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Drawing Exit Tickets: A New Way to Formatively Assess

By Margaret Hoeger

Instructional Strategies, Assessment

I recently read that drawing is more effective than writing or reading to help students remember information.[1,2] In two separate articles, the authors observed that regardless of a student's ability to draw, they are still able to remember more concepts if they drew them than if they wrote them down. As I routinely use exit tickets in my classroom to assess my students' understanding, I thought that perhaps I could have students draw their exit ticket rather than write answers to a question as an exit ticket at the end of class. After some experimentation with this approach, I have found that not only do I now have another tool to assess their understanding, but I was also providing them with a tool to remember complex topics creatively.

Mass spectrometry lesson

I use my new approach to exit tickets primarily with advanced students in my IB Chemistry HL class; however, I think it can be used successfully in General Chemistry classes as well. As I explain later in this article, my students also use this strategy when they are asking to define key words, not just when summarizing an entire lesson.

The first time I used this approach, I had 10 minutes left at the end of a 55-minute class, and asked students to summarize our lesson on mass spectrometry. I warned them beforehand that I was going to ask them to do something that was out of their comfort zone, and shared research that showed how drawing was more effective than writing for remembering concepts. I spent about five minutes summarizing this point, then asked them to draw an image on a piece of scrap paper summarizing what

they learned over the last hour. I have to admit that they were frustrated and uncomfortable, as this was something that they had never been asked to do. I encouraged them by saying this was another tool that they could use to help remember challenging concepts not only in chemistry, but in other classes as well. Some students did seem to enjoy the challenge and welcomed the opportunity to be creative.

I liked the creativity that the students put into their drawings. The originality of their drawings surprised me, as each of them focused on different aspects of the lesson that were important to them. One student, as shown in Figure 1, correctly highlighted the mass spectrometer instrument and how it fired electrons at the molecule so that the molecule became a positively-charged species. I thought this was important, as many students identify the fragments as neutral species, rather than positive. Her drawing of a human as a molecule also made the concept more memorable for her, as she could visualize what the molecule was doing inside the mass spectrometer. This assured me as a teacher that she understood this important concept — and also showed me why drawing exit tickets is a good formative assessment.

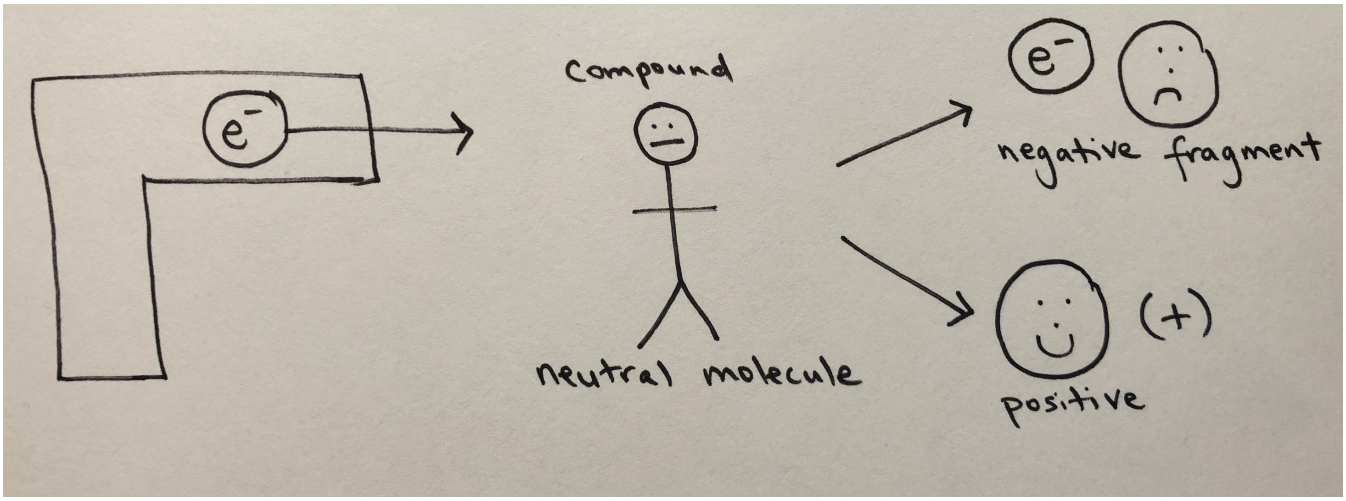

Figure 1. *Example of a mass spectrometry exit ticket drawing by a student.*

Another student's drawing, shown in Figure 2, reflected on some of the comments he had made in class. He was interested in the idea of the electron breaking up the molecules into fragments — again, making it into a charged species. All of the concepts that he summarized were correct, except that he stated relative mass, instead of relative abundance, on the y-axis. This was an important teaching opportunity for me, as I could then highlight the many *correct* concepts that he covered; I decided to address the one misconception he had at the beginning of the next class during our review of the previous lesson. Again, this was a useful tool for me to assess an individual student's learning, and also reinforce concepts to the whole class.

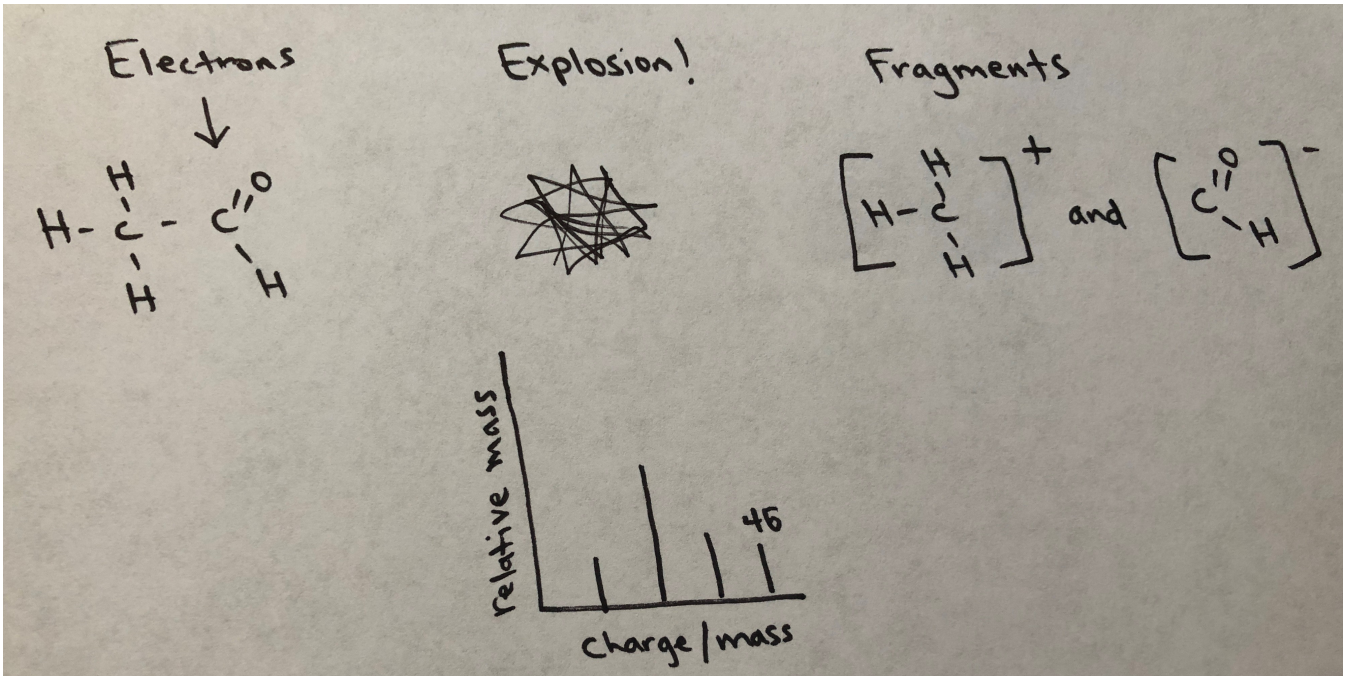

Figure 2. *Another mass spectrometry exit ticket drawing from a second student.*

A third student did what many students do, and summarized what we learned in class by referencing her notes. Depending on the lesson, sometimes I allow students to reference their notes; other times, I ask them to draw from memory. Both processes are valuable. Drawing a summary of notes is useful to this student, as it encapsulates and provides a schematic of everything we have learned. It also provides her with a physical copy of the summary she made after going through the process of sorting important details and presenting them succinctly. It is also useful to me, as I can check that she has the correct details.

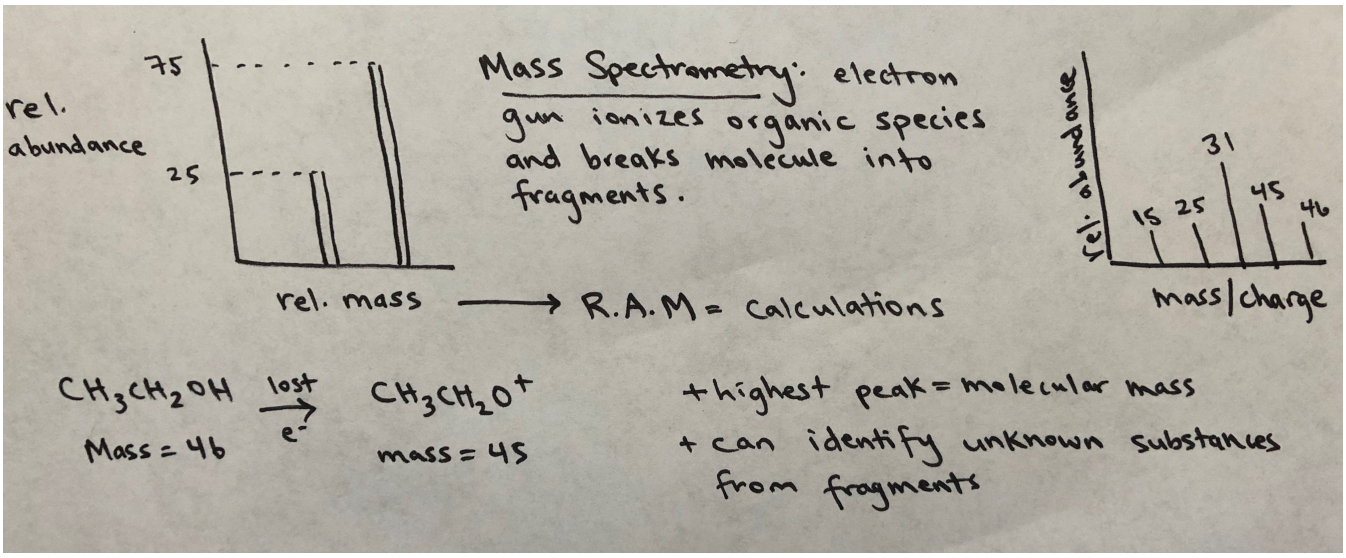

Figure 3. *A third student's mass spectrometry exit ticket drawing.*

Each of the students approached the exit ticket task differently. The first student drew an original drawing summarizing what she learned. The next student had an original drawing and a brief summary of a mass spectrum. The last student drew a detailed summary of her notes. I like the original drawings the best, because they challenge the student to process his or her notes more deeply; I also feel it will

be more memorable to them. The summary of notes, on the other hand, provides more detail about what was covered, and doesn't just focus on a few aspects. From of each of these contributions, I gained a better idea of the students' level of understanding and what they felt was important. It also revealed to me their comfort level with this activity.

I had the students submit drawn exit tickets routinely for our lessons on mass spectrometry and infrared spectroscopy topics during our analytical techniques unit. Each time I gave the students the same instructions: summarize what they learned from the lesson in a drawing. To prepare for the next class, I would review these exit tickets to assess the students' understanding and decide how to discuss the material. I also handed these exit tickets back to students at the end of the unit before they took the test. The students now had another summary as they prepared — not only for the unit test, but also for the standardized IB exam in May. They could use these exit tickets to reflect on the content as well as how they devised the drawings.

Considerations and improvements

The first time I used this exit ticket strategy, I thought that I gave students plenty of time to respond, at least 10 minutes of a 55-minute class. But on some occasions, this clearly wasn't enough time for those students who needed more time to process information. Unfortunately, collecting these at the end of class can be a bit chaotic, as students are rushing off to their next class. If you have students whom you know might require more time, try to look at their exit tickets to see if they may need an additional evening to finish theirs.

In my classroom, I don't assign a grade to exit tickets — but if I did, it would likely be a completion grade. This would ensure that students are going through the process. Alternatively, a rubric could be made to encourage the students to cover the different aspects of the lesson, but both my students and I liked the chance for them to be creative and show individuality.

I found that as this approach to exit tickets became a routine in my classroom, that students became faster at synthesizing the information. In some cases, this was because they knew what they were expected to do at the end of class, and therefore spent time in class planning what they were going to draw. Still, the work they submitted ranged all the way from highly imaginative renderings, to detailed and annotated diagrams remembered from class, to several images that required further explanation. They submitted what they felt was important from the lesson and what they would later use to remember the information.

I often start the following class by projecting 2-3 students' exit ticket drawings for everyone to see. Then, as a class we discuss the correct concepts as well as any misconceptions. This process highlights the different ways that the information can be processed and summarized. Students like seeing not only their work, but also the opportunity to see other perspectives contributed by their peers.

Feedback

I presented this idea at the ChemEd 2019 Conference, and received positive feedback. I also led a workshop where I asked participants to first draw an exit ticket-like drawing summarizing my presentation, and then share their work with the person next to them. Some participants said that they couldn't understand what their fellow participant had drawn, and some felt that as teachers they wouldn't have enough time to look at 120 exit tickets at the end of the day. The consensus among participants was that it is beneficial for students to draw and share their exit tickets with their peers, and that the act of describing the images further builds understanding.

While I don't use these exit tickets every day, I probably use them 3-4 times during a three-week unit. At the end of the unit, I hand all of the exit tickets back. Students typically enjoy looking at the work they completed and use them to study for the end-of-unit test. One workshop participant at ChemEd 2019 thought that a helpful idea would be to allow the students to bring their exit tickets with them for reference during a test, similar to how some teachers allow students to bring in an index card with notes. This would be another way to motivate students to complete a detailed, memorable exit ticket.

Related ideas

Alternatives to using exit tickets, but still encouraging students to draw, would be to have them draw a sketch to supplement the definition of key words that are used. In the Fernandes article, the original research involved having the students made drawings illustrating a list of words, and then test how well they remembered the individual words. In a General Chemistry class, students sometimes have a hard time identifying the differences among atoms, molecules, and ions. Simply having them differentiate between these with a drawing could be a way to assess their understanding.

I found that having my students draw exit tickets is a useful method for me to collect information on their understanding, a tool that students can use to synthesize and summarize information, and also a way for me to get new teaching mnemonics in class. I think this tool could be used for a variety of different levels of chemistry classes. The process of drawing and summarizing reinforces the concepts. I encourage you to try using this strategy in your own class, as it will stretch your students' imagination and creativity and you will enjoy seeing their finished products! Some of the exit tickets are works of art!

References

1. Fernandes, M. The Surprisingly Powerful Influence of Drawing on Memory. *Current Directions in Psychological Science.* 2018, 27, no. 5, 302–308.
2. Terada, Y. The Science of Drawing on Memory. *Edutopia*, March 14, 2019. www.edutopia.org/article/science-drawing-and-memory (accessed June 25, 2019).

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About the Author

Margaret Hoeger teaches 9th grade General Chemistry and 11th and 12th grade IB HL Chemistry at Washington International School. She has a B.A. in Chemistry from the University of Northern Iowa and an M.A. in Chemistry from Bryn Mawr College. She is interested in formative assessment and follows the ideas from Harvard's Project Zero and Edutopia.