

Acid-base education

Aneri Gandhi, University of Ottawa

Dr. Alison Flynn, University of Ottawa (Department of Chemistry)

Dr. William Ogilvie, University of Ottawa (Department of Chemistry)

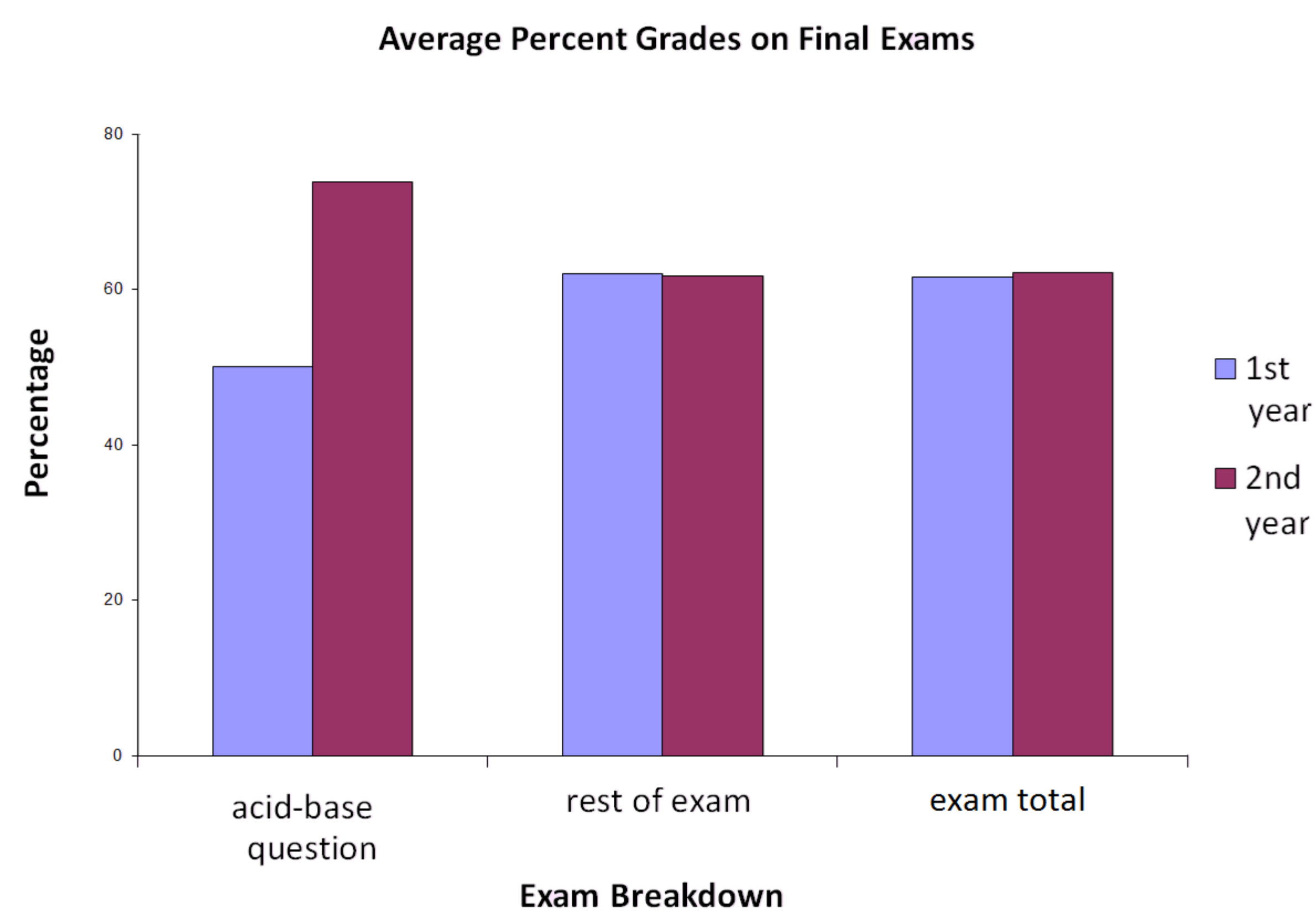


Figure 1: Average final exam percentages of first year and second year Organic Chemistry students

Introduction

A growing concern in first and second year chemistry courses is the difficulty of students to grasp the concepts of acid-base chemistry and apply them to questions that require “out-of-the-box” thinking. Questions often pertaining to acid-base are always the ones that are the most poorly done on exams (see figure 1). Without understanding the basics, students cannot hope to move forward as many successive reactions involve the use of acid-base theories. The importance of students feeling comfortable with these concepts is the core motivation of developing objectives and unique teaching styles suited to the students’ particular needs. The goal of this project was to remove common misconceptions that students have about acid-base and to implement various teaching techniques in order to improve their understanding of these concepts.

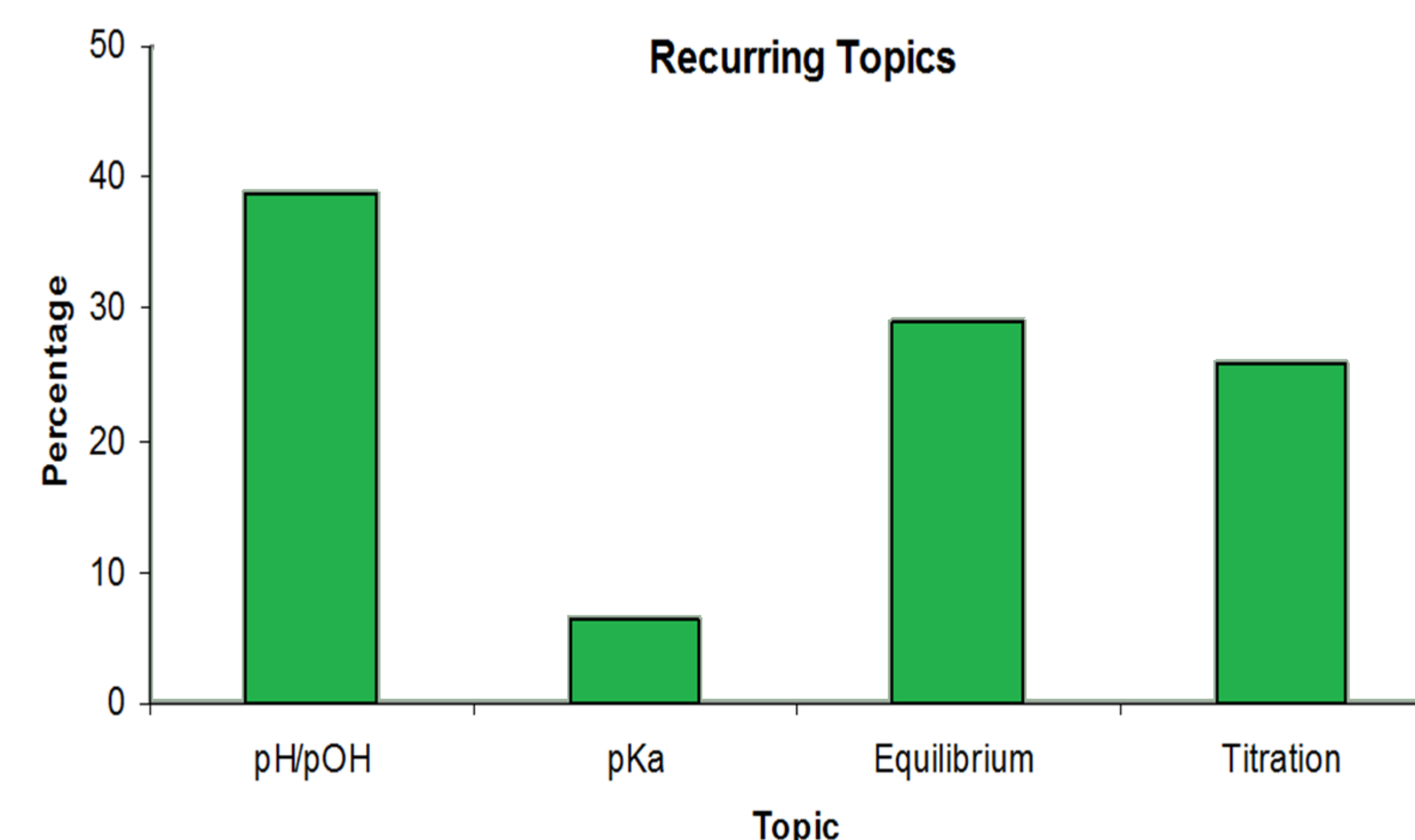


Figure 2: Percentage of recurring topics in the scientific literature.

Conclusion

Based on the results obtained in the 50 hours of research conducted, it is evident that acid-base concepts are extremely difficult for students to grasp. However, this burden can be significantly alleviated through the use of visual aids and more hands-on approaches for students. It has been evident throughout that the use of visual aids, such as in-class demonstrations and concept maps, greatly help students’ understanding of different concepts as they are able to visualize what is being learned. In addition, using practical approaches, such as enabling students to form their own experiments, allows for a deeper understanding of the concepts as well as allows the professors to see which areas students are still struggling with. From here, the next step(s) would be to implement the learning objectives and the novel techniques into the curriculum and observe their effectiveness.

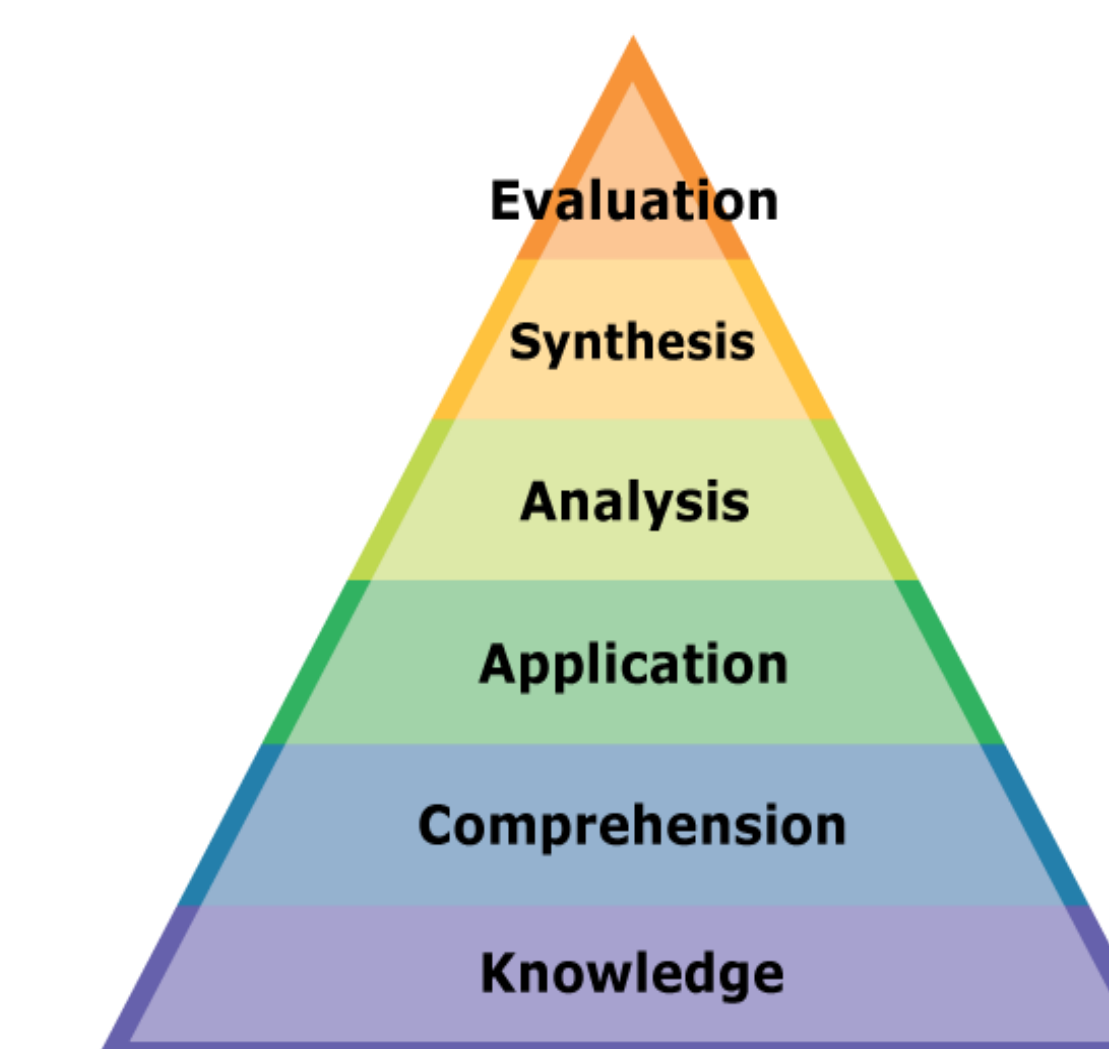


Figure 3: Bloom's Taxonomy of Learning Domains. Image from <http://www.learnnc.org/lp/pages/4719>

Methodology

There are various different approaches that can be taken to tackle this issue. I started off this project by analyzing scientific literature in established journals to:

- 1) determine common misconceptions students have regarding acids and bases
- 2) summarize the various acid-base teaching strategies that are applied
- 3) evaluate their effectiveness in teaching the particular topic.

In addition, various print sources were reviewed to analyze which concepts of acid-base chemistry were emphasized in teaching. Following this research, I developed learning objectives directed towards the areas of study in which students require the most attention.

Results

The goal of this research project was to come up with different teaching methods that are moulded around students’ weaknesses to improve their learning of the acid-base concepts. Through the research conducted, such methods were synthesized based on the common misconceptions and areas of weaknesses that were found. In the 50 hours that were devoted to this project, it was found that students learn concepts well when working in a group, bouncing ideas off of each other, as opposed to working individually. In terms of weaknesses, it was determined that students find it extremely difficult to take what they have learned and apply this knowledge to questions that require a higher order of thinking (higher up in Bloom’s Taxonomy- see figure 3). In addition, they have many misconceptions that are difficult to change. A solution that was created to work around this problem required students to put together their own laboratory experiment (reagents and procedure) to achieve a desired result as opposed to following one that has been pre-made for them. This way, the student’s understanding of the concepts is demonstrated. Visual aids such as concept maps (see figure 4) and in-class demonstrations have also shown an improvement in students’ understanding. Another recurring problem is that students have the tendency to explain each phenomenon based on the most recent model or concept that has been learned as opposed to applying cumulated knowledge throughout to answer a question. Therefore, multi-variate thinking, where a single phenomenon is described using various models and the effects of each are balanced to explain the outcomes, is recommended and is increasingly starting to become a method of interest to professors. These ideas and objectives have yet to be implemented to see the outcome.

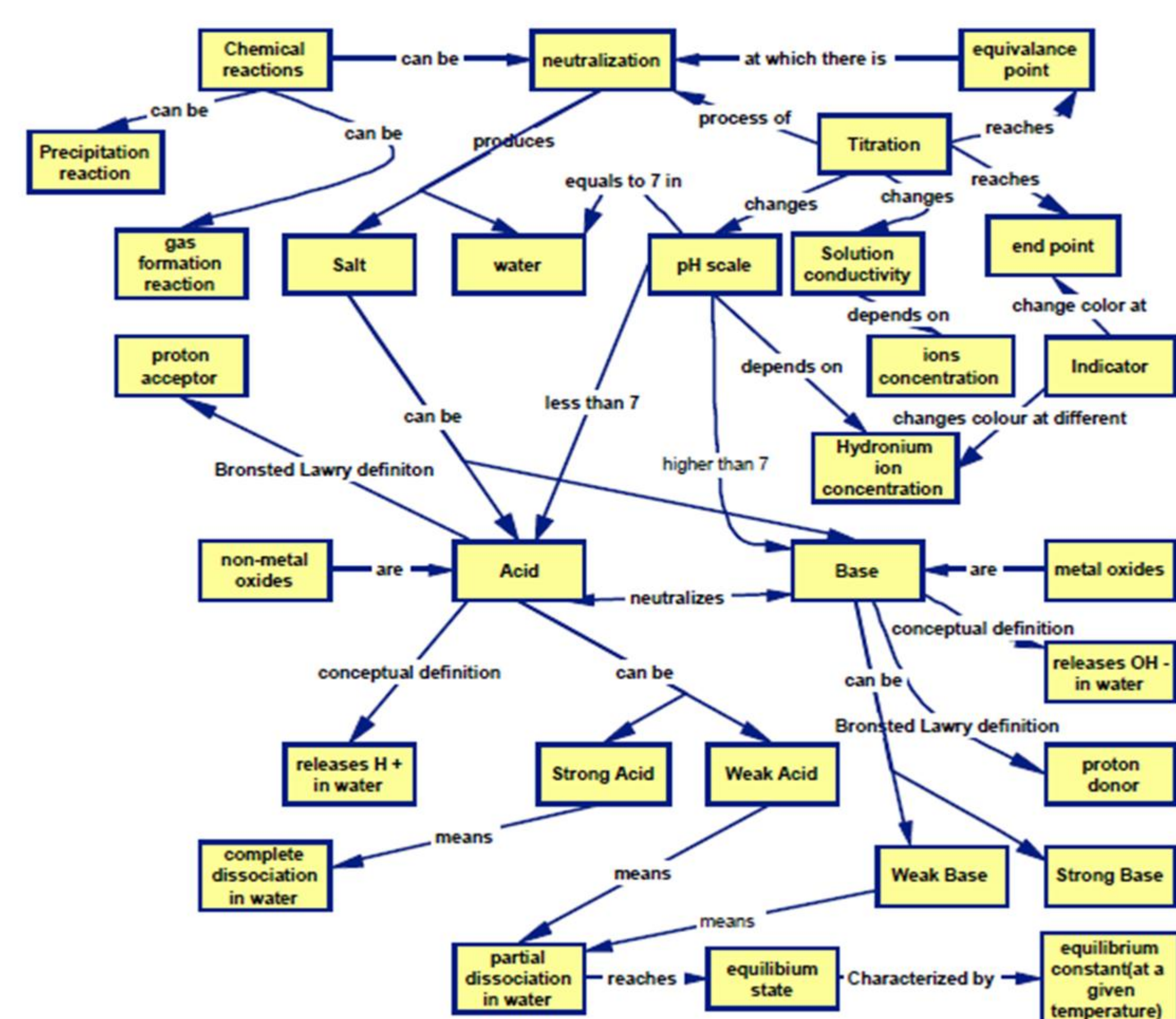


Figure 4: Acid-base concept map. Image from http://www.ejmste.com/v4n3/EURASIA_v4n3_BouJaoude.pdf

Acknowledgements & Contact Information

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Email: alison.flynn@uottawa.ca

Website: <http://mysite.science.uottawa.ca/aflynn//Welcome.html>

