

The teachFASTly.com resources are not intended as a complete curriculum. The activities are designed to be woven into your existing teaching. This Quick Stop Lesson Plan is therefore not a single lesson plan, but rather a quick way of exploring the themes of an activity map. It includes one Discover activity, one Delve activity, and one Debrief activity. Together, these may take more than a class period, and you may want to add other activities between them. For more information visit [www.teachfastly.com](http://www.teachfastly.com).

### Science, Technology, and Service

Technology and science are distinct but closely related. In the United States, the Next Generation Science Standards incorporate an increased emphasis on technology and engineering. This activity map aims to help students see how science, technology, and service can be connected. It encourages them to see applied science and technology as connected with concern for others, to think about justice issues in society that reach beyond their own immediate concerns, and to engage them in behaviors that seek the good of others and the wider world. It offers a way of shaping practice in the science classroom to show its connections with the call to love and serve the world. Teaching FASTly connects motives, beliefs, and practices.

Throughout the activities in this activity map, students have opportunities to see that applied science can be, and has been, used for both good and bad, and therefore there is a need to exercise discernment as scientific knowledge is applied. As the teacher, use these activities to lead students to reflect on this question: God has given us knowledge and skills...how are we using them to seek his kingdom and love our neighbor?

It is recommended that work on this topic be coordinated between science and Bible teachers, and that good communication with parents be practiced.

This Quick Stop Lesson Plan on **Science, Technology, and Service** contains the following activities and attachments from [www.teachfastly.com](http://www.teachfastly.com), which are combined for your ease of use in a downloadable ZIP file:

#### **DISCOVER** Activity: Science and Shalom

Activity Attachment

- *Science and Shalom PowerPoint*

#### **DELVE** Activity: The EM Spectrum

Activity Attachment

- *The EM Spectrum 1 Handout*
- *The EM Spectrum 2 Handout*
- *The EM Spectrum PowerPoint*

#### **DEBRIEF** Activity: Sharing Knowledge

Activity Attachment

- *Science and Shalom PowerPoint*

## DISCOVER

### Activity: Science and Shalom

Time: 25 Minutes

#### In Brief

This introductory activity guides students to consider what shalom is and how it may be related to science.

#### Goals

Students will understand the concept of shalom and its four key relationships. Students will understand how science, applied science, and technology can be connected to shalom.

#### Thinking Ahead

This activity aims to help students see learning about science and technology in a wider context by placing it within our relationships with God, creation, others, and ourselves. It engages students in thinking through how examples of applied science and technology relate to each of these relationships. To prepare for discussion, and before teaching this activity, think through some examples of how science and shalom relate. Some examples are given after question 2. Think about your regular teaching practices outside of this activity. How often do you encourage students to make connections between science, technology, and any of these relationships?

#### Preparing the Activity

Consider moving the desks or tables to form a circle for whole class discussion. You will need projection capabilities and the **Science and Shalom PowerPoint**.

#### Teaching the Activity

Explain to students that they are going to be thinking about how science and technology relate to society and to faith by looking at the biblical concept of shalom. Begin by sharing the following quote from Nicholas Wolterstorff provided as a slide in **Science and Shalom PowerPoint**.

“In shalom each person enjoys justice... Shalom goes beyond justice, however. Shalom incorporates right relationships in general, whether or not those are required by justice: right relationships to God, to one’s fellow human beings, to nature, and to oneself. The shalom community is not merely the just community, but is the responsible community in which God’s laws for our multifaceted existence are obeyed. It is more even than that.

We may all have acted justly and responsibly, and yet shalom may be missing: for the community may be lacking delight... shalom incorporates delight in one's relationships. To dwell in shalom is to find delight in living rightly before God, to find delight in living rightly in one's physical surroundings, to find delight in living rightly with one's fellow human beings, to find delight even in living rightly with oneself."

Wolterstorff, Nicholas. *Educating for Shalom: Essays on Christian Higher Education*, Grand Rapids, MI: Eerdmans, 2004. Used with permission.

Unless it is a very familiar term in your school community, ask students if they have heard the term "shalom" before and where they think it comes from. Explain that it is a Hebrew word that is often translated in the Bible as "peace" but involves more than absence of conflict. It is a term that evokes the way things ought to be, that is, everything standing in healthy relationship to everything else. Ask students to identify from the quotation which relationships are at stake in shalom (God, creation, neighbor, and self), and to give examples for each relationship of how the wellbeing of individuals and their communities can become damaged when the relationship is distorted or broken.

An easy way to remember the four relationships is to have students point upward, down, outward, and inward. It may be helpful to think through with students how all of these relationships interact in society. For instance, if a local water supply is contaminated with lead, that can leave people angry at their leaders and municipal water providers, damaged in their own bodies and anxious about their health, suspicious of their water (a basic natural resource that they need to survive and that has been compromised), and even angry at God for what has happened to them.

Ask students to ponder the following questions for an introduction to the distinctions used here. Make sure students understand the distinctions before proceeding.

- Can the pursuit of basic science impact shalom? How can it contribute to the health, or the damaging of these relationships?
- Can the pursuit of applied science impact shalom? How can it contribute to the health, or the damaging of these relationships?
- Can the development of technology impact shalom? How can it contribute to the health, or the damaging of these relationships?

Ask for specific examples, not just a general yes or no. Give students a chance to share their ideas. Help students see how the potential to do good or harm increases as we move from basic science concepts to their application, and to the development of technologies. Then present one of the following, using the slide(s) in **Science and Shalom PowerPoint** as an example of how a particular technology can be looked at in light of shalom. The Venn diagram format used in this lesson is repeated in later activities.

If time allows, have students work through an additional example in groups or as a whole class.

The following examples are included:

- a) Nuclear energy
- b) Air bags
- c) Emergency rescue & warning systems

Whichever topic(s) you choose, ask students how science is involved, how technology is also involved, and how the relationships that make up shalom could be affected. Encourage students to see the complexity of the issues. Often scientific and technological advances are accompanied by both positive and negative effects. For example, pesticides are useful for protecting crops and improving yield, but they can also cause other living things to suffer, degrade water supplies, and poison humans. Such actions do not honor God.

The goal in this activity is not to investigate any given issue in detail, but simply to introduce the idea that we can think about science in both its application, and its connection with technology, as belonging together with the health of our key relationships.

## **DELVE**

### **Activity: The EM Spectrum**

**Time: 35 Minutes**

#### **In Brief**

This activity engages students in considering how our knowledge about the EM spectrum is connected to promoting or eroding shalom.

#### **Goals**

Students will understand that current technologies depend on scientific knowledge of the EM spectrum.

Students will consider the relationship between scientific knowledge, its diverse applications, and *shalom*.

#### **Thinking Ahead**

Determine how in-depth you want your lesson on the EM spectrum to be and prepare as needed to teach that, drawing on your usual resources. The material provided here is intended to bookend a lesson about the EM spectrum.

In preparation for leading the discussions in this activity, think through the questions raised for yourself: how are the motivations for developing specific scientific knowledge, the knowledge itself, and the technological applications we develop using that knowledge related to questions of good and bad, shalom and suffering? How can you help students see and explore these connections? Consider also the implications for your own teaching practices and what implicit messages are taught about how we should think about science by the way problems are framed. Does it matter whether we teach science as an isolated body of knowledge or as connected with the changes it leads to as we apply scientific knowledge? How might either way of teaching affect how students who go into scientific work think about their calling?

#### **Preparing the Activity**

Photocopy the EM spectrum template from **The EM Spectrum 2 Handout** and give one copy to each pair or group.

#### **Teaching the Activity**

Explain to students that they are going to study the Electromagnetic (EM) Spectrum, and also how our understanding of it can be used to promote or erode shalom.

Considering how the development of technology affects our basic relationships is one facet of considering how applied science and technology can relate to faith. This is part of Teaching FASTly.

Begin by having the class ponder whether the EM Spectrum has anything to do with shalom, and the flourishing of our relationships with God, creation, others, and ourselves. If you did the Venn diagram activity and used the **Science and Shalom PowerPoint** you could use that format again with “projectile motion” as the term in the center. A slide is provided for that purpose in **The EM Spectrum PowerPoint**.

Next teach students about the EM spectrum. A handout with suggested teaching points and a diagram of the EM spectrum is included **The EM Spectrum 1 Handout**.

Tell students that scientific understanding of these frequencies has enabled the development of technologies that now depend on them. Focus in on waves of frequency 2.4 GHz. Transverse waves of this frequency include radio waves, microwaves, and Wi-Fi signals. Project a list of the common uses for wireless internet access. Ask students to name at least one way that each use promotes shalom, and a way in which it erodes shalom. Students may work in groups or pairs for this activity.

- social media (Facebook, Snapchat)

*Example:*

Promoting Shalom: Using your Facebook account to share information about donating to disaster relief.

Eroding Shalom: Spending an hour on Facebook coveting what other people have or posting derogatory comments.

- GPS devices
- smart homes
- immediate access to information
- mobile payment
- government or corporate monitoring
- photo sharing

Have groups share and discuss their answers. If you wish you could have students use the Venn diagram from the **Science and Shalom PowerPoint** to draw together the class’s observations. Encourage students to reflect on the motivations that lead us to intensively investigate particular areas of scientific knowledge, the knowledge itself, and the uses to which we put scientific knowledge.

In pairs or groups, assign students a different frequency in the EM spectrum and ask them to look into what uses exist for that range of frequencies.

You can assign the following frequencies:

- $10^4$  Hz (radio)
- $10^8$  Hz (microwave)
- $10^{12}$  Hz (infrared)
- $10^{15}$  Hz (visible light)
- $10^{16}$  Hz (ultraviolet)
- $10^{18}$  Hz (x-ray)
- $10^{20}$  Hz (gamma ray)

Each pair/group should fill in a copy of the template provided in **EM Spectrum 2 Handout**. Once students are done, have them share their template with the class. Then hang them in order from low to high frequency on an open classroom wall or in the hallway, creating your own visual of the EM spectrum and its uses.

The following sites provide helpful information about different frequencies of EM radiation. Suggest these sites as sources for students or allow them to search for their own.

- <http://www.pbs.org/wgbh/nova/physics/electromagnetic-spectrum.html>
- [http://missionscience.nasa.gov/ems/01\\_intro.html](http://missionscience.nasa.gov/ems/01_intro.html)
- [http://www.bbc.co.uk/schools/gcsebitesize/science/edexcel/electromagnetic\\_spectrum/electromagneticspectrumrev4.shtml](http://www.bbc.co.uk/schools/gcsebitesize/science/edexcel/electromagnetic_spectrum/electromagneticspectrumrev4.shtml)
- <https://www.youtube.com/watch?v=HPcAWNIVI-8>

## **DEBRIEF**

### **Activity: Sharing Knowledge**

**Time: Homework + 5 Minutes**

#### **In Brief**

In this activity students show their progress in seeing how learning physics relates to shalom and discernment by sharing their thinking with others throughout the year.

#### **Goals**

Students demonstrate understanding of how science, technology and shalom can be related.

Students practice articulating their understanding to others.

#### **Thinking Ahead**

This activity should be carried on throughout the year, with students posting information at intervals. Determine whether you will have students reflect once per semester, once per quarter, or assign a few students to each unit/chapter. Consider also whether an online format, such as a blog or wiki, or a physical bulletin board will work best in your setting.

This activity engages students in using the categories explored in this activity map to think about specific scientific topics and their applications. Therefore it can be used as evidence of learning. At the same time, it invites students to reflect on how sharing their learning can itself contribute to the flourishing of others. Teaching FASTly involves taking the whole relational context of learning into account. Consider how often your teaching practices direct students' attention not only to the content being learned, but to how they can seek one another's good, and the responsibilities that come with new knowledge.

#### **Preparing the Activity**

Decide whether to use a bulletin board or an online environment such as padlet.com, and prepare the display space before commencing the activity.

#### **Teaching the Activity**

At intervals throughout the year have students reflect back on the knowledge that they have gained and how there is a need for discernment as we consider the motivations for and applications of scientific understanding in technologies. On a bulletin board or online have the following words posted:

*Science and Technology promoting and eroding shalom*

Have students consider how technological applications of a specific concept or idea both promote and erode shalom, and then create a summary that explains the connections. For instance:

Pesticide allows more food to be produced so more people have access to food. However, pesticides have the potential to harm birds and fish, which erodes shalom in terms of our relationship with creation. Pesticides can also transfer poisons to humans, which means we are not acting well towards one another or being fully responsible before God, and anxiety about our food is not healthy for our own sense of peace. Scientific investigation can help us understand how to reduce harmful consequences. Seeking shalom means asking hard questions about pesticides and investigating constructive responses.

You may suggest that students use the Venn diagram format from the **Science and Shalom PowerPoint** to organize their thoughts.

Give students a due date for adding a post, or more than one over the year, to the bulletin board or online forum. After reading students' posts you may choose particular ones for whole class discussion. You could also provide a mechanism for students to comment on what they learned through each other's posts, either through in-class conversation or a response section of the display. At the beginning and end of the process, discuss how the display itself, and the process of gaining understanding and sharing it with others, can itself be a form of seeking shalom. What good can come from such a process? Ask students to consider how they could share what they have learned outside of the class, perhaps through social media.