

The Interim PLUS

Curriculum Supplement For Schools

The Interim Plus is a periodical dedicated to educational matters and specifically designed to assist teachers in integrating relevant life issues in their lesson planning.

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The federal election is over and change looks to be in store for Canada. We hope that the resource material provided back in September (big thank you to Taylor Hyatt, summer intern) proved useful to classroom instruction. Many of the issues will feature prominently in the next four years of the Liberal mandate and certainly will offer many opportunities for discussion in classrooms.

This month's *Interim Plus* presents material in subject areas not often considered for its moral and faith dimensions. As such, we hope that teachers of those disciplines are able to integrate some of these ideas into their lesson planning.

Secondly, we remind everyone of the deadline fast approaching for the Father Ted Colleton Scholarship and essay contest. Applications and essays must be submitted by December 1.

The topic once again deals with the family, as an institution found to be under heavy pressure, especially in western societies. Students are invited to meet the challenge of reflecting on the theme and writing intelligently about the problem and the possible solutions. Please encourage your students to participate in the program and bring it to the attention of your colleagues so they can do likewise for their students. Information, applications, and poster are all available for downloading at the Interim's website

www.theinterim.com/issues/father-ted-colleton-scholarship/.

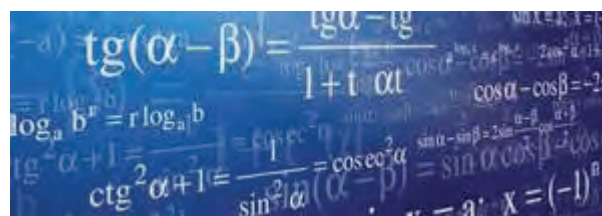
Part A

There is an annual conference on pro-life and technology and many papers are presented. At the 2004 edition an interesting paper was presented by Stephen Koob entitled *Aerodynamics, Mathematics and Pro Life: What's the Connection?* One of our summer interns at *The Interim*, Joseph Marsilla took on the challenge of crafting several

lesson plans in response to the question posed in the article. We are grateful to Joseph for his ability to translate the potential of the article into viable material for classroom lesson planning. What follows is the work of Joseph Marsilla.

Mathematics and Theology: Man's infinite yet discontinuous journey. The Existence Function Redefined.

In high school, math students begin to learn about the various characteristics of mathematical functions. A large part of mathematics bases itself on instantaneous rates of change (slopes) at both continuous and discontinuous portions of various functions. **This lesson focuses on the importance of continuity in mathematics.** Let's begin with a review of some definitions.

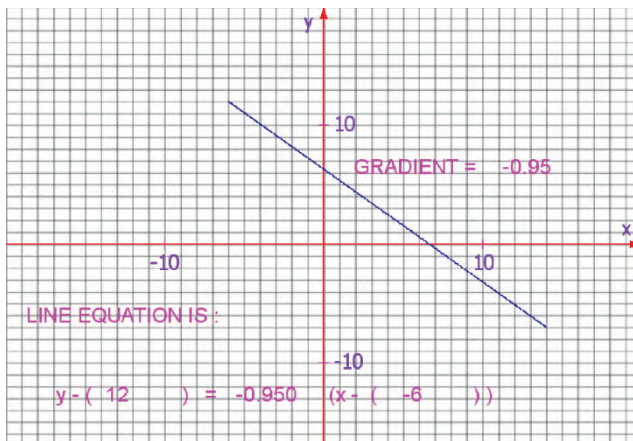


1. What is continuity? Why is it important? Give an example of a familiar continuous function. *Continuity is the characteristic of a mathematical function that describes whether its graph is smooth and simple or discontinuous and undefined. Generally speaking, a function is continuous if you can draw its graph without picking up your pencil. It is a quantity that grows without bound.*
2. Where do discontinuities occur? How do we find discontinuities using techniques learned in calculus?

A discontinuity is a point at which a function is discontinuous or undefined. Mathematically, we define ∞ to be

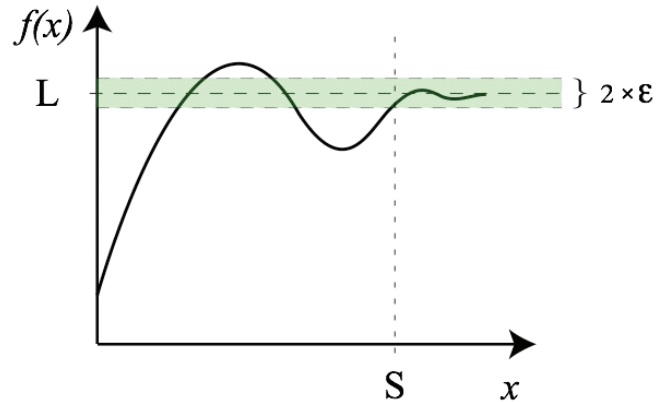
“undefined.” Infinity: a number greater than any assignable quantity or countable number (symbol ∞). For example, the domain of a function whose x values approach every single real number, have x values which approach infinity in both x directions.

Let’s define the existence function $E(t)$ as a function that mathematically describes the existence of an object in direct relation to what that object is. We know that as humans, we have a semi-discontinuous nature; and, according to Aristotle once we have come into existence we will never go out of existence because we have a beginning – conception - but we have no end. He believes that our soul, the immaterial part of a human being, our animating principle will in fact live on for eternity. God, or pure act as he calls it, is double infinite, in reality just infinite because he had no beginning or has no end he always was. In terms of mathematics the $E(t)_{\text{God}}$ would represent a continuous, smooth curve. $E(t)_{\text{human}}$, however, have various discontinuities along our path of existence that are and will possibly always be undefined. As **Koob** states in his article, “These discontinuities appear to be singularities where the human existence is undefined or unexplainable.”



1. Theological proofs for these discontinuities: For religion teachers, get your students to search the bible for verses that describes our semi-infinite nature and God’s infinite nature. Can we answer the discontinuities prevalent in the $E(t)_{\text{human}}$ function theologically? philosophically?
2. What are the types of discontinuities prevalent in mathematical functions? Explain and give examples of each.
3. Describe the human existence function in terms of three theological points of discontinuities that humans face. What are some questions about these “discontinuities” that we cannot answer?

A: God is seen as doubly infinite, infinitely unbounding in all possible directions. In mathematics, semi-infinite objects are objects which are infinite or unbounded in some but not all possible ways. (Their domains and/or ranges are restricted within the elements of all real numbers). The semi-infinite nature can be seen in many familiar functions. These are functions that have discontinuities along their path of curvature.



1. Conception
 - a. When does life begin?
 - b. When does ensoulment take place?
 - c. How does the importance of life’s beginning affect the ethical implications on the continuance of human cloning and abortive processes?
 - d. What does Aristotle have to say on this matter? (connect to Aristotle’s theory of potentiality and actuality)
2. Bodily Death
 - a. What is the exact moment of death?
 - b. When does the soul leave the body?
 - c. When can organs be harvested? When there is no brain stem activity, or when our instruments are not sensitive enough to detect the activity that may still be there?
3. Transfiguration (i.e. glorified bodies)
 - a. When and to what will our bodies be transfigured? What age will we be? Will we have a procreative system or an excretory system?
 - b. Look up the gospel reference to the transfiguration of Christ before death, and His glorified body after resurrection.
4. Write the domain and range for the function given below ($f(x) = 1/x$).

Find the inverse of this function and determine whether or not the inverse relation is a function.

Transform the graph of $f(x)$ to sketch $g(x)$, state the domain and range of this new function. ($g(x) = -1/(x+1)$) (give solution for this) (MHF3U)A. CHARACTERISTICS OF FUNCTIONS (1.3,1.4,1.5, 1.6,1.8,1.9)

5. What discontinuity does this represent? What are some other types of discontinuities? Give an example of each.

A: The graph shows us that the y value seems to approach $-\infty$ from the left as the x -value approaches $x = 0$, marked by the dotted line. This represents a discontinuity, since the function is not connected over the dotted line. Specifically, this type of discontinuity is called an **asymptotic discontinuity**. The dotted lines represent asymptotes; they are values for which the function never takes a value, yet still approaches. **Point discontinuities** are also called removable discontinuities or removable singularities. They occur when a certain point on a piecewise curve is given to be discontinuous, these discontinuities also occur when the denominator/nominator of a function in question cancel out (ex $(x-2)(x)/(x-2)$). **Jump discontinuities** occur where the function approaches two different values from either side of the discontinuity. The forth type of discontinuity is an oscillating discontinuity in which a continuous functions osculates excessively close to given values such that a number at that point cannot be found directly.

6. How can you use instantaneous rates of change to find discontinuities of a graph? What do tangent lines and secant lines represent when talking about the rate of change of a function. (MHF4U: D:1.1-1.9)
7. What methods in integral calculus can be used to determine whether a function is continuous or discontinuous?

A: A commentary on slopes, limits and differentiation: One way to determine the continuity of a function is to

$$f'(x_0) = \lim_{x \rightarrow x_0} \frac{f(x) - f(x_0)}{x - x_0} = \lim_{h \rightarrow 0} \frac{f(x_0 + h) - f(x_0)}{h}$$

find the instantaneous rate of change of a function at that point. Instantaneous rate of change of a function is basically the slope between two points which has very small intervals. The instantaneous rate of change over this interval represents the slope for the tangent line of the graph

at that point. When a point has no value, the resulting instantaneous rate of change for that point on the graph will be undefined. In calculus there are two commonly used methods which allow easy determination of the continuity of a curve. (Both are based upon the principles on instantaneous rates of change and slopes. In mathematics, a limit is the value that a function or sequence “approaches” as the input or index approaches some value. A function is discontinuous when the left hand limit does not equal the right hand limit of a given function. A function is called differentiable at if $f'(x)$ exists and is called differentiable on an interval if the derivative exists for each point in that interval. If is differentiable at then is continuous at that point.

8. Using your knowledge about continuity, determine whether each graph represents $E(t)_{\text{God}}$ or $E(t)_{\text{Human}}$. Describe what each point of discontinuity would be on an $E(t)_{\text{human}}$ graph. a) $\sin(\ln(x))$ b) $\cos(1/x)$ c) $(x)\sin^{-1}(e^x)$ d) $x^{4\sin(x)} + \ln(4^{e^x}) + x^2/(x+1) + 1$ c) $e^x / \tan(x)$
9. (Grade 12 Advance Functions): Sketch the graph of a simple rational/sinusoidal function using its key features, given the algebraic representation of the function. Determine, through investigation without technology, key features (i.e., vertical and horizontal asymptotes, domain and range, intercepts, positive/negative intervals, increasing/decreasing intervals) of the following functions: a) $(x^2+16)/(x^4-16)$ b) $(x^2-4x+3)/(x-1)^3$
10. (Grade 12 Calculus): Using integration by parts, find the integral of $\ln(x)$. Show your work. Find all the critical points of this function. Is this function continuous or discontinuous? What are the absolute max/min points of this graph, what are the points of concavity? Graph this function.

www.lifetechconference.org/proceedings/2004/paper/2004-koob.pdf

www.ignatiusinsight.com/features2009/wbrennan-interview_july09.asp

www.math.brown.edu/utra/discontinuities.html

Lesson 2

No matter what field of study, one can learn more from studying God’s contribution to that field than the contributions of all the other experts in that field.

There are three prevalent discontinuities related to the human condition. Graph the relevant data.

1. Make a function describing the relation of these values
2. Propose integration and derivation techniques for graphing the situation in question.
3. Using statistical analysis, graph and compare birth, conception, and death rates (including abortions and miscarriages) in Canada (in the United States, or a European nation, or the whole planet). Examine the results. Should we be concerned at the foreseen outcome for these different areas?
4. For grade 11/12 functions): **Show and graph the existence function.**
5. Create graphs that describe the various types of discontinuities

Contraception: the deliberate use of artificial methods or other techniques to prevent pregnancy as a consequence of sexual intercourse.

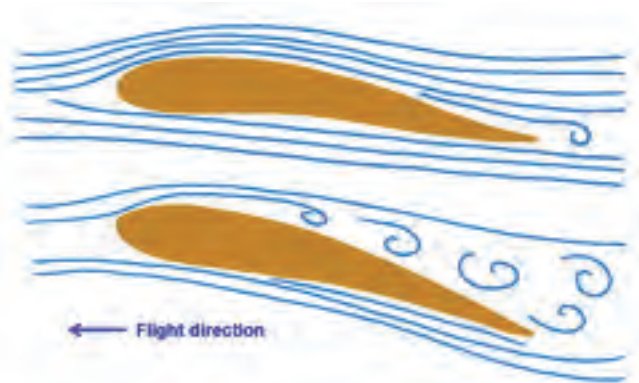
Culture of Death: Pope John Paul II defined the culture of death as a lethal mentality possessing an unlimited capacity for engulfing a wide range of victims and it employs an inclusive perspective, highlighting “whatever is opposed to life itself,” such as genocide, abortion, euthanasia, suicide, experimental exploitation of human beings, slavery and human trafficking, torture, mutilation rituals, and other immoral activities. An ominous feature of this increasingly monolithic mindset, the pope revealed, is “a war of the powerful against the weak: a life which requires greater acceptance, love and care is considered useless, or held to be an intolerable burden, and is therefore rejected in one way or another.” He called this phenomenon “a truly alarming spectacle, if we consider not only how extensively attacks are spreading but also their unheard-of numerical proportion, and the fact that they receive widespread legal approval and the involvement of certain sectors of health-care personnel.” (Gospel of Life)



**Aerodynamics and contraception:
How are the two so jointly connected?**

As an introduction students might be asked to read the definitions of terms given below and then view the videos cited. The first listed explains the four forces that produce flight in airplanes, while the second one explains the incredible journey of the sperm. The students should be able to appreciate the fine laws which govern the universe from motion to flight, and the parallels in human biology as well.

www.youtube.com/watch?v=5ltjFEei3AI,
www.youtube/U9g4gRWkFTs



Pro Life movement: A group of human beings with the world view that life ought to be protected, cherished and fought for at all stages of life from conception to natural death. The overall goal of a pro-lifer is not only to be acquainted with the various pro-life issues of his day but to also walk for life every day. We all ought to be able to defend all pro-life issues, concisely and with love.

Aerodynamics: The mathematical concepts of discontinuity and singularity that we have been focusing on have application in the study of aerodynamics (and/or fluid mechanics). Aerodynamics can be defined as study of the flow of air (or other fluid) over a solid body, like an airplane, automobile, or man on a bicycle. The mathematical models that represent the physical flow of fluids over a body are a set of equations called the “**Navier-Stokes Equations**” (Give these equations in there linear and nonlinear forms). You can take the short cut and solve these equations by disregarding any air viscosity (if this occurred in reality there would be no flight), or you can solve the full non-linear solution of the NS equations in relation to the boundary conditions of the air wing itself (this allows for exact determination of the lift and drag experienced by an aircraft).



Viscosity: this measures the spread of momentum through a fluid at the molecular level. It can be describes as the property of a fluid that resists the force tending to cause the fluid to flow.

Stephen Koob ingeniously parallels the study of aerodynamics with a pro-lifer's involvement in the prolife movement (and their corresponding knowledge about prolife issues). There are numerous strategies that give a solution for the effect of fluid viscosity experienced by an aircraft during flight. Some strategies are better and more accurate than others but may be disregarded because of their difficulty to solve. Similarly pro-lifers are at different levels and have various strategies for dealing with contraception, some don't even identify it as an issue worth worrying about while others see it as a founding pillar that upholds the culture of death.

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|---|---|
| <ol style="list-style-type: none"> 1. Fluid flow can be modeled as a vector field, a vector is a quantity having both direction and magnitude. Viscosity is the internal resistance of the fluid to flow. (need to implement strategies to deal with/solve for the effects of viscosity) 2. Strategy A: Neglect Viscosity and solve for the irrationality of the NS equations. (field is ir-rotational) 3. Strategy B: Use the solution of the linearization of the NS equations to distinguish the boundary conditions of air flow over the wing 4. Strategy C: Solve the non-linear versions of the NS equations. Most exact solution, needed to give a near perfect calculation of lift and drag | <ol style="list-style-type: none"> 1. Contraception prevents or stifles the conception of new life (prevents pregnancy). It extends from pre conception to post conception issues, and acts as the main internal resistance which the pro-life movement must overcome. (need to implement strategies to deal with/solve contraception) 2. Strategy A: Neglect contraception and its effects on society (ignorant) 3. Strategy B: Accept contraception as a worthy, but unimportant prolife issue. Seen as something that should be tolerated but not spoken out against (complacent) 4. Strategy C: See contraception as an issue that upholds our culture of death, seen as near kin to abortion. We accept that it is a very important pro-life issue that must be addressed along with our ongoing fight of abortion. (no complacency) |
|---|---|

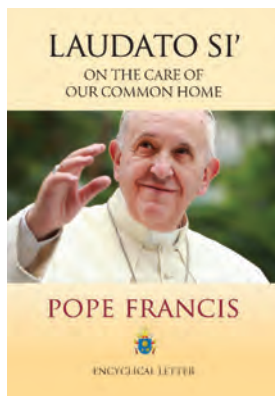
$$Re = \frac{vL\rho}{\mu} \quad \alpha_G = \frac{Gm_e^2}{\hbar c} \quad V_D = \frac{n_D - 1}{n_F - n_C}, \quad \alpha = \frac{E_a}{RT}$$

1. What is a vector? Vector field?
2. Can fluid flow be seen as a type of vector field? What is the curl of a vector field? Divergence? How can we calculate these descriptive factors of a vector function? (question might be too advanced)
3. Viscosity can be measured by finding the Reynolds number (Re) of a given substance. The Reynolds number is defined as the ratio of inertial forces to viscous forces of a Newtonian fluid and is dimensionless. Other quantities of similar nature include the gravitational constant in Newtonian mechanics, the Abbe number in classical optics (which is a measure of the material's dispersion (variation of refractive index with wavelength) in relation to its refractive index), and the Arrhenius equation in Thermal Chemistry.

Task: With a partner find your own dimensionless quantity or ratio. Explain to your teacher why this is significant. Use your knowledge of Newtonian mechanics, ther-

- mal physics, optics or electromagnetism.
4. What are some ways that the necessity of viscosity in aerodynamics mimics the necessity of the contraception to the culture of death? Can we take short cuts when dealing with this issue or do we have to face this head on?

PART B



This section offers material for a Grade 9 geography course. Ever since the release of the encyclical *Laudato Si* this past summer, much has been printed in response to the many topics raised in the encyclical. One such topic pertains to the earthly environment and man's responsibility

for it. Thank you to Daryl Huevos, another summer intern, for the material that follows in this section. It is an introduction to one basic theme appearing in the encyclical and appropriate to the grade nine level of study. Later this academic year we shall offer an extensive analysis of the encyclical and several of the issues raised in it and the developments that have transpired since its release, like the pope's visit to the United States, speech at the U.N., the Synod on the Family, and the Paris meeting on Climate Change.

Creation and Human Responsibility

Since the Industrial Revolution the human population has become more and more urbanized as it has also grown exponentially. The phenomenon of urbanization has gone apace and actually picked up steam in the last 65 years. This movement to the cities has brought material advancement, better living conditions, more economic opportunities and a wealth of other benefits. But some observers have pointed out that with urbanization has come much human dislocation, a rise in crime, greater inequality in distribution of wealth, a growing anonymity and social isolation and environmental degradation. In the large picture, looking at the health and state of the planet as a whole, some are blaming the human species for ruining the planet. They are seen as the chief perpetrators of a certain environmental instability and jeopardizing the enjoyment of the planet and its resources for future generations. The situation was considered to be serious enough to warrant a papal encyclical on the topics associated with the environment.

In his encyclical Pope Francis included a prayer composed by Saint Francis of Assisi.

*Praised be you, my Lord, with all your creatures,
especially Sir Brother Sun,*

who is the day and through whom you give us light.

*And he is beautiful and radiant with great splendour;
and bears a likeness of you,
Most High.*

*Praised be you, my Lord,
through Sister Moon and the stars,
in heaven you formed them
clear and precious and beautiful.*

*Praised be you, my Lord,
through Brother Wind,
and through the air, cloudy*



*and serene, and every kind of weather
through whom you give sustenance to
your creatures.*

*Praised be you, my Lord, through Sister
Water,*

who is very useful and humble and precious and chaste.

*Praised be you, my Lord, through Brother Fire,
through whom you light the night,*

and he is beautiful and playful and robust and strong”.



Reflection:

1. Is the situation truly dire as suggested in the encyclical?
2. What tone is set by the inclusion of this prayer?
3. What are some examples of environmental degradation or instability?
4. How does this poem show the interconnectedness between the simple things within nature?
5. How do different groups in society view these simple things in nature? For example, how might a small farmer in Ontario view this relationship versus the chief executive officer of Monsanto foods?
6. Through the choice of words in the prayer, how does it make you feel about nature?

Classroom Activity:

From the following list of words or from a similar random list generated by the class (make sure the words pertain to the environment and nature), have the students create a chain by choosing 5 words and showing how each of them are interrelated to each other:

Water, Grass, Bumblebees, Rocks, People, Dogs, Lakes, Mosquitoes, Cows, Lettuce, Fire, Homes, Fish

Eg. **Lakes** contain **water** which makes the **grass** grow which is food for **cows** which is beef for **people**.



- a. Have them take out one of the five words. What, if any difference, does it make to the chain?
- b. How important is each item in nature to the chain?
- c. Is creation all one big family, with each part significant in its own way, but all being interdependent or interconnected?
- d. Keeping in mind this sense of interconnectedness, how might a seemingly disparate and distant happening like high infant mortality rates in third world countries affect the economy in a country such as

Canada?

- e. How might the melting ice caps in the Arctic affect people living in Brazil?
- f. How might a warming of the climate impact on land values in northern Ontario or Northern Manitoba?
- g. Can nature rebound despite man's exploitation of it? (see this article for an optimistic view of nature and its rebounding from human degradation,

Nature Rebounds, Jesse H. Ausubel,
http://phe.rockefeller.edu/docs/Nature_Rebounds.pdf)

In the encyclical, Pope Francis mentions that there is a threefold harmony between God, mankind and nature. Here are a few major points from *Laudato Si* about this harmony:

- Notes of “disharmony” in one relationship bring disharmony in others. Thus, a world that forgets God is soon to degrade nature; a degraded nature disrupts the relationships between people.
- We have developed a “throwaway culture,” where the poor, the elderly, the unborn, the unemployed, the migrant and the disabled are cast to the margins because they lack economic utility.
- We need to build a human ecology – based on the right to life, health of the family and access to education – along with a natural ecology.
- The time has come to accept decreased growth in some parts of the world, in order to provide resources for other places to experience healthy growth.
- An environment that is not taken care of could harm those who are living in less fortunate countries since they are mainly dependent on nature and basic industries such as fishing, forestry and farming.
- We must be responsible stewards of creation, use and care for the family of all animals and creatures because all creatures and all of creation are interconnected.
- Human beings are being deprived of their physical



connection to nature in the large cities. Many sprawling cities, surrounded by slums in the poor world, have become nearly unlivable, as residents literally choke on pollution. The poor are often excluded from green spaces that have been privatized by the wealthy.

- We need to reject a magical conception of the market, which would suggest that problems can be solved simply by an increase in the profits of companies or individuals.
- Time and space are not independent of one another, and not even atoms or subatomic particles can be considered in isolation.

Questions

1. How do you think the following groups might react to the encyclical's content?



- a. international climate-change activists, like Al Gore, David Suzuki
- b. critics of the market economy
- c. missionaries and evangelists
- d. theologians
- e. international progressive elites
- f. population control organizations
- g. sustainable development promoters
- h. free market exponents



2. One of the suggestions in the encyclical is that richer countries need to lower their economic growth in order to permit development in poor ones. How might this be a problem for nations? What do economists say about what brings more development for poor countries?



Pope Francis makes the case that we are called to care for the earth since it is our common home. He constantly mentions the term anthropocentrism which is the belief that human beings are the central and most significant species on the planet. Although in *Genesis* man is given “dominion” over all the Earth, Francis challenges us to be caregivers for the environment

Francis challenges us to be caregivers for the environment

in order to allow it to flourish for future generations instead of exploiting and squandering all of its resources without any real consideration for future generations.

Rather, Pope Francis wants us to help those who are in need in order to share the global resources in an equitable way. He invites us to form a family among all human beings as well as our common home on earth.

Classroom Activity:

In small groups, prepare a skit which displays a conflict dealing with interrelationships within human society or between mankind and nature. An example of the latter might be the use of fracking rock sediment to extract oil. An example of the former might be trafficking in migrants or the practice of abortion.

The skit should include the conflict as well as a possible solution in order to solve the conflict. Present the skit to the class and have a discussion on their presentations.

Discussion Questions:

1. Why do you think that interrelationships within

mankind itself and/or between mankind and nature present huge dilemmas?

2. Why was the conflict portrayed in the way it was for each skit group?
3. What were some of the solutions provided for each conflict?
4. What are some other ideas to solve the conflict(s)?
5. How does society view these conflict(s)?
6. How much attention do the conflicts get in media? In churches? What might help to explain this?
7. How important is each of the problems to you?
8. Might the problems be different or handled differently in other countries?
9. Based on *Laudato Si* is authentic care for the environment compatible with abortion or approval of same sex marriage and other moral aberrations?

10. *Laudato Si: The Cheers and Challenges:*

<http://www.ncregister.com/daily-news/laudato-si-the-cheers-and-the-challenges/>

