│ Chemistry Curriculum and Methodology A

Summative Task: Resource Analysis

Select an appropriate resource which may be incorporated into the teaching of SACE Stage 1 or Stage 2 Chemistry (this will assist in the production of the final Topic Folio).

Analyse the resource according to the criteria outlined in the Analysis Table.

Prepare a multimedia presentation (may be in the form of a flipped recording) based on your analysis of the resource (approximately 3 - 5 minutes) to share in the following Tutorial.

Assessment

The Analysis Table and Multimedia Presentation are to be submitted electronically via MyUni (15%). The digital resources will be shared through a Discussion Board to extend the resource repository being developed. You will be asked to post comments in 3 active discussions (5%) to demonstrate further evidence of collaboration and engagement with the task.

Course Learning Outcomes

* Demonstrate deep knowledge and understanding of the complexity of the discipline and the teaching strategies of the learning area.
* Assemble a range of subject-appropriate resources, including online, that engage a diversity of students in their learning.
* Integrate relevant research and theory to develop a broad repertoire of subject-appropriate teaching and learning strategies, including use of ICT.
* Demonstrate communication skills to present a clear and coherent exposition of knowledge and ideas to a diverse range of students

Assessment Rubric Student:

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| --- | --- | --- | --- | --- | --- | --- |
| **Assessment Design Criteria** | **Fail**  **0 < F < 49%** | **Pass**  **50 < P < 64%** | **Credit**  **65 < C < 74%** | **Distinction**  **75 < D < 84%** | **High Distinction**  **85 < HD < 100%** | **Weighting** |
| **Selection of resource** | Identifies and selects a resource of limited relevance | Identifies and selects a mostly relevant resource | Identifies and selects a relevant resource | Identifies and selects a highly relevant resource | Discernibly identifies and selects a highly relevant resource | 2.5% |
| **Analysis of accessibility, relevance and suitability** | Limited analysis | Analysis of relevance and suitability | Clear analysis of relevance and suitability | Clear and comprehensive, analysis of relevance and suitability | Comprehensive, clear and insightful analysis of relevance and suitability | 5% |
| **Connection to curriculum & methodology** | Constructs limited connections to curriculum and pedagogy | Constructs connections to curriculum and pedagogy | Constructs clear connections to curriculum and pedagogy | Constructs clear and detailed connections to curriculum and pedagogy | Constructs clear, detailed and perceptive connections to curriculum and pedagogy | 5% |
| **Communication** | Limited communication of findings | Communicates a range of findings with the use of ICLT | Communicates a range of findings effectively with appropriate use of ICLT | Communicates a range of findings highly effectively with appropriate use of ICLT | Communicates a range of findings highly effectively with highly appropriate use of ICLT | 2.5% |
|  | | | | | Result: | 15% |
| **Discussion board** | 5% | | | | | |
| Comments: |  | | | | | |

Analysis Table

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| --- | --- |
| **Resource** | The Feynman Lectures on Physics, Volume I, Chapter 1. Atoms in Motion.  Although the lectures as a whole where taught over the first two years of a university degree in undergraduate physics, Feynman begins with a broad introduction to science (with a focus on chemistry), and it is this introduction I think is a relevant resource. The first chapter, “Atoms in Motion” forms this introduction to chemistry and is a good resource for chemistry teachers I think, and that the first three chapters form not only a good introduction to science for a layperson, but also an example of some really inspirationally thoughtful, concise, and eloquent teaching (writing) that could inspire teachers to adopt his style of exposition. I’ll give some examples below and in my talk about what I mean exactly by this. |
| **Link** | http://www.feynmanlectures.caltech.edu/ |
| **Accessibility** | Technically the rights to The Feynman Lectures on Physics belong to the California Institute of Technology (Caltech), and so copying and reproducing the work is not allowed but it is free to access and read online, so bringing it up in a web browser in class should be allowed I should think. |
| **Relevance** | The way I envision this being relevant is mostly in terms of providing exemplars of teaching methodology --- content pedagogy knowledge, essentially. Direct quotes and examples taken directly from the lectures could also be included to add flavour to a topic, especially if students are particularly interested in history or have heard of Feynman. |
| **Suitability** | Feynman’s general introduction and description of science as a whole is directly relevant to science inquiry skills --- deepening an understanding of the logical process underlying the steps of making a hypothesis, designing an experiment, and matching observed phenomena to your hypothesis, and what to do when it does not match (celebrate!).  Some of the introduction to chemistry in the first few sections contribute towards science understanding on a variety of Stage 1 SACE Topics, and could be used as examples or just inspiration for a teacher to make their own examples based on the ideas Feynman introduces and the way he introduced them. For example, Feynman’s “atomic hypothesis” that “all things are made of atoms” matches exactly with the first science understanding point of subtopic 1.2: Atomic structure “All materials consist of atoms”. Feynman’s example of salt dissolving in water (Figure 1-6) could be used to illustrate concepts related “Ionic Bonding” in subtopic 2.2: Bonding between atoms, and solubility in water as in subtopic 4.2: Solutions of ionic substances. Later on Feynman’s introduction to chemical reactions has a discussion of combustion (Figure 1-8) that relates to subtopic 6.1: Concepts of oxidation and reduction, and so on. |
| **Application** | I’ll give two examples, one broad and general and one specific with an example of particular activity:   1. Broad and General application:   One of the most striking things for me about Feynman’s writing is how he provides caveats with his figures and explanations. Often, particularly from our perspective as teachers, we consider these kinds of caveats “obvious”, but I think there is potentially a lot of educational value in being explicit about these things. I’ll provide a few quotes corresponding to descriptions of the first few figures in Chapter 1 to clarify exactly what I mean.  “Fig. [1–1](http://www.feynmanlectures.caltech.edu/I_01.html#Ch1-F1). This is a picture of water magnified a billion times, but idealized in several ways. In the first place, the particles are drawn in a simple manner with sharp edges, which is inaccurate. Secondly, for simplicity, they are sketched almost schematically in a two-dimensional arrangement, but of course they are moving around in three dimensions.”  He is precise (gives the exact magnification, for example), and hints at concepts that will come later, “atoms don’t actually have defined boundaries” while at the same time essentially saying “but we’ll use that simplification to talk about them for now”. The 2-dimensional simplification vs a 3-dimensional structure is nice too, and he brings up again later in Figure 1-4 “Fig. [1–4](http://www.feynmanlectures.caltech.edu/I_01.html#Ch1-F4): the molecules lock into a new pattern which is *ice*. This particular schematic diagram of ice is wrong because it is in two dimensions, but it is right qualitatively”. Another point that Feynman doesn’t mention here, although he brings it up later on is that this figure is a still image, while in reality these molecules and atoms would be constantly moving around and vibrating, bouncing off each other and rotating in three dimensions. I think there is educational value in using simplifications, but there is also educational values in explaining to the students that the representations you are giving them ARE simplifications, and describing the ways in which they are simplifications, to help scaffold their future learning when they are then asked to develop their understanding beyond the simplification.  Another small example, but a personal favourite: “In Fig. [1–2](http://www.feynmanlectures.caltech.edu/I_01.html#Ch1-F2) we have a picture of steam. This picture of steam fails in one respect: at ordinary atmospheric pressure there certainly would not be as many as three water molecules in this figure. Most squares this size would contain none—but we accidentally have two and a half or three in the picture (just so it would not be completely blank).”  One last example, “Figure [1–7](http://www.feynmanlectures.caltech.edu/I_01.html#Ch1-F7) is an illustration of the three-dimensional structure of common salt, sodium chloride. Strictly speaking, the crystal is not made of atoms, but of what we call *ions*. An ion is an atom which either has a few extra electrons or has lost a few electrons.”. This is a fantastic example of how a new concept, in this case ions, can be introduced through these caveats. Including caveats with your explanations naturally leads to questions: and if your students are asking you questions, you’ve already won. Even if they don’t though, it is still representing a fundamental quality of science in that all our theories are models for reality, useful but not absolute.   1. A specific (SIS) application:   I’ll start with one of my favourite quotes from this text: “the sole test of the validity of any idea is experiment”. Feynman repeats this several times, stating that it is what he believes to be the “fundamental hypothesis of science”. He explains what he means by this in more detail by contradicting a statement often made by philosophers that “one of the fundamental requisites of science is that whenever you set up the same conditions, the same thing must happen” in a section of text that when I first read it, made me laugh out loud and forward a quote of it to everyone I thought might be interested, I’ll include that text here:  “… it is fundamental to the scientific effort that if an experiment is performed in, say, Stockholm, and then the same experiment is done in, say, Quito, the *same results* must occur. That is quite false. It is not necessary that *science* do that; it may be a *fact of experience*, but it is not necessary. For example, if one of the experiments is to look out at the sky and see the aurora borealis in Stockholm, you do not see it in Quito; that is a different phenomenon. “But,” you say, “that is something that has to do with the outside; can you close yourself up in a box in Stockholm and pull down the shade and get any difference?” Surely. If we take a pendulum on a universal joint, and pull it out and let go, then the pendulum will swing almost in a plane, but not quite. Slowly the plane keeps changing in Stockholm, but not in Quito. The blinds are down, too. The fact that this happened does not bring on the destruction of science.”  (this is a quote from Chapter 2, section 3: Quantum physics)  I might design an activity for Science Inquiry Skills based around this concept. For example, I might tell my students that some beer-loving (and coincidentally Belgian) scientists decided to do an experiment to test the reproducibility of their beer-brewing production. So far they had been preparing their wort and leaving it in large barrels in the cellar of their monastery (they also happen to be monks) until it formed into beer after some time. They decided that this time they would prepare twice the normal amount of wort, put half of it in the cellar as usual, and send the other half to some hermit friends of theirs who live in the nearby Zenne valley. They are interested if the two batches of beer turn out the same, as the only thing that they have changed is the location at which the fermentation is done. Of course the two batches of beer turn out completely different, the beer from their cellar turns out sweet and rich and frothy as usual, while the beer fermented in the Zenne valley turns out sour and tart but refreshing. Why do you think the beer turned out so differently? |

You can find more information --- presentation slides, and other resources I also looked into --- in my e-portfolio post:  
<https://armadilloa16.github.io/eportfolio/chemcm/2018/02/13/feynman-lectures.html>