

What do we learn from Chemical Bingo?

- *What does the Periodic Table of elements teach us?*
- *In the lively atmosphere of the comprehensive middle school, what actually is learned from the popular classroom game of Chemical Bingo?*
- *Would students of chemistry benefit from an (Interactive Multi Media) IMM version of the game?*

The Periodic Table

In its modern form, Mendeleev's Periodic Table is an arrangement of the chemical elements in a segmented two-dimensional array that ranks them in order of atomic number (the number of protons in the nucleus of an atom of an element) and points to their periodicity in physical and chemical properties.

Mendeleev was as much pedagogue as chemist and the table that evolved from his original conception, is a rich tapestry of history, exotic name and clever iconography. What we have in the Periodic Table is a very human interpretation of one particular facet of the created order, and an instructional machine *par excellence*.

On the internet, there are several wonderful IMM examples of the Periodic Table. There is also a range of learner-centered, interactive tests of knowledge concerning its application.

Chemical Bingo

In contrast to Mendeleev's Periodic Table, Chemical Bingo is a learning stratagem based on a simple game-of-chance. Most teachers employ the game for the relatively limited objective of assisting adolescent students of science to commit to memory the internationally accepted symbols ascribed to the chemical elements (no matter how they are named, in whatsoever language). Each student is given a Bingo card inscribed with a set number of randomly selected symbols. The Caller, in the first instance the classroom teacher, announces the name of an element drawn randomly, one-at-a-time, from a hat. Each student crosses out the symbol for the element if it is present on her/his card. The first student to have all the elements on her/his card crossed out is declared the winner and is given a prize, usually a chocolate frog.

Before long, any teacher worthy of the name comes to realize that this simple game-of-chance has the potential to teach to a much wider purpose than that originally intended. Rather than merely calling out the name of the element (say, for example, "Helium" to which the students respond by searching on their Bingo cards for the symbol *He*), soon the teacher is calling out clues such as: "*The symbol for a noble gas that we use for inflating lighter-than-air party balloons*" or "*The symbol for the second most abundant element in the universe, the atomic nucleus of which contains two protons and, in its most common isotope, two neutrons*" or "*The symbol for the element named after the ancient Greek name for our Sun*" and so on. In time, with a

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responsive class (and most are responsive), the situation arises where students themselves are clamoring to act as Caller and to invent their own version of clues that will test the other students' level of recall and understanding.

Whether these richer veins are tapped or not depends very much on a range of factors in the educational environment constructed by the teacher.

First there is the interface: the design of the Bingo card has a significant bearing on the depth of understanding invoked by the game. The typical card is set up as a simple rectangle of rows and columns containing the prescribed set of symbols. However, by designing the card so as to mimic the form of the Periodic Table either in its entirety or in a cut down version, the student can be painlessly drawn into a deeper mode of thinking.

The props the Caller uses to support the students are equally important. Early in the students' experience of the game it helps to have an overhead transparency of the elements coupled with their matching symbols. This prevents frustration and loss of motivation. As the level of students' recall improves, a less declarative form of support can be provided, in which the written name of the element without the accompanying symbol is placed on a blank matrix, set up in the form of the Periodic Table. In time the props can be dispensed with altogether (not without a few howls of protest, it should be added).

Then of course there is the issue of how the depth of content and skills contained in the clues are matched to the ability of the student and to the instructional sequence in the formal, teacher-led lessons that deliver the curriculum. For, of course, Chemical Bingo is not an end in itself.

Chemical Bingo is a pedagogical stratagem, which along with other strategies is designed to achieve specific learning outcomes within a set curriculum; set usually from above. This is a stratagem that is part of a top-down approach to learning, let there be no mistake about it. But could it possibly be otherwise?

An IMM Version?

At first glance, Chemical Bingo is an obvious candidate for Computer Enhanced Learning (CEL): the design of interactive interfaces, the generation of random numbers, the step-by-step development of skills, and the carrot-and-stick approach to motivation are all the kinds of things that computers do best. They have long been used by educators of behaviourist persuasion.

For those who are of more "constructivist" persuasion, a perceived advantage of a CEL version is that it would shift the center of gravity from the teacher to the learner. On the one hand, a stand alone format (e.g. CD-Rom) would encourage a 'learner-to-data base' mode of interaction. On the other hand, an online Internet environment, could seek to encourage a 'learner-to-other' (including other learner) form of communication. In both cases, computers would mediate the interaction. The influence of the teacher (instructional designer) would be in the background, rather than foreground.



Would this, in fact, be a desirable outcome of the shift to the CEL environment?
Probably not!

The thing that is most noticeable about the success of the game of Chemical Bingo in the class-room situation is the tacky, human, spontaneous mode of interaction that it engenders. With the master-of-ceremonies out the front, the 'feel' is more that of vaudeville than of row-upon-row of one-arm-bandits in a darkened, smoke-filled dungeon.

What is it about games-of-chance that so grips the public imagination (if that is not too strong a word for it)? In a much-quoted aphorism, Einstein was reputed to have said: "God does not play dice with the universe." But clearly, we populace at large are not persuaded.

In 1997-1998, before the full impact of the Internet revolution was upon us, 80% of Australians were reported as participating in gambling of some kind, although the majority gambled less than once a week. In that year, Australians lost \$10.8 billion on commercial gambling which equated to an average loss of 3 per cent of disposable income. For identified problem gamblers, losses from gambling represented an average of 22% of household income.

Indisputably, the internet is awash with games of chance and pseudo skills. Children are actively encouraged to participate. Many of these sites are promoted by the creators of on-line casinos and many are examples of interactive multimedia at their most enticing. Is it any wonder that data from the "2000 Prevalence Study 'Gambling Behaviour in Britain' showed that the group most vulnerable to developing a gambling problem is 16-24 year old males, with 4% of those who have gambled in the last year developing a gambling problem". It is not just with tongue-in-cheek that Creed (1998) referred to the latest generations of gaming machines as 'one-armed behavioral technicians'. The same could be said of many of the on-line gaming sites.

The question we must ask then is this: "is Chemical Bingo safe? even in the hands of a teacher? and even if he is a trained vaudeville performer? What would we in fact be teaching, if we unleashed an IMM version of the game onto the internet?"

Food for Thought

Lehrer, Tom (2000). *The Elements*. <http://www.privatehand.com/flash/elements.html>
Adapted from the 1950s song. [accessed July 2009]

Levi, Primo (1984). *The Periodic Table*. Translated from the original 1975 Italian version. Penguin, London.

Sacks, Oliver. (2002). *Uncle Tungsten: Memories of a Chemical Boyhood*. Vintage Books, New York.



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