Utah SEEd Standard 3.2:

Standard PHYS.3.2 - Plan and conduct an investigation to provide evidence that an electric current causes a magnetic field and that a changing magnetic field causes an electric current. Emphasize the qualitative relationship between electricity and magnetism without necessarily conducting quantitative analysis. Examples could include electromagnets or generators. (PS2.B)

Science and Engineering Practice:	**Disciplinary Core Idea**:	**Crosscutting Concept:**
Developing and Using Models ● **Science:** A major practice of scientists is planning and carrying out a systematic investigation, which requires the identification of what is to be recorded and, if applicable, what are to be treated as the dependent and independent variables (control of variables). Observations and data collected from such work are used to test existing theories and explanations or to revise and develop new ones. ● **Engineering:** Investigations are used both to gain data essential for specifying design criteria or parameters and to test designs. Like scientists, engineers must identify relevant variables, decide how they will be measured, and collect data for analysis. Their investigations help them to identify how effective, efficient, and durable their designs may be under a range of conditions.	● Magnets or changing electric fields cause magnetic fields; electric charges or changing magnetic fields cause electric fields. ● Forces at a distance are explained by fields permeating space that can transfer energy through space.	**Cause and Effect: Mechanism and Prediction:** Events have causes, sometimes simple, sometimes multi-faceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering. ● **Empirical evidence** is required to differentiate between cause and correlation and make claims about specific causes and effects. ● **Cause and effect** relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller-scale mechanisms within the system. ● **Systems** can be designed to cause a desired effect. ● **Changes** in systems may have various causes that may not have equal effects.

4 Advanced	3 Proficient	2 Approaching Proficiency	1 Beginning Proficiency
I can: **Plan and conduct an investigation** to provide evidence that an electric current causes a magnetic field and that a changing magnetic field causes an electric current. Use the data from the investigation to accurately explain the observed phenomenon. ***AND*** ~~Evaluate the data from the investigation to~~ propose ways the investigation could be improved or to identify additional data that is needed to support the explanation.	**I can:** **Plan and conduct an investigation** to provide evidence that an electric current causes a magnetic field *and* that a changing magnetic field causes an electric current. Use the data from the investigation to accurately explain the observed phenomenon.	**I can:** **Conduct an investigation** to provide evidence that an electric current causes a magnetic field *or* that a changing magnetic field causes an electric current. Relate the data from the investigation to the phenomenon.	**I can:** **Conduct an investigation** involving electricity and magnetism. State that electricity and magnetism are related.