

## IMRAD Cheat Sheet

### Abstract

Abstracts can vary in length from one paragraph to several pages, but they follow the IMRAD format and typically spend:

- 25% of their space on importance of research (Introduction)
- 25% of their space on what you did (Methods)
- 35% of their space on what you found: this is the most important part of the abstract (Results)
- 15% of their space on the implications of the research (Discussion)

### Introduction & Importance (Make a case for your new research)

Begin by explaining to your readers what problem you researched and why the research is necessary. Convince readers that it is important that they continue to read.

Discuss the current state of research in your field, expose a “gap” or problem in the field, and then explain why your present research is a timely and necessary solution to that gap. See Novelty Handout.

### Methods (What did you do?)

Methods are usually written in past tense and passive voice with lots of headings and subheadings. This is the least-read section of an IMRAD report.

### Results (What did you find?)

Results are where the findings and outcomes of the research go. When talking about this data, we can think of the results as having two parts: report and comment. The reporting function always appears in the results section while the comment function can go in the discussion section. Make sure all tables and figures are labeled and numbered separately. Captions go above tables and beneath figures. (See Example on Page 3)

- Report**
1. Refer to your table or figure and state the main trend  
*Table 3 shows that Spam Filter A correctly filtered more junk emails than Filter B*
  2. Support this trend with data  
*Filter A correctly filtered... The average difference is...*
  3. (If needed) Note any additional, secondary trends and support them with data  
*In addition... Figure 1 also shows...*
  4. (If needed) Note any exceptions to your main trends or unexpected outcomes  
*However...*

- Comment**
5. (If needed) Provide an explanation  
*A feasible explanation is... This trend can be explained by...*
  6. (If needed) Compare to other research  
*X is consistent with X's finding... In contrast, Y found...*
  7. (If needed) Evaluate whether the findings support or contradict a hypothesis
  8. State the bottom line: what does the data mean?  
*These findings overall suggest... These data indicate...*

### Discussion (What does it mean?)

Discussion sections contain the following moves:

1. They summarize the main findings of the study. This allows readers to skip to the beginning of the discussion section and understand the main “news” in the report.
2. They connect these findings to other research
3. They discuss flaws in the current study.
4. They use these flaws as reasons to suggest additional, future research.
5. (If needed) They state the implications of their findings for future policy or practice.

# Examples

## Abstract

- 25% (Introduction)
- 25% (Methods)
- 35% (Results)
- 15% (Discussion)

.....  
This experiment tests the effect of choke type and gun selection on target accuracy in order to determine the best gun specifications. Three competent shooters of approximately equivalent marksmanship abilities tested three different choke types (full, modified, and improved) and two different guns (a Remington 11-87 semi-automatic and a Beretta 682 Gold E). With a confidence level of 95%, the gun selection ended up to be the only significant factor. The Beretta was found more accurate than the Remington possibly because the Beretta's weight is centered in the middle of the gun while the Remington is a little barrel-heavy. However, if the confidence level is lowered to 90%, choke type is also significant, with the improved choke more accurate than the modified or full. Thus, for target shooting, the most accurate combination would be the Beretta with an improved choke.  
.....

*Introduction*

*Methods*

*Results*

*Discussion*

## Introduction

Bioplastics are manufactured from renewable biomass sources rather than petroleum and other fossil fuels.<sup>1</sup> Bioplastics may be a sustainable alternative to petroleum plastics because they use fewer fossil fuels in production and reduce greenhouse gas emissions as they biodegrade<sup>1a</sup>. Most bioplastics are currently made from starch-based plastics or starch-polyester blends.<sup>1b</sup> However, polylactic acid (PLA), a thermoplastic aliphatic polyester typically derived from corn starch, tapioca or sugarcane, may become a more commercially viable option.<sup>3</sup> PLA resembles traditional plastic, making it acceptable to consumers, and is able to be processed on equipment already used for petroleum plastics. PLA has been used for biodegradable medical implants, packing materials, diapers and 3D printers. However, although PLA biodegrades under carefully controlled conditions, it is not yet compostable except in industrial composting facilities and cannot be mixed with other recyclable materials. This limits the commercial viability of PLA because the infrastructure to transport bioplastic waste to appropriate composting facilities has not yet been developed.<sup>2</sup> A device that composts PLA and other bioplastics within a home composting environment would make PLA a more viable commercial option.<sup>3</sup>

## Methods<sup>1</sup>

### Sb-Doped SnS Thin Film.

Pure, stoichiometric, single-phase SnS thin films can be obtained by atomic layer deposition (ALD) from the reaction of bis(N,N'-diisopropylacetamidinato)tin(II) [Sn(MeC(NiPr)<sub>2</sub>)<sub>2</sub>, referred here as Sn(amd)<sub>2</sub>] and hydrogen sulfide (H<sub>2</sub>S).<sup>3</sup> Rather than using ALD as previously reported,<sup>3</sup> SnS thin films were deposited using a modified chemical vapor deposition (CVD) process, referred here as a pulsed-CVD, to speed up the deposit rate to ~15 times higher than that of ALD...

### Material Characterization.

Film morphology was characterized using field-emission scanning electron microscopy (FESEM, Zeiss, Ultra-55). The film thickness was determined from cross-sectional SEM. The elemental composition of the films was determined by Rutherford backscattering spectroscopy (RBS, Ionex 1.7 MV Tandetron) and time-of-flight secondary ion mass spectroscopy (ToF-SIMS)...

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<sup>1</sup> Sinsersuksakul, Prasert, Rupak Chakraborty, Sank Bok Kim, Steven M. Heald, Tonio Buonassisi, and Roy G. Gordon. "Antimony-Doped Tin (III) Sulfide Thin Films." *Chemistry of Materials*. 2012 (24). 4556-4562. Web. ACS Publications. 21 Oct., 2013.

## Results

### A.

Table 3 shows that Spam Filter A correctly filtered more junk emails than Filter B.<sup>1</sup> Filter A correctly filtered 88% of junk emails whereas filter B only filtered 63% correctly.<sup>2</sup> However, Filter A takes longer to run than Filter B.<sup>4</sup> This increased run time is due to the type of programming language used in Filter A.<sup>5</sup> These findings overall suggest that Spam Filter A is a better filter than Filter B even though it takes longer to run.<sup>8</sup>

### B.

Fig. 3 shows that the electrical conductivity of the Cu-doped ZnO is much lower than that of the undoped ZnO.<sup>1</sup> The electrical conductivity of even the 100 ppm Cu-doped ZnO specimen was about 3 orders of magnitude lower than that of the undoped ZnO.<sup>2</sup> As the doped Cu content increased, the electrical conductivity gradually decreased.<sup>3</sup> As a result, the 1000 ppm Cu-doped ZnO had the electrical conductivity 5 orders of magnitude lower than that of the undoped ZnO.<sup>8</sup>

## Discussion

The data collected from this small study suggests that verbal instructions are not needed to complete a simple assembly task and may even interfere with the task. The participants who received words plus pictures made more errors, took longer to complete the task, and were less confident that they had completed the task correctly than participants who received pictures alone. One reason for this finding may be the simplicity of the task since none of the guidelines we examined suggest that textual information would interfere with visual instructions.

*Summarize results*

*Explain results*

Our study is hampered by the small number and homogeneity of our participants. All of our participants were college students and this may have affected our results. Additional research might examine whether older participants would benefit from verbal instructions accompanying pictures. More research is also needed examining different tasks. Our study involved a highly physical task (constructing a lego vehicle). Future research should examine how pictures and verbal instructions might interact on a more conceptual task, such as installing and using a software program.

*Flaws*

*Future research*

Based on this limited analysis, we recommend that instruction writers consider excluding verbal instructions on a simple assembly task. Our results indicate that verbal instructions may in some cases interfere with users' abilities to follow pictorial directions.

*Implications*