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# Using Toulmin Model to Analyze Undergraduate Students' Combinatorial Argumentation

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**Abstract.** Combinatorial argumentation is a set of proofs from arrangements of certain objects in the set supported by, according to Toulmin model, claims, data, warrants, and backing. This research aims to analyze the structure of combinatorial argumentation given by undergraduate students using the Toulmin model. This research involved 93 second semester undergraduate students at the Department of Mathematics Education Sriwijaya University. The participants were asked to complete arguments on the proofs of some mathematical statements related to binomial theorem. Their combinatorial argumentations were then analyzed using the Toulmin model. Results show that algebraic argumentation is more favorite among undergraduate students than combinatorial argumentation, and most students have difficulty in providing claims, data, warrants, and backing in combinatorial argumentation.

*Keywords: Toulmin Model, Combinatorial Argumentation, Proof*

## **FIRST, SECOND, AND THIRD LEVEL HEADINGS (FIRST LEVEL HEADING)**

(Use the Microsoft Word template style: *Heading 1*) or (Use Times New Roman Font: 12 pt, Bold, ALL CAPS, Centered)

This document was prepared using the AIP Conference Proceedings template for Microsoft Word. It provides a simple example of a paper and offers guidelines for preparing your article. Here we introduce the paragraph styles for Level 1, Level 2, and Level 3 headings. Please note the following:

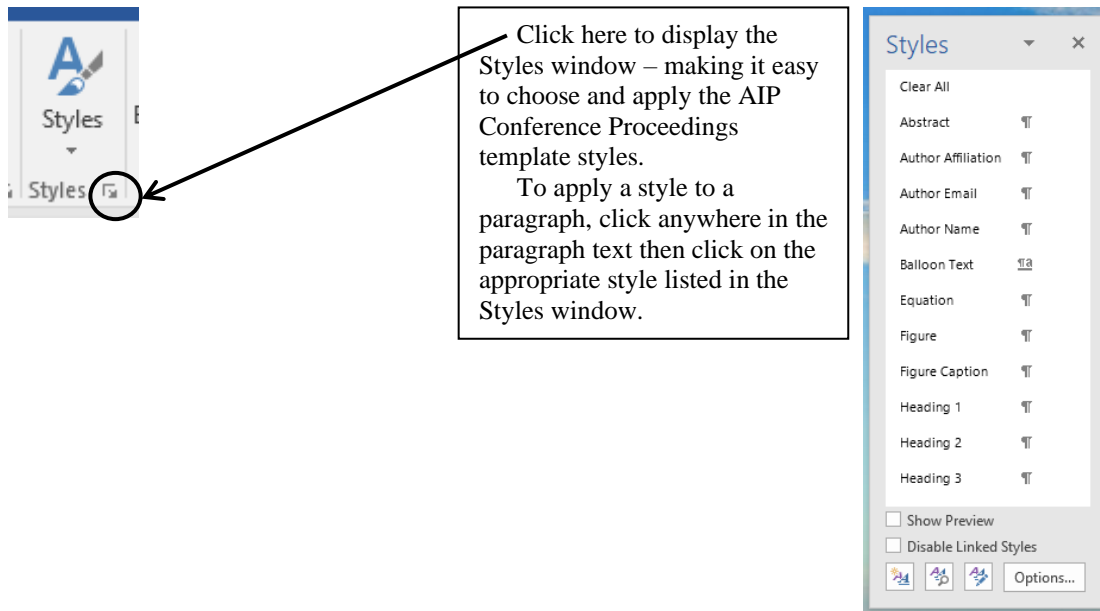
- In this template we note whether each heading is Level 1, 2, or 3 – for example, “(Second Level Heading).” This is for guidance only; your article headings will, of course, not need those notations.
- Under each heading we have noted which paragraph style to use – for example, “(Use the Microsoft Word template style: Heading 2).” Again, those notes are not part of the headings. Their purpose is to advise you of the name of the style defined in the AIP Conference Proceedings Word template.

To format a paragraph, use the Microsoft Word template style: *Paragraph* or Times New Roman Font: 10 pt, Indent: First line: 0.2", Justified.

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## **How to Use this Template (Second Level Heading)**

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You can edit or delete the content provided in this template and replace it with the text and figures of your article. Please be sure you do not accidentally leave any of this text as part of your paper!

## **Heading with Each Initial Letter Capitalized (Second Level Heading)**

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Apart from prepositions and articles, all words in second and third level headings should have their initial letters in uppercase. Prepositions are words like “for,” “from,” “with,” “in,” “off,” and articles include words such as “an,” “a,” “the.”

This is the paragraph spacing that occurs when you use the [ENTER] key.

### *Heading with Each Initial Letter Capitalized (Third Level Heading)*

(Use the Microsoft Word template style: *Heading 3*) or (Use Times New Roman Font: 10 pt, Italic, Centered)

As with first and second level headings, all words except prepositions and articles (see above) should appear with initial letters in uppercase.

This is the paragraph spacing that occurs when you use the [ENTER] key.

## **MATHEMATICS (FIRST LEVEL HEADING)**

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Here we provide some basic advice for formatting your mathematics, but we do not attempt to define detailed styles or specifications for mathematical typesetting. You should use the standard styles, symbols, and conventions for the field/discipline you are writing about.

### **A Note on Microsoft Word’s Equation Editors (Second Level Heading)**

(Use the Microsoft Word template style: *Heading 2*) or (Use Times New Roman Font: 12 PT, Bold, Centered)

From Word 2007 onwards, Microsoft Word provides two “Equation Editors,” which, for ease of reference, we’ll call “Old Style Equations” and “New Style Equations.”

- “**New Style Equations**” (Word 2007 onwards): With Word 2007 Microsoft introduced a powerful new built-in Equation Editor that enables input of sophisticated mathematics typeset (usually) in the Cambria Math font. You access it from the Insert menu.
- “**Old Style Equations**” (Word 97–Word 2003): For versions of Microsoft Word between Word 97 and Word 2003, mathematical input was created by an add-in: Inserting and editing a “Microsoft Equation 3.0 object,” typically by *Insert* ⇒ *Object* and selecting “Microsoft Equation 3.0.”

Newer versions of Microsoft Word (Word 2007 and onwards) still support the original “Old Style Equations” method of creating mathematics by inserting an equation via *Insert* ⇒ *Object* and selecting “Microsoft Equation 3.0.” Whatever method is used, please make sure the equation is clear and readable.

### **Which Microsoft Word Equation Editor Should I Use? (Second Level Heading)**

(Use the Microsoft Word template style: *Heading 2*) or (Use Times New Roman Font: 12 PT, Bold, Centered)

Due to technical requirements of OpenType font technology, Microsoft Word’s “New Style” Equation Editor works only with fonts specially designed for mathematical typesetting. Unless you have obtained and configured new OpenType math fonts, it is highly likely that your installation of Word will use the Cambria Math font for all mathematics created with the “New Style” editor. Using the Cambria Math font for mathematics and Times Roman for your text will cause a mismatch in the visual appearance of your article, so, for consistency, we prefer authors to use the “Old Style” Equation Editor because it is straightforward to amend the size/style of the fonts it uses.

## Formatting and Inserting Equations (Second Level Heading)

(Use the Microsoft Word template style: *Heading 2*) or (Use Times New Roman Font: 12 PT, Bold, Centered)

Equations should be centered with equation numbers on the right-hand side (flush right). Achieving a pleasing layout of equations can be tricky in Microsoft Word, so here are some tips. You can either:

1. Copy, paste, and edit the sample equation provided (recommended), or
2. Manually insert an equation and equation number

### *Copy, Paste, and Edit a Sample Equation (Third Level Heading)*

(Use the Microsoft Word template style: *Heading 3*) or (Use Times New Roman Font: 10 pt, Italic, Centered)


To use this “Old Style Equation” as a “template,” highlight the entire line, then use cut and paste to the new location. Note that the equation number will automatically update (increment).

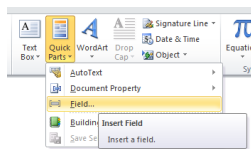
$$\frac{d[F_1]}{d\omega_2} = SAm_2 \cos \omega, \quad \frac{d[F_1]}{d\omega_3} = SAm_2 \cos \omega \quad (1)$$

### *Manually Inserting an Equation and Equation Number (Third Level Heading)*

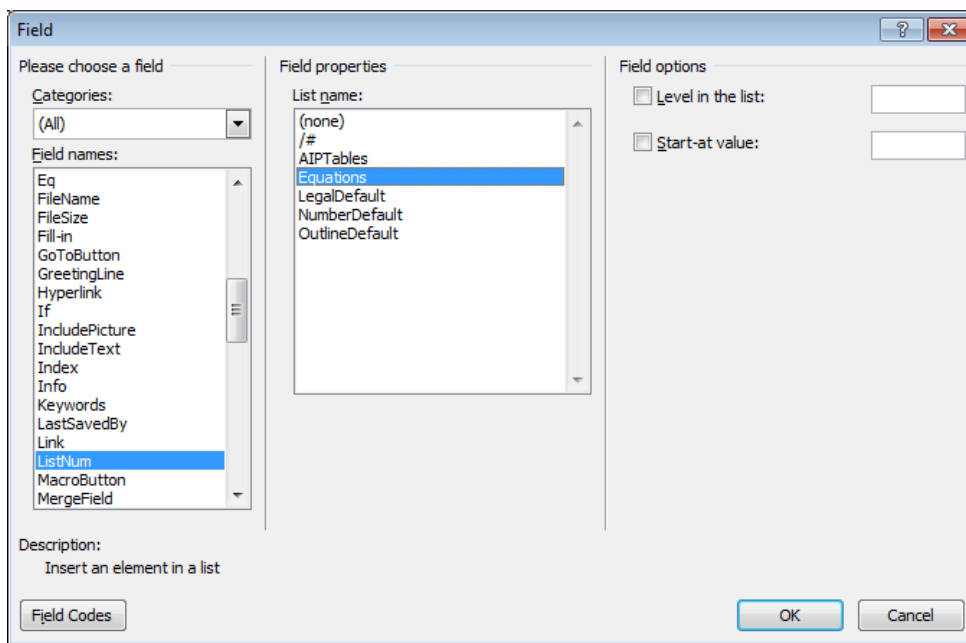
(Use the Microsoft Word template style: *Heading 3*) or (Use Times New Roman Font: 10 pt, Italic, Centered)

If you prefer to manually insert and number equations, follow this step-by-step guide:

1. Make sure you can see “hidden characters” by switching on “show invisibles” from the Home menu (it looks like this: ). This allows you to see paragraph markers (¶) and tab characters (→), which are usually hidden from view.
2. Create a blank paragraph by pressing [ENTER].
3. Format your new blank paragraph by applying the Microsoft Word template style: *Equation*. The *Equation* paragraph style sets up the tabs so that you can center the equation and have an equation number appear at the right.
4. Place your cursor at the start of your new paragraph and press the [TAB] key twice.
5. Place your cursor between the tab characters (→) and insert your equation using *Insert* ⇒ *Object* ⇒ *Microsoft Equation 3.0*.
6. To add an equation number, place your cursor at the end of the paragraph (just before the paragraph markers (¶) and after the second tab character (→)).
7. On the *Insert* tab, in the *Text* group, click *Quick Parts* and then click *Field*:



8. A dialog box should appear:



9. From the list of *Field Names* on the left of the dialog box, select *ListNum*.
10. From the list of *Field properties* on the right, select the “Equations” *List name* and click OK. You should now see an equation number in parentheses: e.g., (3).

### **OTHER SPECIFICATIONS (FIRST LEVEL HEADING)**

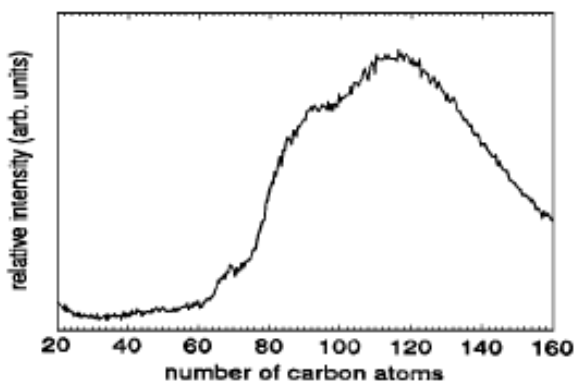
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Figures, tables, and equations must be inserted in the text and may not be grouped at the end of the paper. Important: A miscount of figures, tables, or equations may result in revisions. Please double check the numbering of these elements before you submit your paper to your proceedings editor.

### **Figures (Second Level Heading)**

(Use the Microsoft Word template style: *Heading 2*) or (Use Times New Roman Font: 12 PT, Bold, Centered)

If you need to arrange many figures, a good tip is to place them in a table, which gives you additional control of the layout. Leave a line space between your figure and any text above it, and the figure description and any text below it, like this one:



(a)

(b)

**FIGURE 1.** To format a figure caption, use the Microsoft Word template style: *Figure Caption* or *Times New Roman Font: 9 pt, Centered*. The text “**FIGURE 1,**” which labels the caption, should be bold and in upper case. If figures have more than one part, each part should be labeled (a), (b), etc. Using a table, as in the above example, helps you control the layout

Cite all figures in the text in consecutive order. The word “Figure” should be spelled out if it is the first word of the sentence and abbreviated as “Fig.” elsewhere in the text. Place the figures as close as possible to their first mention in the text at the top or bottom of the page with the figure caption positioned below, all centered. Figures must be inserted in the text and may not follow the Reference section.

#### *Color Figures (Third Level Heading)*

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#### **Tables (Second Level Heading)**

*(Use the Microsoft Word template style: Heading 2) or (Use Times New Roman Font: 12 PT, Bold, Centered)*

Due to the wide range and complexity of tables, we simply offer an example for guidance. Please follow the style for table (and figure) captions.

**TABLE 1.** To format a table caption, use the Microsoft Word template style: *Table Caption*. The text “**TABLE 1,**” which labels the caption, should be bold and all letters capitalized. Center this text above the Table. Tables should have top and bottom rules, and a rule separating the column heads from the rest of the table only.

<b>Column Header Goes Here</b>	<b>Column Header Goes Here</b>	<b>Column Header Goes Here</b>
Row Name Here	x	x
Row Name Here	x	x
Row Name Here	x	x

#### **FINAL KEY POINTS TO CONSIDER (FIRST LEVEL HEADING)**

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### *Why Should I Care About Font Embedding? (Third Level Heading)*

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## CONCLUSION

(Use the Microsoft Word template style: *Heading 1*) or (Use Times New Roman Font: 12 pt, Bold, ALL CAPS, Centered)

In this section we welcome you to include a summary of the end results of your research. Font should be Times New Roman, 10 pt.

## ACKNOWLEDGMENTS

(Use the Microsoft Word template style: *Heading 1*) or (Use Times New Roman Font: 12 pt, Bold, ALL CAPS, Centered)

If desired, in this section we welcome you to include thank your comments for those who have supported your research. Font should be Times New Roman, 10 pt.

## REFERENCES

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References should be numbered using Arabic numerals followed by a period (.) as shown below and should follow the format in the below examples.

1. M. P. Brown and K. Austin, *The New Physique* (Publisher Name, Publisher City, 2005), pp. 25–30.
2. M. P. Brown and K. Austin, *Appl. Phys. Letters* **85**, 2503–2504 (2004).
3. R. T. Wang, “Title of Chapter,” in *Classic Physiques*, edited by R. B. Hamil (Publisher Name, Publisher City, 1999), pp. 212–213.
4. C. D. Smith and E. F. Jones, “Load-cycling in cubic press,” in *Shock Compression of Condensed Matter-2001*, AIP Conference Proceedings 620, edited by M. D. Furnish *et al.* (AIP Publishing, Melville, NY, 2002), pp. 651–654.
5. B. R. Jackson and T. Pitman, U.S. Patent No. 6,345,224 (8 July 2004)
6. D. L. Davids, “Recovery effects in binary aluminum alloys,” Ph.D. thesis, Harvard University, 1998.
7. R. C. Mikkelson (private communication).



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- 3-** **DO NOT** alter the margins of our templates. They are carefully designed for AIP's production process: Altering them can cause significant delays. Paper size should be 8 ½ x 11 with margins set at: Top – 1 inch, Left – 1 inch, Bottom – 1.18 inch, Right – 1 inch.
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- 5-** **DO NOT** include any headers, footers, or page numbers in your document. They will be added to your article PDF by AIP Publishing, *so please do not amend this template to add them to your paper.*
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