Clarifying Chemistry

What is motivating?

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> *The 'ask-and-receive' relationship is a space in the [Science] subject team, and is a unique contribution to team literature*

Geology 'Rocks'! In Junior Science it was fun and presumed to be motivating to use this cryptic as a title for a unit, a lesson or as an interrupting exclamation in class. Creativity did not provide a similar positive motivating phrase for Chemistry, from my recall. On 'bad' days students opined its 'confusing chemistry' or 'chemistry stinks'! What about 'Chemistry is crackers!' Does a one liner motivate enough?

In-service days in Science were valuable events when curriculum concepts were unpackaged and better explanations modelled, learning tools were shared—I loved mnemonics, like ROYGBIV and LEO goes GER—and as well assessment strategies were devised and procedural consequences compared. But, why was it only on those days that this seemed to happen? School days seemed usually to be too busy, boring and barren for sharing these insights.

Gregory Smith (2009) in a phenomenological study of 15 high school science departments within the Queensland state education system has noted that while the Professional Standards of Queensland's teachers indicate that teamwork is critical to teachers' work, "the research findings highlight the non-supportive team and teamwork policies, procedures, and structures in the schools and identify the lack of recognition of the specialised skills of science teachers" (Abstract). He describes schools as "support vacuums" and identifies four impediments to teamwork in schools:

- Non-social relationships to science teachers;
- School policies and structures;
- Lack of school policies and structures; and
- Vulnerability and low self-efficacy. (p. 228)

Smith models relationships between these factors, increasing the number of variables considered (pp. 218–235), and claims Science teachers expound a unique conception of teamwork.

> The science department provides a space where teachers can 'weather the storm' of being undervalued, frustrated, unappreciated, and demoralised together. The team identity generated by the teachers provides support as they are bombarded by a deficit view of science teaching. The science department provides a strong collective bounded by the discourse of science and social relations. It is also central to science teachers' identity as it engenders a sense of worth and value…In the development of their own team model, science teachers illustrate their own shared mental models of teamwork…The 'ask-and-receive' relationship is a space in the subject team, and is a unique contribution to team literature. (pp. 237–238)

Colleagues in Science are usually sympathetic to mutual need. Managing the wide variety of equipment, imminent danger and content variation accentuates the need of short timelines and immediate solutions. If you ask science teachers, someone will usually respond, but often only if you ask. It's about busyness but also an acknowledging of professionalism and specific past professional training.

Clarifying motivation: Gold still glistens!

Present when my eldest granddaughter returned home after her first Chemistry lesson, my curiosity demanded I ask what her lesson was about. "It was amazing! We turned small copper coins into gold ones—and they used to do it to two cent coins and take them down to the canteen coz they looked like two dollars, so that's why we had to use one cent coins." Now, I was interested in the Chemistry rather than the ethical implications, "So how did you do it?" I was thinking electrochemistry of some form. "We just dipped it in things and then heated it." "So, what happened—how?," I asked. "It just went gold. It was a great lesson. Here it is." The coin was glistening in the palm of her hand. Would she let me touch it?

Here is the quick method. However, use the reference list to gain clear statements of resources, danger assessments and some alternative chemicals. Place a 'copper' coin in a solution of sodium zincate that is in contact with zinc metal in the solution. The coin is coated with a silvery metal at this stage. Take the plated coin in some tongs, wash, and then heat it in a Bunsen flame for a few seconds. The coin now appears gold. Rinse the coin to cool it before handling it. The gold 'coating' may flake off.

Clarifying the chemistry

Zinc and compounds of zinc are amphoteric meaning they react with both acids and bases. The zincate solution can be formed by reacting zinc metal, with caustic soda solution (3M) while it is heated to boiling, a reaction summarised by the ionic equation

$$2H_2O(l) + Zn(s) + 2OH^-(aq) \rightarrow Zn(OH)_4^{2-}(aq) + H_2(g)$$

The copper coin in contact with metallic zinc forms an electrochemical cell with the two half equations:

$$Zn(s) \rightarrow Zn^{2+}(aq) + 2e$$

$$Zn(OH)_4^{2-}(aq) + 2e \rightarrow Zn(s) + 4OH^-(aq)$$

and a summarising ionic equation

$$Zn(s) + Zn(OH)_4^{2-}(aq) \rightarrow Zn^{2+}(aq) + Zn(s) + 4OH^-(aq)$$

The zinc on heating, forms an amalgam with the copper which when it solidifies (Low M.P. = 900–940°C) is termed brass. This is the gold colour.

The pedagogy

This activity includes many concepts to discuss, depending on the level at which it is introduced. Some suggest that third graders can carry out the experiment. Is it appropriate to use significant experiments that support the development of deep concepts as 'wow' factor, unexplainable demonstrations in earlier years, often ignoring dangers? For all students the phenomenon will deepen the wonder about chemical composition and reaction. Early concepts include the states of matter, mixtures and the properties of matter.

An associated project could investigate the physical properties and uses of brass. Senior chemistry years can consider amphoteric properties, electrochemistry, complex ions, forms of equation writing with assigned questions potentially drawn from any, or all these areas.

"So do you think you will like Chemistry?" "Yeah, of course." It wasn't just the coin that glistened. There was a sparkle in her eyes and controlled excitement in her voice. TEACH

References

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