications that the authors have intended this study solely for fellow linguists. Firstly, it is unlikely that biomedical researchers would survey a publication in a language and communication journal for writing inspiration. Secondly, the authors had assumed that readers are familiar with the topic by neglecting an overview of CARS and its relevance to fledgling biomedical researchers. Readers cannot help but think that the biomedical audience was added as an after-thought and as an extra justification of this work. (*Category: Impact on reader*)

In (7) and (8), personal opinions are not just stated, but substantiated by relevant facts in the former, and inferential reasoning in the latter. Such substantiations are admittedly harder to craft, as they require, in the words of Dobson and Feak (2001), both critical and creative reasoning (see Introduction section of this paper). They point to the need to move beyond mere visible features and the thought process to the creative process of producing the critique.

General discussion and recommendations

As we have seen, the majority of the students in this study focused on surface issues, looking at what was “obvious” from the text. This was possibly a natural starting point for many of them because issues such as the rhetorical

structure of introductions and referencing were covered as part of the writing course they were attending. This made it convenient for them to compare Biomed-Intro with best-practice models and samples in their lecture notes and tutorial worksheets.

It may well be argued that the raising of surface issues is perfectly legitimate in certain cases, and by no means any less insightful than the raising of depth issues. However, the overwhelming tendency of the students in this study to raise surface issues is suggestive of the somewhat 'mechanical' manner in which they approached the CT task. As we saw earlier, the writing also tended to state the obvious, staying within the textual features singled out for mention. There is, in other words, weak evidence of students engaging with the issues in a broad, analytical, and reflective fashion (Ennis, 1992; Cooper & Patton, 2010). Further, while depth issues were raised, they tended to be restricted to the argumentation strategies employed in Biomed-Intro, with only five students making mention of the overall impact or significance of the reading.

It is conceded that the results of this study, being small and exploratory, need not reflect the situation among the wider student population. But the propensity to focus on surface issues — on things related to form and structure — may not be uncommon. What appears needed is a greater focus on the "critical" aspect of CT, and a move toward a deeper engagement with data, facts, and claims. Granted, this engagement is effortful and time consuming, but it can equip students with the skill to move beyond the mere surface to assess,

challenge, and even propose new perspectives on the issue under consideration. And as a skill set, CT cannot be mastered overnight. Constant exposure to CT-type activities, with feedback and discussion in conferencing sessions, is crucial.

As a means toward this goal, a two-stage approach is recommended. First, as Dobson and Feak (2001) observe, “students must understand an article and be able to accurately express that understanding in writing before they can successfully write a critique” (p. 189). This understanding can be facilitated via summary writing, which directs attention to the basis, key claims, and rhetorical structure of the text under consideration. This first stage is invaluable not only in helping students understand the key concerns of the text, but also, crucially, in serving as an exercise in CT. As Hood (2008) points out:

[The ability to write summaries] requires the writer to position themselves in a field of knowledge by representing in a summary way the contributions of others so that they can be compared contrasted and evaluated. (pp. 351-352)

It is in the second stage that the comparison, contrast, or evaluation takes place. Necessarily, this stage involves a set of evaluative criteria. This may take the form of probes such as those listed in the rubrics in Table 2 (see also list of similar questions in Dobson & Feak, 2001, p. 193). Such questions are helpful in focusing attention on specific areas of concern, and can be a valuable scaffold for some individuals, though not all. As we saw, the skewing of the

results in this study occurred in spite of the presence of such questions in the rubrics.

This underscores the need to complement the questions with an overarching guide to CT. Such a guide is available in the Toulmin model (Toulmin, 1958, 2003). First introduced in 1958 by the British philosopher Stephen Toulmin, the model is a valuable resource for analyzing arguments, and is used in multiple disciplines, from rhetoric to philosophy, medicine, and law (see collection of papers in Hitchcock & Verheij, 2005).

The Toulmin model comprises six interrelated components — Data, Claim, Warrant, Backing, Qualifier, and Rebuttal. The Data serve as the evidence in support of the Claim. The Warrant and Backing are statements or assumptions of support that link the Data to the Claim. Specifically, “[t]he Warrant is an inference license according to which the Data support the Claim, while the Backing provides in turn support for the Warrant” (Verhaij, 2005, p. 348). Qualifiers are expressions indicating degrees of possibility or certainty (e.g., “likely”, “certainly”) as regards the Claim. The final component, the Rebuttal, provides exceptions or counter arguments to the Claim. Schematically, the Toulmin model is expressed as follows (the example, in italics, is taken from Verhaij, 2005, p. 348):

Figure 1: Components of the Toulmin model

It might appear that the Toulmin model is restricted to only the arguments and claims used in the writing. This need not be so. The model, in fact, is flexible enough to be applied to other aspects of the text as well (e.g., Potter, 2007). For instance, as pointed out earlier, many students in this study focused on the rhetorical structure of Biomed-Intro in their critiques. According to Swales's CARS model, the use of such a rhetorical structure (Data) carries the implicit claim that the reader of Biomed-Intro is a member of a particular

discourse community (Claim). But the article's rhetorical structure can also serve as a useful starting point to lead the student to address depth issues by assessing if the authors' assumption about the targeted audience (Warrant) is a reasonable one. As part of this process, the Backing for the Warrant can be ascertained by checking the journal's web page (or a copy of the journal itself) regarding its aims, scope, and intended audience. If the Warrant and Backing are satisfied, the student may then accept the authors' implicit claim. Even so, the student can further question if such a rhetorical structure is appropriate for a non-specialist trying to understand more about the topic in the article, or if the structure is lacking in some way (Rebuttal). The Toulmin model lays bare the numerous aspects of an argument or text feature, and so helps students to consider not only surface issues (e.g., Data, Claim), but also deeper issues in the Warrant, Backing, and Rebuttal. This can go some way to equip them with the skills to look at issues in a balanced, informed manner.

As compared to the use of specific probes, then, the Toulmin model is far more general and applicable across different disciplines and genres. Hernandez, Kaplan, and Schwartz (2006, p. 51), for instance, show how the use of the Toulmin model encouraged CT among their own American high-school students in history, mathematics, and chemistry. They argue that "[t]he Toulmin model provides a common language for students to discuss their reasoning in all classrooms" (p. 51). More crucially, Stapleton (2001) notes that the Toulmin model can be used "to identify key elements of critical thinking displayed in the students' writing" (p. 515), thus providing a means to help students go beyond

surface issues, and consider the deeper assumptions or opposing views related to the claim.

CONCLUSION

This study sought to investigate the form and nature of issues raised by second-year biology undergraduates in their critiques of the introduction section of a research article (Biomed-Intro). Given the dearth of studies in this area, it is still largely a matter of conjecture how students themselves approach CT tasks, and what their contributions reveal about their typical approach.

Through an exploratory analysis of 120 critiques, this study revealed the following:

- a. Two types of issues were raised in the critiques — (1) *surface* issues, to do with visible features in Biomed-Intro, such as structure and language, and (2) *depth* issues, such as argumentation and the significance and impact of Biomed-Intro.
- b. The vast majority of the students included surface issues in their critiques, with a tendency to focus on generic features. Primarily, these issues revolved around those to do with rhetorical structure and the use of in-text citations. In the main, critiques focused on surface issues showed weak evidence of a deep, personal evaluation of these issues.
- c. Students who raised depth issues largely addressed the arguments used in Biomed-Intro and the impact of the text on the reader. In general, they

produced critiques that contained more evaluative comments. Such students were in the minority; there was only one student whose critique focused entirely on depth issues.

In light of these findings, a recommendation for a two-stage process to enhance the teaching of CT within the curriculum is proposed. This process involves, first, summary writing and, second, the use of evaluative criteria and the Toulmin model as an overarching framework.

Much work remains to be done. This small study, exploratory and restrictive as it is, certainly needs to be expanded to include critiques written by students from other disciplines, backgrounds, nationalities, and educational levels. The tentative list of surface and depth issues — and even the method of analysis — can be refined through a larger study to establish a more representative indication of the types of issues that students generally raise in CT-based tasks. On the assessment, practical front, further research efforts are also crucially needed to find out if the two-stage recommendation can indeed help students think more critically and produce critiques that are balanced and thoughtful.

On a sobering note, perhaps, we should acknowledge that there is no quick fix for CT difficulties. Students are likely to continue to prefer addressing surface over depth issues in the short term. But with the use of the proposed two-stage process, and the benefit of further student-centred research in this area, we can at least be hopeful that Ennis's (1992) "reasonable, reflective thinking" or Facione's (2010) "critical spirit" may become second nature among students in the foreseeable future.

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