

## Ozone measurement practice in the laboratory using Schönbein's method

Ramirez-Gonzalez et al

### Summary

The overview is that this work is improved, and I can see that it can be made suitable for publication *if* the authors embrace fully the moderate level of changes I suggest, which are designed to be practical and possible.

The response of the authors to Reviewer 1 (below) worried me. To develop a teaching approach, as part of an outreach activity or not, it is bizarre not to base this on the effectiveness of students' learning. If it is ineffective, there is no point at all in their teaching approach. This said, upon reading the text the authors have moved to a good way to include what they can in the absence of any plan within their work to collect the evidence to eventually write it up as a study - this is not at a sufficient level for a teaching and learning journal, but I continue to advocate that *Geoscience Communication* is pragmatic and flexible.

*"However we would like to point out that measuring the effectiveness of the learning of the students was not the main purpose of this work. Our aim is to develop a teaching approach for something that was not taught before and to perform a scientific outreach activity."*

I still have concerns about the English in the manuscript, but it is at the level of copy-editing, and I will defer what is required in this regard to the Editor-in-Chief. I have gone through the abstract (see below), but not the whole document.

I list below the more significant changes that are required, and request a point-by-point response to them accompanied by a manuscript that includes track changes.

1. Abstract - you are still missing a sentence on the advantage of this lesson to the students over other similar possible lessons. Shorten and use bits you already have in the text (e.g. P2 L18-23), and insert a sentence on the advantages into abstract, perhaps as below.
2. P3L7 - Similarly to point 1, make a change here. " ..... familiar with this topic, by [list reason(s) this is better, as in abstract, to finish this sentence]."
3. Results of background survey in the Introduction. This a very odd format and needs to be altered as it is a side-track from the main purpose of the paper. Add a section on this, after the current Section 1, 'Student knowledge of environmental issues including ozone' [i.e. place P4L10-24 in this, perhaps with an additional sentence to start and finish it]. A forward reference can still be used at P2L27 - still not ideal, but acceptable.
4. To reinforce the point of this work, insert a short paragraph immediately before P5L1 to recap in one place the benefits/advantages/new parts of the new lesson you advocate. I've seen bits at P2L18-23, P4L5-8, P4L1(?), also cost mentioned in response to reviewer 1. This is similar to points 1 & 2.
5. The overall structure is still quite unusual for a pedagogical study (and this is such as study). But this can be overcome adequately by use of section headings. So, I'll be prescriptive - you should change the section headings as I detail in the minor comments below.
6. P11 - Section 5 is still a little too thin/short to be acceptable.
  - o You could bring it over the threshold by adding a few lines (e.g. 5) of self-reflection on the teaching i.e. what could have gone better/worse, in hindsight how would you improve (or not), looking back advantages of Problem based learning over other approaches you could have chosen. This must, please, include 1 or 2 references to papers on different teaching techniques i.e. "we could have used techniques X (reference), or Y (reference), but .....this and this ... so .... PBL was best". Here, you should explicitly link back to the benefits/advantages/new parts of the new lesson that I know you can list (as above), at least noting that you did succeed in incorporating them, at least in your view.

- You might also move the first two paragraphs of the 'Conclusions' section up into this one, which would help. They could still be mentioned more briefly in Conclusions.

I also have some detailed comments. In terms of grammar and English, I have not attempted to make this list complete.

- P2L1 - something wrong with grammar
- P2L8 - there not 'they', and grammar - had not 'let'?
- P2L24 - full stop at end of sentence.
- P2L28 onto next page - grammar in sentence.
- P3L3 - grammar. 'subjects amongst'?
- P3L8 - 'competence' is the wrong word here.
- P4L1 - This is a nice point.
- P4L2 - 'the' scientific method? You might also consider mentioning this as an advantage of the lesson you propose e.g. in the abstract.
- P4L9 - omit this last sentence as whilst true it isn't applicable to other teachers who might give the lesson as far as I can tell.
- P4L5-8 - It's good to see developments/novelties of the lesson identified, but they get rather lost in the middle of the text.
- P5L7 - grammar
- P5L12 - Change to 'Teaching method selected'. .... this and the next change are needed as current headings are confusing.
- P5L19 - Change to 'Detailed description of the proposed session'
- P9 - Change heading of 4.3 to 'Discussing the results with the students' ..... to avoid the reader being confused (this could be you discussing the results of your analysis of the effectiveness of the lesson e.g. by student feedback).
- P10 - Change heading to 'Evaluation of the proposed session'

Figure 2 - Results in introduction. Unusual, but OK in the structure chosen.  
 Figure 3 - never referred to in the main text. Either cite or remove.

**Abstract.** We present a laboratory technique that can be used to measure tropospheric ozone, following a traditional method developed by Christian Friedrich Schönbein in the 19th century. The aim is to familiarise students with both the scientific method and the concepts of pollution and climate change, and \*\* advantage over other lessons of this type is - the hands on bit? / the PBL bit? / better fills a particular knowledge gap in students? \*\*\*\* We include a description of how to conduct the lesson at two different levels of complexity (advanced and basic) to allow it to be adapted to the capacity of the students. The advanced level includes the production in the lab of paper strips as they were produced in the 19th century, whilst the basic level does not. This practice is suitable for use by both high school and first-year undergraduate students. This technique was developed and presented in high schools during a communication campaign to celebrate the annual Galician Scientist Day. We evaluate the teaching approach used through the results from collected surveys and feedback received from the students and teachers.

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