Investigating the Effect of Teaching Embedded Rebuttals on Students’ Argumentative Essays: A Preliminary Study
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Abstract
The centrality of rebuttals in successful arguments is well documented in research on argumentation, but less well understood are the contribution of embedded rebuttals to argumentative cogency, the pedagogical value of teaching embedded rebuttals, and how best to teach them. Embedded rebuttals are rhetorical acts of anticipation and response that writers perform as part of developing a larger argument that justifies their thesis. This study begins from the hypothesis that there is pedagogical value in embedded rebuttals: it is expected that teaching embedded rebuttals leads to more successful argumentative essays. The context is a first year writing course on science communication in which undergraduates are required to write an argumentative essay as a major assignment. Teaching of embedded rebuttals took the form of class instruction featuring guided close observation of texts and students conferencing with the tutor on a draft of their essay. The pedagogical value of embedded rebuttals is explored by inquiring into their correlational effects on the writing (content) achievement of student writers. The implications for teaching embedded rebuttals are pointed out.

Key Words: argumentation; embedded rebuttals; science communication; teaching in Higher Education

Introduction
In research on argumentation, the importance of rebuttals in arguments has been well acknowledged (Nussbaum & Kardash, 2005). Rebuttals - the writer’s refutation of counterarguments - have been found to enhance persuasiveness by reinforcing the writer’s overall stance in argumentative essays (Onoda, Miwa & Akita, 2015). Rebuttals in an argumentative essay can be variously located. However, not all textual locations of rebuttals have received interest and attention by researchers in equal measure: in refutational two-sided messages, the support-then-refute arrangement has been deemed the most persuasive while the refute-then-support arrangement the least (O’Keefe, 1999). Less known has been the contribution of interweaving discussion of supportive and opposing claims within an argument to the cogency or persuasiveness of an essay.

A site for rebuttals that has been relatively unexplored in the literature is their being embedded in a supporting argument, such as “a quick move within a paragraph, where you imagine a counterargument not to your main idea but to the sub-idea that the paragraph is arguing or is about to argue” (Harvey, 1999). Such intra-paragraph or mid-argument moves may take the form of rhetorical acts of anticipation and response in relation to the paragraph claim, sub-claims or
supporting evidence. In this paper, we will use the term embedded rebuttals to refer to rebuttals that are attempted within a larger argument, and indeed as part of building support for that argument. We are of the view that (1) embedded rebuttals are as significant as (if not more than) rebuttals of the stand-alone type as argument is fundamentally an ongoing, dynamic process of writers attempting to adjust readers’ beliefs towards the essay’s position, and indeed a dialogic activity (Bakhtin, 1981); and that (2) embedded rebuttals deserve greater interest and attention in research on argumentation. Before turning to the problem that motivated this study, it may prove instructive to illustrate embedded rebuttals by observing their operation in expert argumentative discourse.

Embedded Rebuttals in Expert Writing

The importance of embedded rebuttals may be attested to by their regular appearance in expert, published argumentative discourse. The discourse realization and effect of embedded rebuttals may be appreciated by studying how they operate in an instance of professional argumentation.

Consider the case of a professional (published, peer reviewed) article from Teaching & Learning Inquiry -- Kreber (2013), which takes the overall position that research in teaching and learning in higher education has transformative potential. The following is an excerpt from her paper, and the third argument she mounts in support of her position. In this argument she develops her point that the benefits of good, research-informed teaching extend beyond students to wider society. In italics is an embedded rebuttal she employed to strengthen her point:

Students strive not only towards their own authenticity but recognise their mutual interdependence and the need to support others in becoming authentic… Fostering [students’] capabilities contributes to a more just and sustainable society as the students employ the capabilities they were afforded through higher education for the sake of promoting the same capabilities among wider society, thereby supporting the authenticity of others… One might argue that this can happen through volunteering in the community, through political engagement and social action, or simply through the various decisions graduates make in their personal lives. However, an important implication arises in particular for graduates from professional subjects, such as engineering, law, health care, accounting, social work, and so forth. Fostering... capabilities in students on professional programmes could have a profound impact on how they engage in their work context after graduation… thereby supporting the authenticity of those they serve... This call for authentic and socially responsible professionals with an inner disposition to act in the interests of the “public good,” rather than according to self-interest or in exclusive compliance with external demands or directives, continues to be critical (p.10).

How does Kreber’s (2013) embedded rebuttal work, and what effects does it create for writers and on readers? The italicised argument is embedded as it is nested within a larger argument (namely that good teaching benefits not just students but also those whose lives will potentially be touched and transformed by the students after graduation) that supports her overall position. It pertains specifically to the local concern of the present argument (i.e. the idea of extended influence on wider society), and less generally to transformative potential or the lack of it. It anticipates that readers may disagree with her point as they may argue that students can make themselves useful to society in their own ways, regardless of teaching quality. And it addresses this opposing concern by counter-arguing that the impact on society would be profound if students benefitted from high quality teaching that is informed by research.
The effect of an embedded argument such as Kreber’s (2013) may thus be thought of as strengthening readers’ regard for the main argument by minimizing their potential resistance to the writer’s main point. In authentic argument, readers do not develop resistance only towards the writer’s overall position, or do so at the conclusion of an essay, but they may contend with his/her point, or evidence, in his/her development of a position. The belief that students may benefit from more textured and cogent arguments by being taught embedded rebuttals thus constitutes a point of departure for undertaking the present study.

Motivation & Problem

The motivation of this study came from writing tutors’ observations of rebuttals being unsatisfactorily attempted in the argumentative essays of undergraduates in a science communication course. We have observed students’ rebuttals to be frequently, and rather strangely, compartmentalized in, or relegated to, the near-closure of their essays, often resulting in the major part of their essay being insufficiently persuasive. Consider the example below of a student’s mid-essay argument on terraforming (i.e. making planets habitable by Earth-like life). As he argues in this part of the essay, terraforming affords us precious resources for the continuation of mankind:

Terraforming provides us with the continuity of resources that we require for the preservation of human life. Our planet’s biocapacity is already exceeded and it is becoming increasingly difficult to meet the needs of our ever-expanding human population (World Wildlife Fund, 2014). The potential utility of reforming other planets for inhabitation is colossal. For instance, Mars contains a multitude of resources such as water and rare metal minerals such as gold and platinum, among others (Schulze-Makuch & Davies, 2013). Additionally, it has around 144 trillion square meters of surface area that is rich in essential elements such carbon, nitrogen and oxygen (Zubrin, 1996), land that we can exploit to grow plants. Given that there are around 100 billion galaxies comprising planets (Howell, 2014), the vast amount of resources we are potentially able to amass from terraforming will assure the continued survival of mankind (From unedited student essay, used with consent).

The above argument is deemed insufficiently persuasive (and indeed, rather simplistic) by tutors for several reasons: (1) It does not consider differing environmental conditions between Mars and Earth and the attendant implications on the usability of Mars’s resources; (2) It does not consider how many planets there are like Mars which can be potentially suitable candidates for terraforming; (3) It does not consider the extractability of those resources and whether the extraction may be realised in time before the disappearance of mankind. These are rather urgent ‘questions’ or gaps in argument pertaining to the student’s main point – resource potential – rather than to his position on terraforming more generally as a whole. These questions may need to be addressed (at least one, if not more) in a just-in-time manner, if the argument is to be considered reasonably acceptable or persuasive.

Faced with such an argument, writing tutors could view it as simplistic, and then advise the student to discard it and reconsider his/her position. However, we have chosen to take a somewhat different approach, which is guided by a dialogic perspective on academic argument: we think the student can be helped by being encouraged to embed rebuttals in his/her argument, that is to anticipate potential objection or resistance to the argument presented, and then formulate a suitable response that would trivialize the objection (and enhance the argument) in some way.
For purposes of contrast, consider the example below of a mid-essay argument written by another student, who argues against the pursuit of time travel. In the argument shown, the student develops the point that wormholes (a potential method of time travel theorised by theoretical physicists) are but a pipedream:

Wormholes remain a romantic notion today that makes the pursuit of time travel hard to justify. This is because wormhole travel requires one to surpass the speed of light. We can currently accelerate particles to 99.99% the speed of light (Fritzsch, 1994), but however much power is fed in, we still cannot break the speed-of-light barrier. As Physics Nobel laureate David Gross explains, an infinite amount of energy is required to accelerate particles beyond light speed, and in the process, the object’s mass would become infinite. This in turn limits the object’s speed. The reason photons (particles of light) travel at light speed is that they have no mass. It may be argued that particles called neutrinos have recently been discovered to be capable of overcoming the speed barrier – in an experiment conducted by CERN, a neutrino beam was measured to arrive 60 nanoseconds faster than light over a distance of 370km with a margin of error of 10 nanoseconds (Gillies, 2011). CERN's research director Sergio Bertolucci, however, has deemed this discovery to be an error, and researchers are still unable to confirm the result (Bertolucci, 2012). Hence, until wormhole travel finds a reality beyond science fiction, time travel remains an unworthy pursuit (E29).

Compared to the ‘terraforming’ argument, this ‘wormhole’ argument appears less simplistic, and indeed more well-considered and persuasive, owing in part to the embedding of a counterpoint relating to the writer’s supporting claim that wormholes won’t work as we have not succeeded in overcoming the speed-of-light barrier. The embedded rebuttal (italicized) anticipates the objection that new evidence has surfaced that suggests the barrier has been broken, and refutes the objection by denying the veracity of the new evidence. The result is a more nuanced, better developed, and persuasive argument.

We opine that a possible reason for what we perceive to be frequent ritualistic enactments of rebuttal typically near the opening and conclusion of essays (rather than intra-paragraph or mid-argument), often in less persuasive essays such as ‘Terraforming’, could be the result of an overzealous implementation of ‘organizational plan’ pedagogies (Bacha, 2010) in students’ formative years of education. Such pedagogies often dispense organizational templates for students to ‘fill in the blanks’ and reproduce prescribed textual patterns. Perhaps most widely known is “the ‘five paragraph’ essay which consists of the introduction of the topic, the statement of a claim, three supporting paragraphs for the claim and a concluding paragraph” (Wingate, 2012, p.147). Like the ‘five paragraph’ essay, many model texts that are often used to teach the argumentative genre present rebuttals in neatly defined stages and sites for convenient description, identification, and subsequently reproduction by learners, avoiding the messier in media res enactments that constitute dialogic argument. While ‘organizational plan’ or ‘template’ implementations of genre pedagogies may have their merits, researchers have also warned of the dangers of prescriptivism and reproduction, of treating genres as “moulds into which content is poured” and of “fail[ing] to acknowledge variation and choice” (Hyland, 2003, p.26) in teaching genre practices. In saying so we are not dishonouring genre pedagogies in students’ formative years but underlining the fact that student writers “need to acquire genre schemas as stepping stones to more expert textual practices” (Gebhard & Harman, 2011, p.50). As writing educators in Higher Education, we take a keen interest in helping our students acquire those practices. We are therefore of the view that embedding rebuttals is one way in which undergraduates may be helped to develop sophisticated argument practices.
Theoretical Framework

Our study is anchored in a dialogic perspective of language (Bakhtin, 1981) and of academic argument (Hyland, 2000). A Bakhtinian view of language sees all verbal communication as carrying dialogic overtones in that “to speak or write is always to refer to, or to take up in some way, what has been said/written before, and simultaneously to anticipate the responses of actual, potential or imagined readers/listeners” (White, 2003, p.261). Like it or not, written arguments exist against “a background made up of contradictory opinions, points of view and value judgements... pregnant with responses and objections” (Bakhtin, 1981, p.281). What this signifies for us writing educators is that authentic argumentation must necessarily feature rhetorical acts of anticipation and response in the course or process of building consensus for a position or point of view. Confining the appearance of rebuttals to the near-closure or near-opening of essays may be good enough for displaying ritualized adversativeness (Tannen, 2002) in conformity to general academic discourse expectations but does not do justice to the dialogic nature of argument. Argumentative text is “fundamentally polyphonic” and few would contest its “dialogical and dialectical nature” (Leitao, 2003, p.301). Its “plurality of competing interpretations” also implies that a successful arguer must “anticipate possible negative reactions to his or her persuasive goals” (Hyland, 2000, p.13). Hoey (2009), whose work on textual interaction is underpinned by a Bakhtinian perspective, notes that skilled writers are often more adept at accurately anticipating important questions that readers will want answered without compromising what they want to argue.

Research Questions

This paper begins from the hypothesis that teaching embedded rebuttals is pedagogically beneficial for helping students to produce more successful (convincing) argumentative essays in the context of a compulsory science communication course for science undergraduates. Argumentative essays were assigned in the course to develop students’ ability to articulate opinions and perspectives with coherence. Arguments have had a place in science literacy and communication courses (Osborne, Erduran & Simon, 2004; Osborne et al., 2013) but they have not been explored from the perspective of embedded rebuttals. From what is known about rebuttals (Nussbaum & Kardash, 2005; Onoda, Miwa & Akita, 2015) and about the nature of argumentation as informed by a dialogic perspective of language (Bakhtin, 1981) we have a cause to believe in the pedagogical value of embedded rebuttals, but evidence is needed from an analysis of classroom work in specific disciplinary contexts to support the theoretical argument and investigate the effect of teaching embedded rebuttals on argumentative quality. Our paper represents a beginning exploration in this direction, and specifically, in the context of a writing and communication course in Higher Education that is designed for and tailored to the needs of science undergraduates (Ng et al., 2014). The study reported in this paper is part of a larger study that attempts to undertake pre- and post-instructional comparisons of teaching embedded rebuttals and to understand how the various modes of instruction contribute to argumentative quality in students’ written texts. Through our work we seek to strengthen the connection between science literacy education and rhetoric and argumentation.

In this paper we will focus our analysis of students’ written arguments on a specific group of essays, namely those within the experimental group (i.e. post-instruction) which contained embedded rebuttals. Our focal interest and specific research question are thus:

How might embedded rebuttals enhance argumentative quality? More specifically, what types of embedded rebuttals tend to be associated with more highly scored essays?
Method

The corpus of this study comprises 33 final draft argumentative essays which featured the enactment of embedded rebuttals. The essays were written for a major assignment in a compulsory science communication course for Science undergraduates. Essays were each 1500-1800 words in length and written on an issue of scientific controversy of students’ choice. The student authors were from classes taught by the three authors. Only essays of students who consented to their assignment being used for research were admitted to the corpus. All the essays were from the Academic Year 2015-2016 Semester 1’s run of the course in which embedded rebuttals were first introduced to the module and taught.

Teaching of embedded rebuttals took the form of (1) class instruction featuring guided scrutiny of how embedded rebuttals work in popular science texts (e.g., in Richard Dawkins’s *The Selfish Gene*) and academic essays, and (2) writing conferences in which tutors provided feedback on a draft of the essay and advised on embedding rebuttals to enhance the persuasiveness of students’ arguments. This was often done by tutors pointing to potential trouble spots in the argumentative text and encouraging students to anticipate potential objections and formulate rebuttals within their main arguments. Class instruction on embedded rebuttals was implemented in the context of teaching students what it means to develop an argument. Toulmin’s (1958) model informed our approach to argument development as it provided a “good starting point for teaching argumentation to students, particularly to introduce them to the argument structure and meta-language” (Kathpalia & See, 2016, p.33). However, we were mindful not to present Toulmin elements in prescriptive terms by ensuring that those elements constituted the starting points and indeed, stepping stones to deeper engagement with the argumentative genre. In this latter endeavour our pedagogical approach was informed by Graff’s (2010) rhetorical analysis, which involves examining “not only what authors communicate but also for what purposes they communicate those messages, what effects they attempt to evoke in readers, and how they accomplish those purposes and effects” (p.376). Sample class activities used to teach embedded rebuttals in relation to argument development are shown in the Appendix.

The next step was to identify embedded rebuttals in the essays. Each essay was read (and re-read if necessary) to ascertain its overall stance or position so that its supporting arguments could subsequently be identified. Arguments that opposed the essay’s position were excluded from our analysis as we were interested in rebuttals embedded within main (supporting) arguments. In identifying embedded rebuttals we often relied on textual cues of concessive intent (e.g., *It is true that...; of course; admittedly; granted; although*, etc.) and of counter-expectation and contrast (e.g., *However; but*, etc.) as discourse markers provide useful information about argumentative elements and their relationships (Ferretti, Lewis, & Andrews-Weckerly, 2009). Following Stapleton and Wu (2015), we paid attention to indicator words and semantic structures that suggested cues to counterclaims and rebuttals. As they note, “*Some may claim that ... often indicated that a counterclaim was introduced. While this argument has some merit, it does not... suggested a rebuttal*” (p.15).

Although embedded rebuttals are often expressed as a quick move within a paragraph, we were mindful not to limit our analysis to the unit of a paragraph, as it is possible that a main argument may take more than a paragraph to develop. Our unit of analysis was thus a main/key argument, our definition of this being the assertion of a claim in support of the essay’s position and provision of reasons, warrants and evidence to support or justify that claim. We thus found it useful to
“differentiate the superordinate and subordinate relationships among [argumentative] elements” (Ferretti, Lewis, & Andrews-Weckerly, 2009, p.580) in determining whether rebuttals were embedded or non-embedded, particularly in ascertaining embedded rebuttals that were developed beyond a quick move and which found expression more fully in a paragraph(s). Embedded rebuttals that were successfully identified were highlighted and put aside for further analysis. The identification exercise yielded 33 essays that contained embedded rebuttals and 19 essays that did not.

Further analysis sought to describe the nature of the embedded rebuttals identified. A coding scheme covering four types of embedded rebuttals was conceived to make possible a “finer grain of analysis” that “can help to reveal argument structure in more depth and [enable] a higher degree of reliability and accuracy” (Qin & Karabacak, 2010, p.448) in portraying students’ deployment of embedded rebuttals. Embedded rebuttals were coded according to whether they were realised as a quick move within a paragraph (Type (a)) or as a more elaborated step within the main argument (Type (b)). A more elaborated step may take the form of a single paragraph, or even more paragraphs than one.

Apart from noticing the degree of development of each embedded rebuttal, we were also interested to know if the rebuttal concerned a claim (main or supporting), or point of evidence. Where potential objection was anticipated of a claim, an embedded rebuttal was simultaneously coded as Type (c), or as Type (d) when the objection was anticipated of evidence. The coded embedded rebuttals were then counted. Simultaneous coding of embedded rebuttals as Types (a)/(b) and as Types (c)/(d) acted as a checking mechanism for consistency: if a total of 3 embedded rebuttals were identified in an essay, the totalled count of Types (a)/(b) rebuttals should agree with that of Types (c)/(d) rebuttals. Where the totals failed to tally, that was then an indication for us to revisit our analysis and resolve the inconsistency. What emerged from this stage of analysis is a portrait of the various types of embedded rebuttals that are contained in each essay and the frequency of these rebuttals by type (Table 1).

Table 1. Sample analysis of embedded rebuttal by essay and type.

<table>
<thead>
<tr>
<th>Essay</th>
<th>Number of embedded rebuttals by type</th>
<th>Rating on content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(a)</td>
<td>(b)</td>
</tr>
<tr>
<td>E22</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>E27</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>E23</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>E24</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>E29</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>E25</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>E31</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>E9</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>E8</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>E33</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
Argumentative quality of essays in this study was determined by the rater’s score on the content component. In assessing content, tutors considered criteria such as the extent to which the argumentative goal has been met, whether “defensible, persuasive argument” was accomplished, and whether counterarguments and rebuttals were clearly identifiable and well substantiated. As part of course quality assurance and ensuring equitable and valid assessment of students’ work, all scores were put through multi-faceted Rasch model (MFRM) analysis to manage rater differences and adjust for rater severity (Wu & Tan, 2015).

We acknowledge that a potential issue with relying on content scores is that they may not be based entirely on the frequency of embedded rebuttals. However, in this preliminary study, we are less interested in making conclusive claims about establishing a causal relationship between embedded rebuttals and argumentative quality (persuasiveness) than affirming a possible and positive correlation. We chose content scores as we thought that it is in the content criterion that patterns of correlation between embedded rebuttals and argumentative quality can be most plausibly discussed. While other components such as organisation and language also play a part, excellent organization or perfect language alone are less likely to render an argument persuasive without Toulmin's argumentative elements to constitute the field of discourse. An alternative for content scores as an indicator of argumentative quality that we may consider for future work may be Varghese and Abraham's (1998) “stance toward discourse”, or “the ability to consider other viewpoints and rebut or resolve these” (p.301). We might also be considering a primary trait scoring rubric similar to stance toward discourse but which focuses on the degree of development of argument.

Findings

This study primarily sought to discover if student writers who deployed embedded rebuttals in their argumentative essays tended to score more highly on content than those who did not, and relatedly if teaching embedded rebuttals may be pedagogically productive for enhancing the quality of students’ written arguments. Table 2 shows the results of our analysis of the 33 essays that featured embedded rebuttals. We grouped the essays into three categories based on their content scores: Category I essays were those that scored above 80%; Category II essays scored between 70% and 80%, and Category III essays scored below 70%. Included in the table are the mean frequencies of the various types of embedded rebuttals and mean ratings on content by essay category.

As can be seen from Table 2, essays that scored higher on content tended to feature higher counts on the average in embedded rebuttals of all four types. For instance, Category I essays contained almost twice as many Type (a) embedded rebuttals (i.e. those realised as a quick move within a paragraph) compared to Category III essays. Differences in the deployment of Types (b) and (d) embedded rebuttals appeared to be the starkest between the two categories: Category I essays contained 8 times as many Type (b) embedded rebuttals (i.e. those realised as a more extended move within an argument) as Category III essays. The ratio for Type (d) ones (i.e. embedded rebuttals in which anticipated objection pertained to evidence supporting the paragraph claim) was 17:1.
Table 2. Mean frequency of embedded rebuttals by category of essay and type of rebuttal.

<table>
<thead>
<tr>
<th>Number of essays</th>
<th>Mean frequency of embedded rebuttals by type</th>
<th>Mean rating on content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>a 2.3 b 0.8 c 1.4 d 1.7</td>
<td>82.6</td>
</tr>
<tr>
<td>Category II</td>
<td>a 2.0 b 0.2 c 1.2 d 1.0</td>
<td>74.9</td>
</tr>
<tr>
<td>Category III</td>
<td>a 1.1 b 0.1 c 1.1 d 0.1</td>
<td>69.0</td>
</tr>
</tbody>
</table>

To study how Type (a) and Type (b) embedded rebuttals may be variously deployed in combination to produce differentiated argumentative quality, we computed the mean ratings on content by combination. Our results are shown in Table 3.

Table 3. Mean content rating of essays containing different types of embedded rebuttals.

<table>
<thead>
<tr>
<th>Combination of embedded rebuttals</th>
<th>Mean rating on content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a+2b</td>
<td>86.6</td>
</tr>
<tr>
<td>1a+1b</td>
<td>83.3</td>
</tr>
<tr>
<td>≥4a+1b</td>
<td>79.9</td>
</tr>
<tr>
<td>3a+0b</td>
<td>77.4</td>
</tr>
<tr>
<td>3a+1b</td>
<td>76.6</td>
</tr>
<tr>
<td>2a+0b</td>
<td>74.6</td>
</tr>
<tr>
<td>1a+0b</td>
<td>70.7</td>
</tr>
</tbody>
</table>

As can be seen from Table 3, essays that featured 1 Type (a) embedded rebuttals used in combination with 2 Type (b) ones (i.e. 1a+2b) tended to fetch the highest rating on content (i.e. 86.6%). In general, when both types of embedded rebuttals were present and deployed in combination, mean ratings on content tended to be higher compared to when a single type was present, although there seemed to be an exception (3a+1b). We will comment on one such instance (essay E26) in the discussion section.

Discussion

The observation of higher mean frequencies of embedded rebuttals of all four types in higher-scored essays broadly suggests that embedded rebuttals in some way contribute to the quality of students’ written arguments. The correlation may be indicative of a dialogic process at work in the textual development of students’ arguments and the thinking that underlies it: more successful
student writers seemed to take better regard of readers’ potential needs and expectations in constructing their arguments, anticipating their contradictory opinions and potential objections to the text-in-development. Such a dialogic process seems to agree with Kellogg’s (2008) characterization of experienced writers who are adept at knowledge crafting, that is “shap[ing] what to say and how to say it with the potential reader fully in mind..., anticipat[ing] different ways that the reader might interpret the text and tak[ing] these into account” (p.7) in developing their argument. From our analysis, one of the starkest differences resides in Type (d) embedded rebuttals – those in which potential resistance from readers is anticipated of evidence used to develop the writer’s argument. The ability to see the flaws in one’s own evidence being used to justify one’s argument places substantial demand on critical thinking on the writer’s part, and this may be one area that calls for attention in helping students to embed rebuttals successfully.

Similar to the case of Types (a) and (b) embedded rebuttals, higher counts of Types (c) and (d) rebuttals were also noted to associate with higher-scored essays. Particularly noteworthy is the finding that the most successful essays contained 17 times more Type (d) rebuttals than the least successful ones. These were embedded rebuttals that concerned data (evidence) used to support a claim. The stark contrast may reasonably be accounted for by a particular critical thinking ability termed "the antilogos ability - the ability to critically evaluate whether specific information may support different claims" (Glassner & Schwarz, 2007, p.11). Antilogos is a sophisticated argumentative ability as it "necessitates the application of principles of critical reasoning as well as dispositions for critical reasoning..., relies on creative thinking... [and] depends on the knowledge people have of the issue at stake" (p.11). While it may not always be practical or desirable to teach students content knowledge of issues, one significant implication for helping students acquire powerful uses of embedded rebuttals may be to work with them on the principles and dispositions of critical reasoning.

Our observation that the combined deployment of Types (a) and (b) embedded rebuttals tended to yield higher ratings on content compared to single-typed enactments may suggest that more successful student writers are more rhetorically aware in developing their arguments: they seem more confident in being able to embed a contradictory point of view without losing sight of their main claim in the distance (such as when a main argument takes more than a paragraph to develop). Such heightened awareness seems to agree with Hoey’s (2009) description of the skilled writer being not just one who accurately anticipates readers’ reactions to his/her developing text but also one who does so “without compromising what s/he wants to say” (p.185). As a close study of one such high-scored essay will reveal below (Figure 1), embedded rebuttals of the Type (b) may be more elaborately performed due to evidence being incorporated into the response element to develop and support it (Moves 10-12). A Type (a) embedded rebuttal, typically a quick move within a paragraph, may similarly feature a backed response but such backing may be limited to subclaims (Moves 6-7). The implication here is that it may be necessary not just to instruct students to respond to anticipated reader reactions, but also how to respond, how much to respond, and how one does know.
(1) First, BHT is safe and beneficial to humans as it is an antioxidant, which is one of its main properties... (2) When BHT is present in food, oxygen molecules react preferentially with it to fats or oils... (3) This prevents fats in food from becoming rancid, thus preserving the flavour and nutritional value of food. (4) However, there are disagreements regarding the use of BHT as it is synthetic and may cause cancer; there are alternatives such as Vitamin C and E which are natural antioxidants and not carcinogenic. (5) Despite that, the use of natural antioxidants are limited as they tend to be short-lived. (6) On the other hand, BHT is more stable, which means it can carry out its function for a longer period. (7) Its fat-soluble nature also indicates that it is more effective in preventing direct oxidative rancidification... (8) Therefore, BHT helps to preserve the nutrients in food that are essential for the body...

[In a separate paragraph]... (9) there are studies that show that BHT does not lead to cancer and it may even have an anti-carcinogenic effect instead. (10) The first study was done in 1979 by the National Institute for Cancer Research which published a report stating that BHT was not carcinogenic... [Details of the report follow.] (11) Thus, there is no clear evidence to show that the lung tumours in the female are directly caused by the administration of the BHT and it was concluded to be not carcinogenic. (12) Furthermore, a 1999 Taiwanese study had demonstrated that “synthetic phenolic antioxidants decrease the N-acetylation of carcinogens and formation of DNA-carcinogen,” (Quilty, 2009) proving that BHT is anti-carcinogenic as it lacks the activity of phenobarbital in promoting diethylnitrosamine-induced mouse liver carcinogenesis... (E24)

Note: Embedded rebuttals are marked in italics; moves (4) to (7) correspond to an embedded rebuttal of Type (a); moves (9) to (12) correspond to an embedded rebuttal of Type (b).
the solutions suggested by scientists is to substitute fetal bovine serum with cyanobacteria as the main source of food for the meat to grow into muscle tissues (O’Conner, 2014). However, the United States Environmental Protection Agency (2015) warns the public about the use of cyanobacteria as it poses several health risks on human when consumed orally. Cyanobacteria produces toxins, commonly known as cyanotoxins. There are four types of cyanotoxins...

Almost immediately after presenting his claim, the writer introduces what seems to be an anticipated challenge to the claim: that scientists have been working to improve the technology “to make... in vitro meat animal free so as to allow vegetarians to accept and consume in vitro meat.” It is questionable what the significance of vegetarians is in this anticipated objection and how the notion of vegetarianism makes the anticipated objection a potential challenge to his claim. What sabotaged his attempt at embedded rebuttals, we opine, seems to be a premature placement of an anticipated objection and his failure to set it up sufficiently so that the response element that ensues may be comprehensible and viewed as appropriate. It might thus be advisable to teach strategic placement of embedded rebuttals over and above instructing students to embed.

Thus far the analysis and discussion have focussed on the correlational effects of embedded rebuttals on the argumentative quality of the 33 essays in which embedded rebuttals were attempted. Analysis of the 19 other essays in the experimental group that was exposed to instruction in embedded rebuttals is unfinished at the time of presentation of this paper, but our initial findings might suggest that it may be possible for essays to score high on Content without deploying embedded rebuttals. A possible reason could be due to confounding variables that have a bearing on argumentative quality – a text can be persuasive if its main argument is well constructed and backed by sufficient reasons and evidence; embedded rebuttals may increase persuasiveness but they may not be a necessary component of persuasive texts. A more plausible explanation, however, seems to concern the “interweaving discussion of supportive and opposing arguments” (O’Keefe, 1999, p.212): we revisited the essays that seemed able to score high on content despite not featuring embedded rebuttals and noticed a common feature – a “faulty path” (Andrews, 2007, p.12) argument pattern at work in the macro-level organisation of those texts. In a faulty path model, writers take counterarguments as points of departure for their argument, responding to and refining them in turn to carve out their own position. Such an approach has been deemed argumentatively powerful and characteristic of highly skilled writers. For the majority of student writers who may not (yet) have acquired this model as part of their argumentative discourse repertoire, we maintain that embedded rebuttals be taught to enhance the quality of their arguments. We thus note that even if embedded rebuttals may not seem to be a necessary condition for argumentative quality, this does not undermine the pedagogical value of embedded rebuttals.

Some educators may be concerned that embedded rebuttals may not be appropriate to all learners, especially those who come from rhetorical backgrounds that privilege agreement and integration. Multicultural and multilingual learners being a common and increasing presence in today's writing classrooms (Canagarajah & Jerskey, 2009), it is necessary to consider the different histories, backgrounds and rhetorical traditions that students bring to their learning of embedded rebuttals. The potential for student resistance towards embedding rebuttals in a multilingual setting was raised by one of the participants who listened to our paper. We have not interviewed the writers of the 19 essays in the experimental group to find out why they did not employ embedded rebuttals despite being taught, but the presence of these essays probably also bears out the fact that we have not foisted embedded rebuttals upon students by teaching the rebuttals.
in prescriptive and imposing ways. We acknowledge the possibility of there being students who may feel that embedding rebuttals in argument is going on the defensive about one's views and aggressively imposing one's views on readers. However, we are mindful to impart embedded rebuttals as a choice that would be advantageous for students to have in their argumentative repertoire, and an option that comes with certain effects on readers. We thought that the concern for potential resistance should be taken as a cautionary note, and indeed a reminder for teachers to instruct students on the linguistic patterns of anticipation and response that are appropriate to civic, respectful negotiation, rather than as a reason against teaching embedded rebuttals. We also thought it might be helpful for teachers to explain to students our view on the nature of dialogic argument that underpins and informs the approach to argument that we are taking in teaching argumentation the way we do.

**Conclusion**

This study was conceived with an interest in helping science undergraduates enhance the quality of their written arguments, and began with the hypothesis that it may be worth teaching students to embed rebuttals in developing their arguments. The main question we asked ourselves in this paper was how embedded rebuttals may contribute to argumentative quality. We observed a tendency for higher-scored essays to feature embedded rebuttals, not only more frequently but also in more varied ways, in terms of the types of embedded rebuttals applied. What may plausibly account for this, we argue, is a more dialogic process at work in the argumentative composing and thinking processes typically identified with more experienced writers. More specifically, the student writers of higher-scored essays may be better able to balance their considerations of readers with their own argumentative goals. In regard to essays that may feature embedded rebuttals but still fare less ideally on content, we attempted a close study of one particular instance and suggested that it may be helpful to teach the strategic placement of embedded rebuttals within the larger argument. Finally, we acknowledged the possibility of essays in the larger corpus that fared successfully without embedding rebuttals, and argued that this should not be taken as an argument against teaching embedded rebuttals as those essays tended to apply a faulty path model that is argumentatively powerful but which cannot be safely assumed to reside in the argumentative discourse repertoire of less experienced student writers.

In closing, we would like to make some comments on the limitations of our study and raise directions for continued work. We acknowledge that essay ratings on content may not be the most ideal indicator of argumentative quality, and recommend the development and use of a primary or singular trait scoring rubric (e.g., one that focuses on degree of argument development or on stance toward discourse) for correlating writers' use of embedded rebuttals in this regard. We also recognize that more data is needed to confirm our observations and interpretive claims, and that control-experiment comparisons may contribute certainty to our claim about the pedagogical value of embedded rebuttals.
Appendix

Sample class activities for teaching rebuttals embedded in a developed argument

Worksheet: Developing an Argument

Text A is an excerpt from Dawkins’s Chapter 2. Here, the author argues that life could have emerged from a primeval soup which accidentally gave rise to replicators. Demonstrate your understanding of an argument by studying how Dawkins develops his, and answering the questions below.

(Text A)

1. Complete the table:

<table>
<thead>
<tr>
<th>Component in the development of argument</th>
<th>Example from the text (You may use your own words)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLAIM</td>
<td>A main idea/point that supports the thesis or overall argument.</td>
</tr>
<tr>
<td>GROUNDS</td>
<td>Reasons &amp; Evidence used to support the main idea. (e.g. main conclusions from research studies, specific information for exemplification or other credible information or data).</td>
</tr>
<tr>
<td>WARRANT</td>
<td>A “bridge” that connects the data to the claim. (e.g. explanation/interpretation of findings).</td>
</tr>
<tr>
<td>REBUTTAL</td>
<td>Consideration of anticipated objections to the claim followed by an appropriate response that defends the claim.</td>
</tr>
</tbody>
</table>

2. Consider the impact of Dawkins’s writing style as shown in Text A above. To do this, consider the following:

- Is his writing best described as narrative, descriptive or argumentative?
- What effects on the reader are achieved by his choice?
- What is gained, and lost, as a result of his choice?

3. Apply your understanding of “claim”, “grounds”, “warrant”, and “rebuttal” to Text B below by completing the right-hand column of the table:
4. Do you agree with Dawkins’ view that life began with the creation of replicators? Construct one argument (e.g., in a paragraph) for your position, applying what you’ve learnt about developing an argument.

<table>
<thead>
<tr>
<th>Excerpt from an academic essay</th>
<th>Component in the development of argument</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Text B</strong></td>
<td></td>
</tr>
<tr>
<td>(1) Brain chemistry plays a major role in determining the likelihood that a person will lash out in a violent manner. Specifically, studies point to chemical imbalances and anomalies in neural structures as potential indicators of aggressive behavior. (2) Research on violent behavior in ...</td>
<td>(1) ........................................</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2) ........................................</td>
</tr>
</tbody>
</table>

Excerpt from an academic essay

Component in the development of argument
References


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