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FOREWORD

Science as Story: Science Education by Story

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Introduction

Story telling has been a very traditional way for information to be passed on from one generation to another. Long before there were alphabets and methods of writing, the important information and the wisdom of a culture was passed from one generation to the next by stories. This is still evident today even in societies where written information has become very

dominant. Parents in these societies still engage their very young children with stories, either read or orally, long before these children know about letters and reading. In less developed societies where written forms of the language are more recent and literacy rates are still low, story telling holds centre stage in the education of each new generation.

Science as Story

For some strange reasons we, as science educators, until very recently have forgotten that Story could be a powerful form of education in our own subject of science. Yet behind every advance in science there is a human story. New scientific knowledge is always the outcome of human endeavour, some of it relatively short, but for much of it quite prolonged as the scientists concerned worked away in their laboratories, experiencing disappointments, blockages and triumphs. But during these weeks, months and years, there were still other relationships to sustain, other things to attend to, funds and support to be found, rival groups to watch, etc, etc.. The story of the deciphering of the double helix structure of DNA by Watson and Crick in the 1960s was as exciting as any detective story. When Marie Curie's life story and her struggle to isolate the new element radium was published and then made into a film it inspired a generation of young women in the 1940s to enroll for scientific studies.

I used the word "forgotten" deliberately because I myself have been reminded, through a current research project, of the powerful influence **The Harvard Case Histories in Experimental Science** had in the 1950s on a number of the pioneers of science education research who I have been interviewing. Inspired by James B Conant, a leader in science and in the university scene in the USA, these **Case Histories** told the stories of great developments in science like *The Rise and Fall of the Caloric Theory and of The Atomic Molecular Theory* from the inside, getting the reader to share the mind issues that these scientists were grappling with. Ironically, these **Case Histories** were produced not for use with science students but for use in undergraduate classes at Harvard University for law and humanities students. They did, however, become models for the physics curriculum project in the 1960s that became known as Harvard Project Physics. Its materials were, I remember, so very humanly different from PSSC Physics

that appeared a few years earlier. The latter set the style of a dehumanized, conceptual approach to school physics that, alas, has been so dominant in schools everywhere since that time.

Science Education by Story

I recently was given two story books about science. The first was by Michael Guillen and was entitled **Five Equations that Changed the World** (Hyperion, 1995), and the second, by Dava Sobell, was **Gallileo's Daughter** (Fourth Estate, 1999). It is a pity the first author chose only equations that are associated with men, but the significance of women in their lives is very clear in the stories. The second book is built around a woman who was quite essentially important in one of the best-known historical dramas of science, that has so often been presented without any reference to her.

If I say one of the equations in the first of my books was Einstein's $E=mc^2$, readers may like to hazard a guess what the other four equations are. Each of the five stories deals with three aspects that make sub-stories in themselves. The first is the story of the person who produced the equation, what was his background, how did he come to be engaged in this problem area, and what happened to him subsequently. Secondly, there is the story of how the science unfolded to lead to the famous equation, and finally there is the story of what the worldview of things was before the equation and how it was shaken up irreversibly when the equation finally appeared. Like any great storyteller, these three sub-plots are interwoven in ways that carry each along with the others, and continually give readers like me a sense of almost being there.

Examples of Science Education by Story

Belatedly, it is great to see people now writing about the school science curriculum in terms of *Story* being a central feature. After taking a strong STS approach to lower secondary chemistry in England and Wales, the Salters group at York University chose a quite different approach for its successor the A Level Chemistry course. Central among the materials prepared for this course is the student text which has the title, **Storylines**. A list of the stories making up one of its units is given in Example 1.

Example 1

At the same time on the other side of the globe, Dr Cliff Malcolm at the Curriculum Corporation in Australia was pioneering *Story* as the curriculum heart of a new approach to teaching Science in the primary and junior secondary years. (see Example 2 for the storylines of some of its units for the early secondary years.)

Example 2

Good stories have characters, events and a plot that is woven by the way the characters interact with each other and with the events. It is the quality of this interweaving of the human flow of time and space that makes stories so attractive and so memorable. This is the very opposite of the abstract and conceptual way we have been presenting the central content of school science for most of the last thirty years. For most students this approach seems rootless, suspended beyond time and space, and not surprisingly, is hard for learners to comprehend and build into their long-term memories.

Beyond 2000: Science education for the future

Beyond 2000: Science education for the future (Eds. R Millar and J Osborne, King's College London) is a futuristic report on school science education in Britain that was launched at the Royal Society in 1998. In it, a group of leading science educators in that country tried to project their thinking beyond the next minor revision of the National Science Curriculum to set some goals and a vision that might lift curriculum thinking beyond the immediate details of this topic or that one. It is interesting to read that Story has a quite central role in their vision.

> *The curriculum needs to be presented clearly and simply, and its contents need to be seen to follow from the statement of aims.*

> *Scientific knowledge can best be presented in the curriculum as a number of key 'explanatory stories'. (p 2014)*

This is a recommendation well worth exploring by any curriculum authority, and by those responsible for science teacher education, if they are seriously interested in improving the quality of school science teaching and learning.