SCHOOL NAME: Totino-Grace High School

TITLE: Morality and Emerging Technologies

FOCUS: What are the ethical aspects of scientific advances/emerging technologies? (Genome Editing/Digital Genome, Geoengineering, Artificial Intelligence)

Essential Questions:
1. If God made humans co-creators, what does that mean for human's responsibility in expressing God's plan of love as we participate in that process?
2. Since humans are given free will, what is the risk to God's creation?

Summary:
This lesson will engage students in the relationship between science and religion as it relates to the morality of emerging technologies. The lessons (including articles, videos, discussion and written reflection) will inform students' research projects, which are the final assessments for this unit. By researching emerging technology, students will deepen their understanding of the Catholic Church's position on science and religion and the moral implications of developing specific emerging technology. The lesson is intended for upper level high school students in a Morality class.

METHOD:
Timing:
This lesson will include three, 50-minute input days from the teacher, four 50-minute work days by the students, and 3+ 50-minute presentation days. Totalling approximately a two-week period of time.

Lesson plan structure
Day 1:

1. Students will take a pre-assessment. There is an option of two assessments from which to choose.
   Pre-Assessment
   Religion and Science Questionnaire

2. Input by the instructor
   a. Conversational lecture: Wonder and Awe **Slide Presentation**. The slide presentation is self-contained with student work, assignment directions, discussions, and exit slips built into it. Please review the entire slide presentation to get a complete picture of the method.
   b. Students will process material from the conversational lecture and complete an assignment.
      i. Questions and beginning reflection: **Wonder and Awe**
   c. Student homework and follow up discussion. Homework Read: **A Personal Story: Francis Collins**
   d. **Exit Slip 1.**

Day 2: The Proper Relationship Between Faith and Science

1. Input by the instructor **Slide Presentation**
2. Student Assignment Read article: **Science and Faith Do Not Contradict Each Other: The Pontifical Academy of Sciences**
3. **Exit Slip 2**

Day 3-5: Students will have a minimum of three work days to research, plan and seek help from the teacher. **Student Resources**

Day 6: Students will participate in a **Peer-Review.**
Day 7-10: Student presentations will take place over a two to three day period.

KNOWLEDGE, SKILLS, STANDARDS:

Knowledge

1. Demonstrate an understanding of a specific emerging technology of their choice.
2. Demonstrate an understanding of the Catholic Church's Moral teachings including: Scripture, Tradition, 10 Commandments, Beatitudes, Conscience, Virtue, Moral Law
3. Demonstrate what it means to be human in light of the Catholic Church.
4. Demonstrate a Catholic understanding of the complementary relationship between science and religion.

5. Demonstrate an understanding of God as creator: *God rules the universe with wisdom and directs its divine fulfillment (CCC, no. 1719).* USCCB Framework for Morality.
6. Demonstrate an Understanding of Free Will: *Freedom is following the natural law God planted in our hearts (CCC, nos. 1954-1960).*
7. Demonstrate an understanding of Catholic Social Teaching: *Stewardship of God's creation (CCC, nos. 2415-2418).*

Skills

1. Apply the role of Moral Law to a scientific emerging technology.
2. Apply principles of moral decision making, informed conscience to a scientific emerging technology.
3. Apply Christian virtues to a scientific emerging technology.
4. Synthesize the connectedness of faith and science.

Standards

This lesson plan satisfies the United States Conference of Catholic Bishops Doctrinal Framework, Section IV Life in Jesus Christ. USCCB Doctrinal Framework, IV Life in Jesus Christ.

ASSESSMENT SECTION:

Pre-assessment

Pre-assessment
Religion and Science Questionnaire

Formative Assessments

After each of the teacher's input days students will complete an exit slip to assess their learning.
Exit Slip 1
Exit Slip 2
Additionally, during the work days, the teacher will assist students one-on-one with their research and application.

Final assessment:

https://docs.google.com/document/d/1Y8h0h71k-1N0uVy6F7d4Gmj5VWpUpL0xv65PU9P8tyc/edit?usp=sharing

RESOURCES

Good intro Awe and Wonder Video:
https://www.youtube.com/watch?time_continue=1&v=DKate5pTx-Q&feature=emb_logo
For further information :https://www.matthewdgroves.com/organizations
Baglow: Catholic Scientists Throughout the Ages
http://www.pas.va/content/accademia/en.html (Pontifical Academy of Sciences) Its mission is to honour pure science wherever it may be found, ensure its freedom and encourage research for the progress of science. (good for general overview for students)
https://www.pbs.org/wgbh/questionofgod/voices/collins.html (excellent interview with Francis Collins: Director of the National Human Genome Research Institute, and convert from atheism to Christianity)
http://www.pas.va/content/accademia/en/publications/scriptavaria/robotics.html
http://www.pas.va/content/accademia/en/publications/scriptavaria/artificial_intelligence.html
http://www.pas.va/content/accademia/en/publications/scriptavaria/transgenic.html
http://www.pas.va/content/accademia/en/publications/scriptavaria/stemcells.html
http://www.pas.va/content/accademia/en/publications/scriptavaria/humangenome.html
http://www.pas.va/content/accademia/en/publications/scriptavaria/genome.html
(Legal, Ethical Aspects of)
http://www.pas.va/content/accademia/en/publications/scriptavaria/responsibilityofscience.html
http://www.pas.va/content/accademia/en/magisterium.html (Intro to info on Pontifical Academy of Sciences)
https://cruxnow.com/interviews/2020/02/new-academy-for-life-member-bioethics-not-about-condemning-everything/
http://www.bioethics.org.uk/
http://archive.schb.org.uk/downloads/publications/consult_07_bioethics_declaration_may04.pdf
https://cruxnow.com/vatican/2019/10/pope-names-nobel-winning-u-s-chemical-engineer-to-papal-think-tank/ (A woman! general)
http://archive.schb.org.uk/downloads/publications/ethics_of_animal-human_mixtures.pdf
https://www.thinkingfaith.org/articles/20100524_1.htm (Synthetic biology)
https://www.churchofscotland.org.uk/speak-out/science-and-technology
http://www.academyforlife.va/content/dam/pav/documenti%20pdf/2020/CALL%2028%20febbraio/AI%20Rome%20Call%20x%20firma_DEF_DEF_.pdf
https://www.catholicscientists.org/
https://cruxnow.com/global-church/2017/07/scientists-theologians-ponder-biology-religion-go-together/

The Catholic Church and Technological Progress: Past, Present, and Future
https://www.churchofscotland.org.uk/__data/assets/pdf_file/0006/3795/Human_Cloning_Ethical_Issues_leaflet.pdf
https://ieet.org/index.php/IEET2/about(Institute for Ethics and Emerging Technologies:excellent for overview of the study and debate of vital questions)
https://www.ncbcenter.org/free-bioethics-texts
Moral Issues and Implications
https://catholicclimatemovement.global/catholic-teachings-on-climate-change/
https://catholicmoraltheology.com/
http://theolibrary.shc.edu/medical.htm
http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html
https://www.catholicscientists.org/idea/crispr-genetic-engineering-science-its-implications
https://www.catholicscientists.org/ideas/theme/what-does-it-mean-to-be-human
https://www.catholicscientists.org/catholic-scientists-of-the-past/gregor-mendel - Father of genetics
https://cruxnow.com/interviews/2019/11/crispr-gene-technology-poses-new-moral-questions/ genes
https://cruxnow.com/church/2018/05/the-holy-ghost-in-the-machine-catholic-thinkers-tackle-the-ethics-of-artificial-intelligence/ - artificial intelligence
https://www.bbc.com/news/technology-51673296 - artificial intelligence
https://www.catholicscientists.org/ideas/theme/what-does-it-mean-to-be-human
http://www.pas.va/content/accademia/en.html (Pontifical Academy of Sciences)
https://churchlifejournal.nd.edu/articles/a-catholic-history-of-the-conflict-between-religion-and-science/ - Christopher Baglow
https://churchlifejournal.nd.edu/articles/scientific-mythology-threatens-both-religion-and-science/
https://churchlifejournal.nd.edu/articles/after-galileo-modern-science-has-deep-parallels-with-theology/ Daniel Kuebler.
https://www.catholicscientists.org/idea/crispr-genetic-engineering-science-its-implications
http://www.catholicscientists.org/catholic-scientists-of-the-past

Documentaries/Videos

Note: Documentary films broadcasted on UK television channels can generally be accessed from the British Film Institute www.bfi.org.uk
After the Genome (2006)
Head Transplants: Stranger Than Fiction (2006)

Horizon: Life Blood (2001)
Horizon: The Doctor Who Makes People Walk Again? (2005)
21st Century Medicine: Bionic Breakthroughs (2001)
Brave New Babies (1982)
Brave New World: Why Not Clone a Human? Ethical Ch**all**enges of Biotechnology (1999)
DNA: The Human Race (2003)
Frozen Angels (2005)
Homo Sapiens 1900 (1998)
If...Cloning Could Cure Us (2004)
Life and Death in the 21st Century. Pt.3, Designer Babies (1999)
Lines That Divide (2009)
Organ Farm (Part 1): A World Apart (2001)
Relative Risk: The Human Genome Project (1993)
What Makes Us Human (2006)

Videos Used on Keynote Presentation
https://www.youtube.com/watch?time_continue=1&v=DKate5pTx-Q&feature=emb_logo
https://www.youtube.com/watch?v=UZI3D-rMr1Q
https://www.youtube.com/watch?v=USy8AIp-4Lw

http://www.catholicscientists.org/catholic-scientists-of-the-past
Scientists to look at:

Jean Buridan:
Buridan's philosophical ideas were also influential. He emphasized the importance of first seeking natural explanations for new or surprising phenomena: "[Scientists explain such marvels] by appropriate natural causes; but common folk, not knowing of causes, believe these phenomena are produced by a miracle of God, which is usually not true."

Michel Eugene Chevreul: 1786-1889
"In an age when we hear it asserted more loudly than ever that modern science leads to materialism, … [I feel] duty bound to raise a protest against such assertions, diametrically opposed as they are to true science. … [I am convinced] of the existence of a divine Being, the creator of a double harmony, the harmony which governs the inanimate world and which is revealed in the science of Celestial Mechanics and that of molecular phenomena, and the

harmony which governs the organic world. I have therefore never been a materialist … my mind having never been able to regard this double harmony as being the result of chance."

Clyde Cowan: 1919-1974

Neutrino telescopes have been built to detect neutrinos from astrophysical sources such as supernovae. This is all an outgrowth of Cowan and Reines's visionary work. Clyde Cowan was a devout Catholic. His faith gave him strength and consolation in the face of family tragedies, including the death in infancy of several children. He was an active member of Catholic organizations, including the Knights of Columbus.

Rene Descartes: 1596-1650

His "methodical doubt" did not lead Descartes to religious skepticism, however. In his philosophical system, the truthfulness of God is the ultimate guarantee of the truthfulness and reliability of the human capacity to know and reason, which come from God. Descartes gave what he regarded as certain proofs of God's existence. Descartes also maintained the reality of the human spiritual soul as the non-material principle of thought and will in humans.

Pierre Duhem: 1861-1916

As a philosopher of science, Duhem is associated with the well-known and widely accepted "Duhem-Quine thesis," which says that what can be tested empirically are not individual hypotheses in isolation, but only theories as a whole with all their background assumptions. Duhem's own philosophy was a blend of a traditional Thomistic metaphysics and a strongly positivistic conception of science. Duhem wrote, "I believe with all my soul in the truths which God has revealed to us and that He has taught us through his Church." At the same time, he insisted that "physics proceeds by an autonomous method absolutely independent of any metaphysical opinion."

Jean-Baptiste Dumas: 1800-1884

Dumas is also known for the "Dumas method" of determining the amount of nitrogen in chemical substances. This method is still widely used, especially to determine the protein content of foods, because it is relatively fast and easy to use and fully automatable. In 1832, Dumas was made a member of the Académie des Sciences and in 1843 he received the Copley Medal from the Royal Society of London. Dumas was outspoken in defending Christian ethics and Christian beliefs about the spiritual soul and the eternal destiny of human beings, which he saw as being the most solid foundation of human equality and rights. He wrote, "Under this new [Christian] dispensation, right no longer bows before might; justice takes all nationalities under its scepter; fraternal affection is not limited by the color of men's skins; freedom raises to their feet the most oppressed races and castes; the humblest finds a shield

for his defense in his divine origin; and the most powerful recognizes that he is answerable before the eternal tribunal."

Armand Hyppolite Louis Fizeau:1819-1896:

Fizeau was a French physicist, most famous for his measurement of the speed of light and for the "Fizeau experiment" which had important implications for aether theories of light and special relativity. Fizeau's friend, the physicist Alfred Cornu, wrote that Fizeau was openly and all his life a "convinced and practicing" Catholic. In one speech, Fizeau said, in clear reference to materialism, "Science, anxious above all to retain her dignity and independence, wisely refuses to ally herself to philosophic systems … which might come to dominate her. … and on her part … does not intrude inopportunely on philosophical or social questions, nor set herself in hostility to the noble promptings of the heart or the pure voice of conscience."

Jerome Lejeune: 1926-1994:

Lejeune was a French geneticist and pediatrician most famous for discovering in 1958, in collaboration with Raymond Turpin and Marthe Gautier, that Down Syndrome is caused by an extra copy of chromosome 21 (an example of trisomy). This was the first time that an intellectual disability was shown to be the result of a chromosomal abnormality. Lejeune went on to discover the connection between several other diseases and chromosomal abnormalities. Lejeune was very outspoken in defense of the unborn and named the first President of the Pontifical Academy for Life, a position he held for only a few weeks before he succumbed to cancer in April of 1994. He has been named a "Servant of God" by the Catholic Church, the first stage in the process of canonization.

Georges Henri Joseph Édouard Lemaître: 1894 -1966:

Lemaître was a Belgian priest, theoretical physicist and mathematician who proposed the Big Bang theory, which is the central pillar of modern cosmology. Lemaître was opposed to linking particular scientific theories, including the Big Bang theory, to theological ideas, as each field must respect its own methods and competences.

Gregor Johann Mendel 1822-1884:

Gregor Mendel was an Augustinian friar who is credited with founding the science of genetics. The "father of genetics."

Charles Jules Henri Nicolle 1866 -1936:

Nicolle was a French bacteriologist, best known for discovering the means of transmission of typhus, for which he received the Nobel Prize in Medicine in 1928.
Nicolle was raised in the Catholic faith by his mother, but lost his faith at the age of 12, becoming an atheist and remaining so until late in life. Starting in 1934, however, he felt

spiritual anxiety and began a journey back to belief. Important in this was his friendship with a Jesuit priest, Fr. Le Portois, with whom he had many clarifying conversations. He also exchanged hundreds of letters with a long-time Rouen friend, Edouard Delabarre, who urged him to open himself to grace and to whom he confided that he was waiting for a call from God that he had not yet received. In time, he heard that call and reconciled with the Church on August 22, 1935.

Lazzaro Spallanzani 1729 -1799:

Spallanzani is regarded as one of the leading biologists of the eighteenth century. In 1762, he was ordained to the priesthood. He showed that fertilization in mammals results from the combination of semen and ovum, and he was the first to perform in vitro fertilization and artificial insemination (with animals).

Sir Hugh Stott Taylor (1890 -1974):

Taylor was an English chemist who made important contributions in several fields, including catalytic reactions and the structure of proteins.Taylor was a devout Catholic, who helped to establish the Catholic chaplaincy at Princeton University in 1928 and spoke publicly about the harmony between science and faith.

Alessandro Volta (1745-1827):

In honor of Volta's research in electricity, the Standard International unit of electrical potential (the volt) was named after him. Volta also made other scientific contributions, including discovering and isolating the gas methane. Volta gave testimony to his religious beliefs in a letter sent on Jan 6, 1815 to the Canon Giacomo Ciceri, in which he declared, "I have, indeed, and only too often, failed in the performance of those good works which are the mark of a Catholic Christian, and I have been guilty of many sins; but through the special mercy of God I have never, as far as I know, wavered in my faith. … I constantly give thanks to God, who has infused into me this belief in which I desire to live and die, with the firm hope of eternal life. In this faith I recognize a pure gift of God, a supernatural grace. But I have not neglected those human means which confirm belief."