# Education in Radiation, Radioactivity, and Nuclear Science

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## Summary

Nuclear science and nuclear energy are not widely understood topics. A lack of understanding for a potentially dangerous technology can be the cause for avoidance and even fear. In order to break down the barriers of a misunderstood industry, high energy learning is an initiative to change the perspective of nuclear science and technology. Through explanation of the fundamental concepts surrounding nuclear science, we reconstruct a trust within the communities and cultures across the nation. Being able to change the perspective of uninformed and misinformed people may not only benefit the nuclear industry, but the state of our global environment.

## 1. Introduction

Radiation is one of the most misunderstood and negatively inflated scientific topics today. Media often portrays radiation to be both very rare, and extremely hazardous. In order to supply the general public with information to combat misconceptions of radiation, we have created a short series of videos leading up to fundamental understanding.

We all know education is important; it gives people the freedom to form an educated opinion on matters that may affect their lives. Without a good understanding, opinions may be easily influenced by previous biases, myths, and misconceptions. One industry that is largely affected by a lack of education is the nuclear power industry. Many times, nuclear power is linked with nuclear weapons in people's minds and the fear of nuclear accidents releasing radiation hinders nuclear power from becoming a more dominant energy source in the world's energy market. Nuclear science and nuclear energy are not widely understood by the public, mainly because neither topic is taught to people.

Thankfully, the solution to such an issue starts simply: A lack of knowledge may be fixed with an increase in education. It is evident that the issue is more complex, however providing more sources of education and improving on what education there is out there is a step in the right direction. Education in primary, secondary and post-secondary schools allows for a large number of students to be exposed to subjects at a younger age that may help in the future. Topics such as nuclear power will be more familiar and easier to pick up or re-learn. Out of classroom education from well structured websites that provide enough information for a fundamental understanding and links for further study can be helpful for those who choose to take time and research a subject. Wikipedia is

a great example of providing such a layout and can be a useful resource when first exploring a topic. For visual learner, the use of videos can be a convenient resource. The use of long videos such as documentaries or program specials is useful in providing a "big picture" overview of a subject. Longer videos that provide broad concepts instead of small details are more likely to impact viewers positively and not burden learners with too much information all at once.

The use of short educational videos taught in a series allows for a subject to be broken down into smaller, more manageable pieces and allow for more detail to be covered. Using videos that remain shorter than five minutes prevents people from becoming overwhelmed with too much information all at once. A single topic can be focused on in one video and users can review topics multiple times until they feel comfortable moving onto a new topic. There is also the possibility of expanding the topics covered by adding additional videos to the collection.

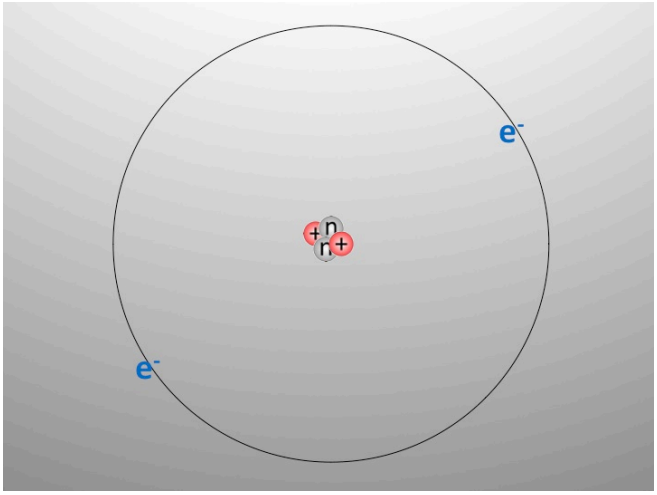

**Figure 1- Atomic structure of Helium**

The project this paper describes uses short educational videos as a way to teach about radiation and radioactivity, a subject relevant to nuclear science and the nuclear power industry. Providing fundamental information about radiation and radioactivity in an easily accessible way can help increase the public's general knowledge and diminish common misconceptions. The videos will start with material that is more familiar and will eventually explore lesser-understood topics, while building on material learnt in previous videos. This paper will aim to describe what information the videos will be presenting, as well as how the information will be presented.

## 2. Video Lessons

### 2.1 Lesson 1: The Atomic Structure: Introduction of protons, neutrons, and electrons.

The First lesson of the video series explores the world of atoms and how they are organized. While this video is not specific to radiation, it serves as a good starting point as it deals with topics that will be most familiar to the audience. Subatomic particles such as protons, electrons, and neutrons are introduced, and the connection between the number of protons and electrons and ions are shown.

### 2.2 Lesson 2: Neutrons and Isotopes.

Now that we have covered the basics of the atom and elements, we look towards further explaining the components of the nucleus. We keep the complexity at a minimum by removing the unnecessary electron graphics. Focusing in on the nucleus, this second video explores the effects

that differing numbers of neutrons has on different elements (i.e. comparing the properties of different isotopes).

### 2.3 Lesson 3: Stability and Decay:

The third video in our series begins by explaining a term used throughout the first two videos that is not specifically defined. Stability of the nucleus cannot be understood until the components of the nucleus are explained in some detail. This lesson begins by referring back to uranium, and showing how the proton/neutron difference is much greater than the smaller nuclei that have been examined thus far.

### 2.4 Lesson Four: Radiation and Radioactivity

It is lesson four where the topic of radiation and radioactivity are explored in greater detail than any of the first three videos. While non-ionizing radiation is discussed, it is ionizing radiation that is the focus. The connection between ionizing radiation and radioactivity will be made, and examples of radioactive elements will be shown.

## 3. Discussion of video format and style

Each video is produced with the intention of making learning as simple as possible. We use a number of methods in order to keep as few hindrances from understanding the necessary content. Every aspect of production involved study and trial of videos both previously created, and our own tested versions.

The videos in the series are each created in the same way. We created slide show presentations using custom images. Using screen capture software, these presentations are turned to video with clear, articulate voice-overs. The audible addition to the presentation helps explain what the viewer is seeing. The presence of voiced explanation also decreases the necessity for written descriptions. In both the presentations and videos, the requirement to read, or have written aspects read to the viewer is less appealing.

To create an educational program that is able to hold the interest of a viewer, each video in the series is held to a short duration. By keeping each video between three to five minutes, we intend to hold the interest of the viewer for the entire duration. A video that is too long will start to cause a viewer to lose interest quickly. A video that is too short would either be lacking necessary information or cover material too quickly for a viewer to understand.

By separating the content into separate videos we enable a viewer to learn at their own pace. Between each video references can be made to other educational sources for additional learning. This also allows for educators to access the content at certain points throughout their own curriculum, and go back to reference material when needed.

Each of these short videos is a step along a linear path to explaining radiation. By viewing each segment in series, the intention is to take the viewer from a very basic understanding of the nucleus to a fundamental level of how radiation occurs. These videos may be watched in succession, or used for review of specific concepts involved with radiation. Each video covers no more than three defined concepts, which are blatantly placed in the title. This will allow for increased accessibility when using an internet search engines and affiliation with other videos on the same subject matter.

Through the research of other videos on the same, or similar topics, we have come to the conclusion that straightforward, graphic supported videos are lacking on free online media sites. The content we are presenting may already be a daunting subject to approach, and this is not compensated for with most available videos to date. Many of the information presented may simply be an individual speaking on the topic, videos which are too long, or cover too much material in a short amount of time. In researching these videos we have derived a method for delivering the content that we believe can be more effective than what is available.

We have acquired a brand name in order to affiliate each video in our series with the other. High Energy Learning pages have been created for Facebook, Youtube and we have also acquired the web address, www.highenergylearning.com (.ca and .info as well). Each video will be posted to these websites and be free for use. The branding and acquisition of these labels on social media sites will enable the potential future of creating new and relevant series covering other subject matter. Each of the three internet mediums have their own advantages for supporting these High Energy Learning videos. Using a website such as Youtube, audiences will be automatically searching for short videos and can be directed to a specific video using either Google or Youtube's search function. This webpage also has a subscription function that allows an audience to keep track of upcoming videos in a specific series if they are interested in learning more. Youtube also contains many other useful features (e.g. creating video series, a description section for each video that can be used for links and additional information, comment sections for each video) that make these videos easy to access.

Facebook, on the other hand is a great tool for reaching additional audience through friend connections. Those users that enjoy videos are able to link and share videos with friends, increasing the number of people exposed to these videos.

Finally, the use of a private website such as www.highenergylearning.com allows for further expansion of the High Energy Learning project into other forms of education beyond videos. There is the more freedom with what you are able to display on a website, and other useful websites and resources may be linked to for additional learning.

## 4. Conclusion

The use of educational videos provides a simple, easy to use mechanism for delivering knowledge. Certain topics, particularly in nuclear science, are quite daunting and have negative implications

towards their difficulty. This requires our information to be delivered in a simple, accessible manner, and we believe our videos and distribution methods will be able to achieve this.

Because of the videos being produced in succession, they come equipped with smooth transition and familiar references. The format, imagery and transitions stay consistent, and examples are re-used in order to use familiarity to the advantage of the viewer. Consolidating information in a single source with the mentality of giving our audience the ability to learn at their own pace makes High Energy Learning both effective and attractive.

Beyond the four lessons that have been highlighted, there is potential for future videos to be created in the radiation and radioactivity series. Videos that further explore methods of radioactive decay, methods of measuring radiation, and health effects of radiation can be added to round off the radiation series. There is also the possibility of creating a video series that focuses on the fundamentals of nuclear power production by discussing how nuclear fission works, the workings of a nuclear reactor, and an overview of some nuclear reactors that are currently in use. Besides topics of nuclear science, other High Energy Learning video series can be made to explore other energy sources such as geothermal and solar energy.

## 5. References

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