

Unit 1: What Do We Know and How Do We Know It?

Reasoning Exercises in Islam and Science

Lesson 1 - Intro to Epistemology and the Islamic Epistemology

How do we apply Human Reasoning?

Time Length: 45-50 min.

INSTRUCTIONAL OUTCOMES

NGSS (Next Generation Science Standards)

Science and Engineering Practices:

- Asking Questions and Defining Problems: Students are encouraged to ask questions about the nature of scientific thought and religious thought.
- Engaging in Argument from Evidence: The examination of propositions (rational, revelatory, empirical) and their justifications fits this practice.

Crosscutting Concepts:

- Cause and Effect: Understanding the relationship between different types of knowledge and how they influence beliefs and understanding.
- Systems and System Models: Exploring how different systems of thought (scientific and religious) interpret and understand the world.

Common Core State Standards (CCSS)

English Language Arts Standards - Science & Technical Subjects, Grades 6-12:

CCSS.ELA-Literacy.RST.6-8.1 & 9-10.1: Cite specific textual evidence to support analysis of science and technical texts.

CCSS.ELA-Literacy.RST.6-8.8 & 9-10.8: Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.

Mathematics Standards (for critical thinking and logical reasoning aspects):

CCSS.Math.Practice.MP1: Make sense of problems and persevere in solving them.

CCSS.Math.Practice.MP3: Construct viable arguments and critique the reasoning of others.

English Language Arts Standards for Speaking and Listening:

CCSS.ELA-Literacy.SL.9-10.1 & 11-12.1: Initiate and participate effectively in a range of collaborative discussions with diverse partners on grades 9-12 topics and texts.

Content Learning Outcomes:

- Identify and explain the sources of knowledge and their relationship to each other.
- Define, provide examples, and explain the relationship between the three types of propositions (rational, revelatory, empirical).
- Classify various propositions and provide justification.
- Demonstrate the position of scientific propositions in the Islamic epistemological framework.

Materials:

- Presentation Slides – Slides 1-19



- **Triple-Entry Vocabulary Journal - Instructions** Teacher-led (**Triple-Entry Journal Template**)
- YouTube Video - **Galileo Galilei - in a nutshell**
- **Sources of Knowledge Graphic Organizer**
- Unit 1: Lesson 1 Assessment Questions – **Instructor's Version** and **Student's Version**

Instruction/Teacher Facilitation:

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- ❖ Share the scenario of this particular medical doctor describing his approach to the relationship between his scientific work and his religion: A medical doctor says that the way he lives as a Muslim research scientist is that he wakes up as a Muslim and does everything as a Muslim, praying, eating, dressing etc, but when he gets to work, puts on his lab coat, and enters his lab, he says, "I leave my Islam at the door." When I am done doing my research for the day, when I exit my lab and take off my lab coat, I am a Muslim again and continue my day as a Muslim would.
 - There are many people of faith, Christians, Jews, and others, who do the same, and leave their religion at the door. They also seem to have this same approach towards religion and science.
 - Ask students: What do you think about this scenario? Is this really the approach we should be taking as Muslims, leaving our Islam at the door when it comes to science and scientific endeavors? **[Students can discuss whether or not they agree with this approach.]**
 - Explain to students: The answer is obviously that this is *not* the right approach, as you will see through this unit's study. God exists outside the lab, but also inside the lab as well. God created what they are researching, the tools they are using to research, and even created the researcher himself. There is no way to isolate God from the realm of science. This is why it is important to have a proper understanding of epistemology and how empirical and rational propositions correlate.
- ❖ Introduce the topic by asking the students how they would define "Scientific Thought" and how they would, in turn, define "Religious Thought" - Usually science is defined to be "rational" thought and discusses logical thinking skills and processes, the scientific method etc. Commonly, in contrast, religious aspects are separated from the realm of science and considered "supernatural" or almost antithesis to science (so if science is rational thinking, then religion is irrational or non-rational thinking, which is why science and religion are separated).

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This is the misconception in our minds, usually taught to us by society or secular schooling. In reality, though, Islam specifically teaches rational thought, therefore in the Islamic worldview, religion and science are not separate, but have much overlap. Historically, the *theologians* were the scientists!

- ❖ Regardless of whether science does or does not work well with religion, do we believe science to be neutral? Is science simply describing and reporting the observable/what we experience in the world, OR does it have its own agenda or philosophical/metaphysical commitments? **[Give students an opportunity to answer these questions.]**
 - Science is *not* neutral, it has its own understanding of reality.



- When scientists study and report, they come with their own beliefs and values, and commitments. Those beliefs and commitments influence the scientists' interpretation of their findings. How things are interpreted is dependent on these influences.
- This is an important aspect to consider and keep in mind when going through this Unit.
- ❖ Looking at religion and science, the main aspect of religion is belief in God.
 - According to the famous scientist and a main contributor to the New Atheist movement/belief, Richard Dawkins, the question "Does God exist?" is a scientific question. Science should be able to answer this question. Ask students: Do you believe it is a scientific question?
 - It can NOT be a scientific question because science is the study of natural phenomena of time and space/place. So if we say that this question is a scientific hypothesis, then we are inferring that God must be within space and time. And as Muslims, this goes directly against our theology/aqeedah. We know that ALLAH swt, as mentioned in the Quran, transcends space and time. This is the limit of science, it can only study natural phenomena within space and time. Science can only study certain aspects of reality, not *all* aspects of reality.
 - Science is not just about learning facts, there are a lot of assumptions made in the field of science and in the process of inquiry, particularly biological sciences, and to understand the study of science, this needs to be made aware of.

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- ❖ How do we apply human reason?
 - In Islam, we are encouraged to ask questions, with the right intentions. [Intent to learn, to benefit from this newly gained knowledge, intent to understand to increase our yaqeen, resulting in increased obedience to ALLAH swt, etc]
 - The Quran also asks questions to *us* as humans, for us to question our own intentions and purposes, and to make us think deeply.
 - Ex: In the Quran, ALLAH swt asks us in Surah At-Takwir, Ayah 26:
قُلْ أَفَأَنْتُمْ تُدْهِنُونَ - "So where are you going?"
 - So what questions are we asking??
- ❖ People of the past did ask questions, and they looked for answers; but not without conflict and clashes with religious thought.

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- ❖ Galileo – Science and the Church - Watch Video [2:45 min.] **Galileo Galilei - in a nutshell**

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After viewing, ask students comprehension questions and critical thinking questions:

- What was Galileo's point? What was he saying? **[A: We should observe physics in the world through scientific method, observe, hypothesize, test/experiment. Galileo discussed these 3 concepts: acceleration, that objects fall at the same rate regardless of size/weight, and argued for heliocentrism (the sun is the center of the universe and the earth rotates around it). Important to note here is that scientific findings do change with further discoveries and reinterpretation.]**



- What was the Church saying? What was their response to Galileo? **[A: The Church felt that his findings contradicted their doctrine, ex: Geocentrism - the earth is the center of the universe, now in conflict because he argued heliocentrism, that the sun was the center of the universe. The Catholic Church had adopted Aristotle's findings and had such value for them that when Galileo presented something contrary to it, it was as if the church itself was being challenged. This set the precedent of conflict between science and religion.]**
- What does it mean for religion and science to conflict? **[A: People say not to bring religion into science because there is this history of conflict and expectation of conflict, inevitably. It**

confuses people because science tells you something and religion tells us something else, specifically for the Christian world. Since we live here in the West, which has been historically Christian-dominant, unfortunately, we have absorbed such feelings as well and see this conflict evident in popular media (movies, schools etc). So, just like the doctor who left his religion at the door, we have been trained to separate science and religion into different compartments. If we look at Islamic history, we will *not* find such a strong disconnect between religion and science, but now in modern times, we are feeling some of that conflict and see people getting confused.]

- ❖ First things first, we have to correct our thinking, our process of thinking, and our predispositions of thought in general.

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- ❖ Triple-Entry Vocabulary Journal - in order to help us keep track of this new set of vocabulary that we will be learning to explain all of these concepts, we will use a Triple-Entry Vocabulary Journal.
 - Introduce students to the **Triple-Entry Journal**.
 - Model how to create the Triple-Entry Vocabulary Journal by displaying the **Triple-Entry Journal template** (which is included in the slide deck) or drawing three columns on the board and label as in the template distributed to students.
 - Stressing the importance of understanding the vocabulary associated with any topic to attain a comprehensive and more complete understanding, and avoid confusion.
 - Teachers should explicitly have students pause and add words to their journals throughout the lesson, specifically terms that students do not know or might not fully understand. (The other columns can be filled at a later time if needed.)
 - Students can also add words that are personally new to them or are difficult for them to comprehend or remember.
 - After formally instructing students to keep adding words to the journal, this task can become more independent and placed as the students' responsibility.

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- ❖ Define Epistemology [Instruct students to add this word to their vocabulary journal.]
 - It is a branch of philosophy
 - Episteme- means knowledge or understanding, -ology - the study of



- Epistemology is the study of knowledge, *how* do we know things, *what* do we know, what *can* we know, and to *what degree of certainty* can we know it.

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- ❖ Judgments or Propositions (hukum) - [Add to vocab. journal]
 - A Proposition, or judgment, is a sentence/statement which can *either* be true or false.
 - Examples: (Ask students to determine if each is a proposition or not.)
 - The sky is blue. - Yes, a proposition because you can observe it and verify its truth or falsehood. Sky - subject; blue - predicate
 - Zaid is not eating. - Yes, a proposition because you can see if he is eating or not and verify. Zaid - subject; eating - predicate
 - Stand up! - NOT a proposition, because can not ascertain its truth or falsehood, it is a command.
 - A proposition, or judgment, has two essential parts: a subject and a predicate.
 - In a proposition/judgment, you either affirm (ithbaat) or negate (nafi) the predicate of the subject.
 - All knowledge is propositional knowledge.
 - Propositional knowledge is a concept found in Islamic theology as well.

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- ❖ What is truth? - We stated that only propositions, or judgments, can be true or false.
 - Yet, the question remains: *How* do we know if a proposition is true or not?
 - For a proposition to be true, it must correspond to the object as it truly is.
 - This is known as ***the correspondence theory of truth***, which states that the truth or falsity of a statement is determined only by how it relates to the world and whether it accurately describes that world. (Corresponding what they have in their mind to what really is true.)
 - In simple words, the correspondence theory says that truth is a connection to reality. To be true is to accurately describe – in other words, match, picture, depict, express, conform to, agree with, or correspond to – the real world or parts of it.

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- ❖ Sources of knowledge -
Muslim theologians state that humans have the following sources of knowledge:
 - The five senses
 - The intellect (al-'aql)
 - True reports
 - Intuition/Inspiration (ilhaam)
 - Thought Exercise: to demonstrate this understanding of the sources of knowledge, give the scenario of a person coming to visit your home and is present at the door:
 - You hear a knock at the door - you hear it (one of 5 senses)
 - Based on the common understanding that usually people at your door knock when they are present and thereafter you can open the door, you



- can use your intellect to understand that since you heard a knock, someone must be at the door. (intellect/aql)
- Your sibling/member inside the house also heard the knock and came and told you that someone is at the door. (true report)
 - A few days earlier, you had a dream that a person was going to come to visit you and that you should prepare to meet him in a specific manner. (ilham)
- Use this scenario and the examples to connect back to as each of the sources of knowledge are now explained more in-depth.

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❖ The Five Senses

- Touch, sight, hearing, taste, and smell
- The five senses provide us with knowledge of physical objects
- Touch is the first sense we develop as a fetus, then taste and smell around the same time, then hearing, and lastly sight. So these senses are our first exposure to the world.
- This is called *empirical knowledge* - knowledge gained from the senses.

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❖ The Intellect - Al-'Aql - our reasoning and logical capacity (the understanding of logic is called Manthiq)

- First principles of rational/intellectual thought: (or Laws of Thought)
 - The principle of non-contradiction (PNC) states that contradictory propositions cannot both be true in the same sense, at the same time.
 - PNC is the most important, foundation principal. Ulema say that this principle is the source of all rational thought. (If we don't have this principle, we wouldn't be able to define knowledge and communicate that clearly. Remember this is regarding intellectual knowledge, not empirical knowledge.)
 - Ex: Two is an even number. Two is not an even number.
 - ◆ Both of these are propositions/judgments.
 - ◆ According to PNC, *both* statements can *not* be true. Only one has to be true and the other has to be false.

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- The principle of the excluded middle (PEM) states that the proposition can either be true or false, not both. There is no middle state between true and false. (Concept of "either or," only one or the other, no middle and no third option.)
 - Ex: Two is an even number.
 - ◆ According to PEM, this statement is either true *or* false. No middle category between true and false.
- This is how intellectual thought is structured; the basis of all reasoning.

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❖ True Reports



- True reports (al khabr as-saadiq) refer to knowledge gained based on the testimony of others.
- Testimonial knowledge is dependant on the *reliability* of the *person* conveying the report or knowledge. Therefore, this is knowledge that must be vetted for truth.
- *Most* of what we know falls under this category.
 - Thought Exercise - Ask students: Can you give me examples of knowledge we gain from true reports?
 - **Textbooks** - info is of this type because a person is writing it from their interpretation of research and their point of view.
 - **Ex: Data** - the collection of data is empirical knowledge
 - but the collector's report/research of data is a true report (because he is the one who saw the data be collected, he read the data himself, and is now sharing that information)
 - **Someone comes and tells you something they saw or heard.**
 - **News reports**
 - **Even google maps is reports**
 - Muslim scholars have done the most work on this category.

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- ❖ Inspiration/Intuition (Ilhaam) - **[this is a very specified knowledge and can be very individualized; not for everyone.]**
 - Something that a person knows that ALLAH Almighty revealed directly to that person's heart.
 - For example: Dreams can be a form of ilham. A very important form of knowledge. It is a Sunnah to get dreams interpreted.
 - In Surah Ash-Shams 91: Ayaat 7-8, ALLAH swt swears "... [by] the soul and He who proportioned it; And inspired it [with discernment of] its wickedness and its righteousness." قَالَهُمْهَا فَجَوَّرَهَا وَتَقْوِيَهَا
 - Ilham/divine inspiration to Umar R: While delivering a sermon in Medina, Umar R suddenly paused and called out, "Ya Sariya, al jabal!" which translates to "O Sariya, [watch] the mountain!" Sariya R was a Sahabi who was the commander of the Muslim army engaged in a battle in a place called Nahawand. Sariya R and his troops heard Umar R's warning and changed their strategy accordingly, which helped them avoid an ambush and win the battle.
 - Also mentioned in Surah An-Nahl 16: Ayah 68 - "And your Lord inspired/revealed to the honey bee: 'Make homes in the mountains, in the trees and in the structures they raise.'"
 - Frederick Kekulé, the German chemist who discovered the chemical formula for benzene in 1865, claimed that he had a dream about the C₆H₆ ring formula with the alternating single and double bonds. Through this ilham/intuition, he discovered the structure of benzene. So we see that ilham has a role even in science.



- This is important to fully understand the knowledge/information we are exposed to. Important for examining science and deen. We need to develop this habit of thinking about what kind of knowledge it is and then, the next step is to verify its truth-ness.

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- Student Activity - instruct students to think of an example or a scenario that would incorporate all four sources of knowledge; similar to the person knocking on the door example. Have them fill out the **Sources of Knowledge Graphic Organizer**.
 - **This can be used in the form of a Think/Pair/Share classroom activity or Group Activity.**
 - **It can also be used as a homework assignment to check for individual understanding.**
 - **Students should then share examples/scenarios with the class.**

Example 1:

NSW Education Standards:

Science - Stage 6 (Years 11–12):

Module 1 of Year 11 Science Extension: Students develop an understanding of the nature, development, and limitations of science, which aligns with epistemological discussions.

English - Stage 6 (Years 11–12):

EA12-2: Explores and evaluates ideas in a wide range of texts, such as philosophical and scientific sources, to develop critical perspectives.

Religious Studies (Studies of Religion) - Stage 6 (Years 11–12):

SOR11-1: Describes and explains the influence of religion on individuals' worldviews and practices, particularly the integration of Islamic epistemology in scientific reasoning.

SOR12-2: Analyzes how religion and belief systems influence society, especially in the context of scientific practices and historical developments.

General Capabilities

Critical and Creative Thinking: Students engage in evaluating propositions and formulating reasoned arguments.

Ethical Understanding: Students reflect on the ethical dimensions of separating or integrating religion and science.

Intercultural Understanding: Explores the contributions of Islamic scholars to science, promoting respect for diverse viewpoints.

This lesson effectively promotes cross-disciplinary learning by incorporating elements from science, history, religious studies, and English.

Example 2:

Alignment with NESA Stage 6 Biology Syllabus

Working Scientifically Skills (Module 8):

Questioning and Predicting: Encourages students to ask questions about the nature of scientific and religious thought, fostering inquiry and critical thinking.

Communicating: Students explain and debate different knowledge systems, enhancing their ability to articulate scientific principles and their relationship to religion.

Processing and Analyzing Information: Analysis of sources of knowledge (empirical, rational, revelatory, etc.) aligns with the syllabus emphasis on data interpretation and evaluating evidence.

Module 5: Heredity and Module 8: Non-Infectious Disease and Disorders

Understanding Evidence: The lesson emphasizes the validity of different propositions (rational, empirical, revelatory) and how to evaluate their truth, relevant to understanding biological concepts built on scientific evidence.

Critical Thinking: The discussion of Galileo and Islamic epistemology enhances the understanding of how scientific knowledge is developed and challenged over time, connecting to the syllabus' historical and evolving nature of science.

Cross-curricular Priorities:

Critical Thinking and Problem Solving: Through activities such as analyzing the interplay of science and religion and evaluating epistemological frameworks, students develop critical thinking skills.

Engagement with Ethical and Social Dimensions of Science: The discussion about whether science is neutral addresses ethical considerations and sociocultural influences, relevant to the syllabus' focus on science as a human endeavor.

Nature and Practice of Science:

Discussing the scientific method, principles of reasoning (e.g., PNC and PEM), and the historical example of Galileo encourages students to reflect on the practices underpinning scientific inquiry.

Key Lesson Features that Support NESA Outcomes:

Sources of Knowledge Framework - Helps students analyze how biological knowledge relies on empirical data, intellectual reasoning, and, in some cases, testimonial evidence from prior research.

Critical Thinking Exercises - Activities like analyzing Galileo's conflict with the Church and evaluating the "neutrality" of science align with the syllabus' goal to foster evidence-based reasoning.



Integration of Islamic Epistemology - While not directly part of the NESA syllabus, this provides a broader perspective on the cultural and philosophical contexts of science, enriching students' understanding of how knowledge systems coexist and interact.

Example 3:

1. Working Scientifically Outcomes

The lesson aligns closely with the **Working Scientifically Skills** from the syllabus:

a. Questioning and Predicting (BIO11/12-1)

NESA Outcome: Develops and evaluates questions and hypotheses for scientific investigation.

Alignment:

- Students are encouraged to ask questions about the nature of scientific and religious thought.
- The lesson prompts students to critically analyze questions about the relationship between science and religion, e.g., whether "Does God exist?" is a scientific question.

b. Communicating (BIO11/12-7)

NESA Outcome: Communicates scientific understanding using suitable language and representations.

Alignment:

- Students are required to discuss and justify the classification of propositions (rational, revelatory, empirical) and explain the relationship between scientific and religious thought.
- The use of the Triple-Entry Vocabulary Journal aids in developing precise scientific language.

c. Analyzing Data and Information (BIO11/12-5)

NESA Outcome: Analyses and evaluates primary and secondary data and information.

Alignment:

- Students analyze the impact of biases and assumptions in scientific inquiry and religious interpretation.
- The Galileo case study encourages evaluation of historical data and perspectives.

d. Engaging in Argument from Evidence (BIO11/12-6)



NESA Outcome: Solves scientific problems using primary and secondary data, critical thinking, and scientific processes.

Alignment:

- Students engage in argumentation by examining scientific propositions in the Islamic epistemological framework and exploring conflicting views of science and religion (e.g., Galileo and the Church).
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2. Knowledge and Understanding Outcomes

a. Cells as the Basis of Life (BIO11-8)

NESA Outcome: Describes single- and multicellular organisms in terms of their cellular structure and function.

Alignment:

- The lesson discusses how empirical knowledge gained from the senses contributes to understanding the physical world (e.g., the five senses and their role in gaining knowledge).

b. Biological Diversity (BIO12-12)

NESA Outcome: Explains the structures of organisms that assist in maintaining biodiversity.

Alignment:

- The Islamic epistemological framework emphasizes understanding the natural world as part of divine creation, encouraging a systems-thinking approach to biodiversity and the interconnectedness of life.

c. Heredity (BIO12-14)

NESA Outcome: Analyses the processes involved in reproduction and inheritance patterns in organisms.

Alignment:

- The mention of Frederick Kekulé's discovery of benzene (via intuition/ilham) connects with the concept of scientific discovery in understanding life's molecular basis.
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3. Cross-Curricular Priorities

The lesson integrates broader perspectives that align with NESA's emphasis on cross-curricular priorities:

a. Critical and Creative Thinking

- Students critically analyze scientific methodologies and philosophical questions.
- Encourages creative thinking through activities like the Sources of Knowledge Graphic Organizer and scenarios involving all four knowledge sources.

b. Ethical Understanding

- Explores ethical considerations in combining scientific inquiry with religious beliefs.
- Promotes understanding of how values influence interpretations of evidence and knowledge.

c. Sustainability

- The systems-thinking approach to understanding relationships between knowledge systems aligns with concepts of sustainability and interconnectedness in the natural world.
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4. General Capabilities

a. Literacy

- Building scientific vocabulary (Triple-Entry Vocabulary Journal).
- Discussions and written reflections improve scientific communication skills.

b. Numeracy

- Logical reasoning and application of foundational principles like the principle of non-contradiction.

c. Personal and Social Capability

- Group activities and discussions foster collaborative learning and shared understanding of scientific and religious perspectives.