Grades 9-12 Technology  
Fundamentals of Computer Science

Computers and God's People

Stage 1: Desired Results

Catholic Standards

DOC All Grades DOC: Catholic Standards

The Profession of Faith

Students will be able to

1. Recognize God in the world's order, beauty, and goodness (CCC 32).

Life in Christ

Students will be able to

1. Understand that we shape our own life as a result of free will (CCC 1731).

2. Know that we must assume responsibility for the acts we perform (CCC 1781).

7. Assume personal responsibility (CCC 1914).

Targeted Standards

ISTE All Grades ISTE: Educational Technology (2007) - OBSOLETE

ISTE Standards for Students

Creativity and Innovation Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:

a. apply existing knowledge to generate new ideas, products, or processes.

d. identify trends and forecast possibilities.

Communication and Collaboration Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:

a. interact, collaborate, and publish with peers, experts or others employing a variety of digital environments and media.

d. contribute to project teams to produce original works or solve problems.

Research and Information Fluency Students apply digital tools to gather, evaluate, and use information. Students:

b. locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.

c. evaluate and select information sources and digital tools based on the appropriateness to specific tasks.

Technology Operations and Concepts Students demonstrate a sound understanding of technology concepts, systems and operations. Students:

a. understand and use technology systems.

b. select and use applications effectively and productively.

d. transfer current knowledge to learning of new technologies.

ISTE Standards for Students, Second Edition, ©2007, ISTE® (International Society for Technology in Education), iste.org. All rights reserved.

ISTE ISTE-S: Grades 912 ISTE-S: Student Profiles - OBSOLETE

for Technology (ICT) Literate Students

The following experiences with technology and digital resources are examples of learning activities in which students might engage during Grades 912 (ages 1418):

3. Select digital tools or resources to use for a real-world task and justify the selection based on their efficiency and effectiveness. (3, 6)

ISTE Standards for Students, Second Edition, ©2007, ISTE® (International Society for Technology in Education), iste.org. All rights reserved.

OH Grades 11-12 OH: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

Capacities of the Literate Individual

Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

They demonstrate independence.

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Life and Dignity of the Human Person

Rights and Responsibilities

The Rights of Children

2. THE RIGHT TO A SAFE ENVIRONMENT that promotes care, protection, and security.

3. THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.

5. THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION and challenges its members to critical and reflective thinking in their search for truth.

6. THE RIGHT TO DEVELOP POSITIVE, RESPONSIBLE AND CARING ATTITUDES AND BEHAVIORS TOWARD OTHERS and to recognize the rights of others to be safe and free from harassment and abuse.

7. THE RIGHT TO LEARN THE SKILL OF SELF PROTECTION by identifying safe and unsafe situations.

8. THE RIGHT TO LEARN RESPONSIBILITY for themselves and their actions.

9. THE RIGHT TO MAKE RESPONSIBLE DECISIONS founded on religious conviction.

Summary

In this unit students are introduced to the concepts of computers and computing while investigating the major components of computers and the suitability of these components for particular applications. Students will experiment with Internet search techniques, explore a variety of websites and web applications, and discuss issues of privacy and security. Students will learn that intelligent machine behavior is not magic but is based on algorithms applied to useful representations of information, including large data sets. Students will learn the characteristics that make certain tasks easy or difficult for computers and how these differ from those that humans characteristically find easy or difficult. Students will gain an appreciation for the many ways in which computing-enabled innovations have had an impact on society, as well as for the many different fields in which they are used. Connections among religious, social, economical and cultural contexts will be discussed.

Unit Goals

1. Students will analyze the effects of computing on society within economic, social, and cultural contexts.
2. Students will examine the history of technology as it relates to Catholicism.
3. Students will apply the ideas of Catholic teaching to the use of technology.

Big Ideas

1. computer science and its impact on society
2. creative nature of computing
3. intelligent behavior

Enduring Understandings

1. Computer Science impacts everything we do.

As people of God, ethical use of technology takes precedence.

Content

1. computers
2. hardware
3. software
4. Internet browsers
5. search engines

Skills

1. Analyze the characteristics of hardware components to determine the applications for which they can be used.
2. Explain the differences between tasks that can and cannot be accomplished with a computer.
3. Analyze the effects of computing on society within economic, social, and cultural contexts.
4. Communicate legal and ethical concerns raised by computing innovation.
5. Explain the implications of communication as data exchange.
6. Evaluate the relationship between Catholic teaching and the use of technology.

Essential Questions

1. How does technology fit into our Catholic identity?
2. What is the impact of Computer Science on society?
3. How do models of intelligent behavior help me improve problem solving?
4. What potential impact does Computer Science have on the future of the world?

Stage 2: Assessment Evidence

Purchasing an Appropriate Personal Computer

Summative: Cooperative Group Work

Students will research different personal computers and investigate the individual parts. They will compare and contrast different parts to choose the appropriate computer to fit the needs of all of the group members within a given budget. They will be required to present their findings to the class.

How Much Do You Know about Computers?

Diagnostic: Diagnostic

Students will be given a quiz to assess their initial knowledge of technology in the digital world.

Careers

Summative: Research Project

Students can research careers in technology for a multimedia or oral presentation.

Stage 3: Learning Plan

Learning Experiences

1. **Research Compilation/ Analysis:** Students receive from the teacher data on the prevalence and the accessibility of computers across the world in an unorganized fashion. Students can then organize the material and draw their own conclusions based on the data.
2. **Research:** Students can research careers in technology for a multimedia report or oral presentation.
3. **Research:** In order to connect to the the real world, student can collect job postings for technology careers in their community, chart responsibilities, salary range, and other outstanding features of the available jobs. This activity will allow students to explore the careers in Computer Science and identify the skills necessary to fulfill these requirements in the future.
4. **Field Trip:** Students can take a field trip to a local tech company. If the class can't make it to a company, students can try emailing a company and requesting a virtual tour or Q & A session with a programmer. This activity will allow students to get an idea about the subtle day-to-day tasks that programmers and other tech positions face. The video " A Day in the Life of a Programmer," which is attached below as a resource in this unit, is a good visual tool to use.
5. **Literacy Connection:** Students can read an excerpt from Steve Jobs' biography or another notable technology guru. They can compare and contrast obstacles that the guru faced while becoming an icon in the technological industry. As a class, students can discuss how the guru's contributions to the field impacted society at large.

Resources

* Video: A Day in the Life of a Programmer (<https://www.youtube.com/watch?v=epVxjABDwyI>)

Technology Integration

1. computer hardware
2. Internet browsers
3. search engines
4. web tools
5. peripheral devices

Resources

* Exploring Computer Science (<http://www.exploringcs.org/wp-content/uploads/2014/02/ExploringComputerScience-v5.0.pdf>)

Grades 9-12 Technology  
Fundamentals of Computer Science

Problem Solving

Stage 1: Desired Results

Catholic Standards

DOC All Grades DOC: Catholic Standards

The Profession of Faith

Students will be able to

1. Recognize God in the world's order, beauty, and goodness (CCC 32).

9. Know that we are created in God's image to serve Him and to rule over all creatures (CCC 380).

17. Understand that charity is the soul of holiness to which we are all called (CCC 826).

Targeted Standards

ISTE All Grades ISTE: Educational Technology (2007) - OBSOLETE

ISTE Standards for Students

Creativity and Innovation Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:

a. apply existing knowledge to generate new ideas, products, or processes.

c. use models and simulations to explore complex systems and issues.

Communication and Collaboration Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:

d. contribute to project teams to produce original works or solve problems.

Critical Thinking, Problem-Solving & Decision-Making Students use critical thinking skills to plan and conduct research, manage projects, solve problems and make informed decisions using appropriate digital tools and resources. Students:

a. identify and define authentic problems and significant questions for investigation.

d. use multiple processes and diverse perspectives to explore alternative solutions.

Digital Citizenship Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:

b. exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.

Technology Operations and Concepts Students demonstrate a sound understanding of technology concepts, systems and operations. Students:

a. understand and use technology systems.

c. troubleshoot systems and applications.

d. transfer current knowledge to learning of new technologies.

ISTE Standards for Students, Second Edition, ©2007, ISTE® (International Society for Technology in Education), iste.org. All rights reserved.

OH Grades 11-12 OH: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

Capacities of the Literate Individual

Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

They demonstrate independence.

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Life and Dignity of the Human Person

Rights and Responsibilities

The Dignity of Work and the Rights of Workers

Option for the Poor and Vulnerable

Care for God's Creation

The Rights of Children

3. THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.

4. THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.

5. THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION and challenges its members to critical and reflective thinking in their search for truth.

6. THE RIGHT TO DEVELOP POSITIVE, RESPONSIBLE AND CARING ATTITUDES AND BEHAVIORS TOWARD OTHERS and to recognize the rights of others to be safe and free from harassment and abuse.

8. THE RIGHT TO LEARN RESPONSIBILITY for themselves and their actions.

9. THE RIGHT TO MAKE RESPONSIBLE DECISIONS founded on religious conviction.

10. THE RIGHT TO GUIDANCE FROM THE CHURCH in their development as loving people.

Summary

This unit provides students with opportunities to become computational thinkers by applying a variety of problem-solving techniques as they create solutions to problems that are situated in a variety of contexts. The range of contexts motivates the need for students to think abstractly and apply known algorithms where appropriate, but to also create new algorithms. Analysis of various solutions and algorithms will highlight problems that are not easily solved by a computer and for which there are no known solutions. This unit also focuses on the connections between mathematics and Computer Science. Students will be introduced to selected topics in discrete mathematics including Boolean logic, functions, graphs and the binary number system. Students are also introduced to searching and sorting algorithms and graphs.

Unit Goals

1. Students will identify and debug various logical problems in Computer Science.
2. Students will examine different types of algorithms and abstractions and their functions within Computer Science.

Big Ideas

1. Computer Science as a tool for solving problems
2. logical analysis
3. algorithms and abstractions

Enduring Understandings

1. Developing problem solving skills is extremely beneficial when using technology.
2. Computational problem solving is done using algorithms.

Content

1. problem solving techniques
2. binary number system
3. algorithms
4. connections between math and Computer Science
5. Boolean logic
6. functions
7. graphs

Skills

1. Solve a problem by applying appropriate problem-solving techniques.
2. Express a solution using standard design tools.
3. Determine if a given algorithm successfully solves a stated problem.
4. Create algorithms that meet specified objectives.
5. Explain the connections between binary numbers and computers.
6. Summarize the behavior of an algorithm.
7. Compare the tradeoffs between different algorithms for solving the same problem.
8. Explain the characteristics of problems that cannot be solved by an algorithm.

Essential Questions

1. How will knowledge of Computer Science help us to solve problems?
2. How does analysis of Computer Science foster critical thinking skills?
3. What connections can be made between math and Computer Science?

Stage 2: Assessment Evidence

Problem Solving Data Gathering

Summative: Research Project

Students will gather data about a real world problem and draw conclusions based on the data that correspond to a given set of questions. Students will then transfer this data to the web design unit and create content based on the data.

Logic Puzzles

Formative: Quiz

Students will be quizzed on logic puzzles. See Attachments in Resources.

Stage 3: Learning Plan

Learning Experiences

1. **Concept Map:** Students can use a concept map in order to define Problem Solving as a noun and verb.
2. **Logic Puzzles/Challenge:** Students can explore problem solving skills and strategies using puzzles both digitally and in print. Games like Sudoku and 2048 serve as a fun way to get students to problem solve. Two students may also compete using a split screen on an interactive white board or projector. This allows two students to be engaged, but the other students will be naturally engaged in critical higher order thinking skills while they watch their peers, consider their own choices, and challenge the choices of their peers.
3. **Independent Logic Application:** Students can solve a set of problems from the LSAT exam. (See Attachments.)
4. **Problem Solving Scenarios:** Students can explore "All Aboard," a group-based problem solving activity using a tarp. The entire class is intended to participate in this activity. (See Attachments.)
5. **Literacy Connection:** Students can read a short story that has a potential outcome that is not directly stated. Students can then map out the potential outcome and other outcomes based on different inputs or choices made in the story. Students can make digital maps of the outcomes based on the programming. (See Attachments.)

Resources

* Storytelling the Secret Sauce to STEM ([http://ww2.kqed.org/mindshift/2015/06/05/could-storytelling-be-the-secret-sauce-to-stem-education/?utm\_source=facebook.comutm\_medium=socialutm\_campaign=nprutm\_term=nprnewsutm\_content=20150606](http://ww2.kqed.org/mindshift/2015/06/05/could-storytelling-be-the-secret-sauce-to-stem-education/?utm_source=facebook.com&utm_medium=social&utm_campaign=npr&utm_term=nprnews&utm_content=20150606))

Technology Integration

1. Internet browsers
2. peripheral devices

Resources

* LSAT: Practice Puzzles | Cambridge (<http://gabrielecirulli.github.io/2048/https://www.manhattanprep.com/lsat/resources/lsat-sections.cfmhttp://www.cambridgelsat.com/assets/pdfs/free-preptests/LSAT-PrepTest-4-India-2012.pdf>)

Grades 9-12 Technology  
Fundamentals of Computer Science

Web Design

Stage 1: Desired Results

Catholic Standards

DOC All Grades DOC: Catholic Standards

Life in Christ

Students will be able to

2. Know that we must assume responsibility for the acts we perform (CCC 1781).

6. Seek the common good together (CCC 1905).

8. Practice solidarity and social charity (CCC 1939).

11. Respect all human life (CCC 2318).

13. Show special regard for the poor (CCC 2443).

14. Demonstrate appropriate care of social communication and technology (CCC 2496).

Targeted Standards

ISTE All Grades ISTE: Educational Technology (2007) - OBSOLETE

ISTE Standards for Students

Communication and Collaboration Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:

c. develop cultural understanding and global awareness by engaging with learners of other cultures.

Research and Information Fluency Students apply digital tools to gather, evaluate, and use information. Students:

a. plan strategies to guide inquiry.

b. locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.

Critical Thinking, Problem-Solving & Decision-Making Students use critical thinking skills to plan and conduct research, manage projects, solve problems and make informed decisions using appropriate digital tools and resources. Students:

b. plan and manage activities to develop a solution or complete a project.

d. use multiple processes and diverse perspectives to explore alternative solutions.

Digital Citizenship Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:

d. exhibit leadership for digital citizenship.

Technology Operations and Concepts Students demonstrate a sound understanding of technology concepts, systems and operations. Students:

a. understand and use technology systems.

b. select and use applications effectively and productively.

c. troubleshoot systems and applications.

d. transfer current knowledge to learning of new technologies.

ISTE Standards for Students, Second Edition, ©2007, ISTE® (International Society for Technology in Education), iste.org. All rights reserved.

ISTE ISTE-S: Grades 912 ISTE-S: Student Profiles - OBSOLETE

for Technology (ICT) Literate Students

The following experiences with technology and digital resources are examples of learning activities in which students might engage during Grades 912 (ages 1418):

4. Employ curriculum-specific simulations to practice critical-thinking processes. (1, 4)

7. Design a Web site that meets accessibility requirements. (1, 5)

ISTE Standards for Students, Second Edition, ©2007, ISTE® (International Society for Technology in Education), iste.org. All rights reserved.

OH Grades 11-12 OH: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

Writing

Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

WHST.11-12.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

WHST.11-12.2c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.

Production and Distribution of Writing 4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.11-12.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Capacities of the Literate Individual

Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

They demonstrate independence.

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Life and Dignity of the Human Person

Rights and Responsibilities

The Rights of Children

3. THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.

8. THE RIGHT TO LEARN RESPONSIBILITY for themselves and their actions.

Summary

This unit prepares students to take on the role of a developer by expanding their knowledge of algorithms, abstraction, and web page design and applying it to the creation of web pages and documentation for users and equipment. Students will explore issues of social responsibility in web use. They will learn to plan and code their web pages using a variety of techniques and check their sites for usability. Students learn to create user-friendly websites.

Unit Goals

1. Students will construct an intuitive website using an appropriate application.
2. Students will develop a plan and a purpose for a website that fits Catholic teaching within a global lens.

Big Ideas

1. design concepts
2. web design and development

Enduring Understandings

1. Web design is characterized by content, style, and development.

Websites have a global reach that can influence and spread ideas across a wide spectrum of the global society.

Content

1. web pages
2. design principles
3. algorithms and abstraction
4. Human Computer Interaction (HCI) and ergonomics.

Skills

1. Create web pages to address specified objectives.
2. Create web pages with a practical, personal, and/or societal purpose.
3. Select appropriate techniques when creating web pages.
4. Use abstraction to separate style from content in web page design and development.
5. Describe the use of a website with appropriate documentation.
6. Design a Web site that meets accessibility requirements.

Write informative/explanatory texts for a website.

Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Essential Questions

How can web design serve as a tool to improve the world in which students live?

1. How will knowledge of design concepts help improve organization skills?

Stage 2: Assessment Evidence

Social Justice Issues Website

Summative: Technology Project

Using an appropriate web tool, students can create a website that analyzes various facets of a social justice issue through a global lens. Students should be sure to address Catholic teaching through creating the site.

Social Justice Action Plan

Formative: Writing Assignment

Students create an action plan for a problem that hits home to them or a problem they think they could solve. The problems can be on a large scale or small scale. The plan will feed the primary assessment during this unit, which is creating a website.

Social Justice Solution to a Problem

Summative: Research Project

The students must research common "solutions" to their problems. Whether or not the solutions work 100% of the time doesn't factor into the research. The student is simply compiling data in order to present their solution to the problem at large. Students can be encouraged to choose an issue affecting their school or local community.

Stage 3: Learning Plan

Learning Experiences

1. **Research for Vocabulary Sketch:** Students are given vocabulary words. They complete their own research through a variety of resources offered by the teacher to understand the meaning of the word. Then, students must put together a sketch (either acting or drawing) that illustrates the concept without simply stating the definition.
2. **Research to Compile Website Statistics:** Students can complete research to find the answers to the following questions. They can then share their findings in a class discussion.

What do most websites offer?

What makes some websites better than others?

How much does a website cost when created by a third party?

What level of programming exists in website construction? (preparing for the next unit)

1. **Exploratory Activity Using Google Sites 101**: Students go through the act of learning about Google Sites through the Google Tutorial. They monitor and pace themselves as they build a website using the tutorial and other resources.
2. **Problem Solving Concept Map Expanded:** Students will apply their concept mapping skills from the previous unit in order to create a map of the "World's Biggest Problems." This activity helps the students pinpoint big problems and how they trickle down into their community.
3. **Action Plan:** Students create an action plan for a problem that hits home to them or a problem they think they could solve. The problems can be on a large scale or small scale. The plan will feed the primary assessment during this unit, which is creating a website.
4. **Research:** The students must research common "solutions" to their problems. Whether or not the solutions work 100% of the time doesn't factor into the research. The student is simply compiling data in order to present their solution to the problem at large. Students can be encouraged to choose an issue affecting their school or local community.

Resources

* Community Tool Box: Developing an Action Plan: Checklist (<http://ctb.ku.edu/en/table-of-contents/structure/strategic-planning/develop-action-plans/checklist>)

Technology Integration

1. computers
2. Internet connection
3. notepad

Resources

O'Leary, Zina. *Researching Real-world Problems: A Guide to Methods of Inquiry*. London: SAGE, 2005. Print.

Resources

* Google Sites Tutorial (<http://learn.googleapps.com/sites>)

Grades 9-12 Technology  
Fundamentals of Computer Science

Programming

Stage 1: Desired Results

Catholic Standards

DOC All Grades DOC: Catholic Standards

The Profession of Faith

Students will be able to

8. Understand that the world was made for the glory of God, the Creator of all things (CCC 290; 293).

Life in Christ

Students will be able to

1. Understand that we shape our own life as a result of free will (CCC 1731).

2. Know that we must assume responsibility for the acts we perform (CCC 1781).

7. Assume personal responsibility (CCC 1914).

Targeted Standards

ISTE All Grades ISTE: Educational Technology (2007) - OBSOLETE

ISTE Standards for Students

Creativity and Innovation Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:

a. apply existing knowledge to generate new ideas, products, or processes.

c. use models and simulations to explore complex systems and issues.

Research and Information Fluency Students apply digital tools to gather, evaluate, and use information. Students:

a. plan strategies to guide inquiry.

d. process data and report results.

Critical Thinking, Problem-Solving & Decision-Making Students use critical thinking skills to plan and conduct research, manage projects, solve problems and make informed decisions using appropriate digital tools and resources. Students:

a. identify and define authentic problems and significant questions for investigation.

b. plan and manage activities to develop a solution or complete a project.

Technology Operations and Concepts Students demonstrate a sound understanding of technology concepts, systems and operations. Students:

a. understand and use technology systems.

c. troubleshoot systems and applications.

d. transfer current knowledge to learning of new technologies.

ISTE Standards for Students, Second Edition, ©2007, ISTE® (International Society for Technology in Education), iste.org. All rights reserved.

OH Grades 11-12 OH: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

Writing

Production and Distribution of Writing 4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.11-12.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.

WHST.11-12.5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

Capacities of the Literate Individual

Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

They demonstrate independence.

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Life and Dignity of the Human Person

Rights and Responsibilities

The Dignity of Work and the Rights of Workers

The Rights of Children

1. THE RIGHT TO A CATHOLIC COMMUNITY that witnesses to Christ and the Gospel by protecting them from child abuse, including sexual abuse and neglect.

2. THE RIGHT TO A SAFE ENVIRONMENT that promotes care, protection, and security.

3. THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.

4. THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.

5. THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION and challenges its members to critical and reflective thinking in their search for truth.

6. THE RIGHT TO DEVELOP POSITIVE, RESPONSIBLE AND CARING ATTITUDES AND BEHAVIORS TOWARD OTHERS and to recognize the rights of others to be safe and free from harassment and abuse.

7. THE RIGHT TO LEARN THE SKILL OF SELF PROTECTION by identifying safe and unsafe situations.

8. THE RIGHT TO LEARN RESPONSIBILITY for themselves and their actions.

9. THE RIGHT TO MAKE RESPONSIBLE DECISIONS founded on religious conviction.

10. THE RIGHT TO GUIDANCE FROM THE CHURCH in their development as loving people.

Summary

Students are introduced to some basic issues associated with program design and development. Students design algorithms and create programming solutions to a variety of computational problems using an iterative development process in Scratch. Programming problems include mathematical and logical concepts and a variety of programming constructs.

Unit Goals

1. Students will design unique code that fits within a given set of parameters.
2. Students will apply concepts of a programming language to solve non-routine problems within unique sets of code.

Big Ideas

1. programming language
2. algorithms and abstractions

Enduring Understandings

1. Programming includes mathematical and logical concepts and a variety of programming constructs.

Content

1. algorithms
2. steps in the program writing process
3. programming structures
4. debugging strategies

Skills

1. Apply appropriate algorithms to solve a problem.
2. Execute a program that corresponds to a set of specifications.
3. Follow the steps in the program writing process.
4. Assess appropriate programming structures.
5. Identify and correct errors in a program.
6. Explain how a particular program functions.
7. Create programs with practical, personal, and/or societal intent.
8. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
9. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

Essential Questions

1. What are the similarities and differences between a computer programming language and spoken language?
2. How can “computational thinking” and “logical analysis” be translated into real world problem solving?

Stage 2: Assessment Evidence

Troubleshooting Code

Formative: Quiz

Students will be given a set of code and will be required to "clean it up."

Scratch Story

Summative: Technology Project

Students will create and animate a story using Scratch.

Storyboarding

Formative: Modeling

Students will outline their Scratch project using storyboarding.

Website Editing

Summative: Self Assessment

Students will go back to their website and modify the code to make improvements based on a self-assessment.

Stage 3: Learning Plan

Learning Experiences

1. **Brainstorming for Programming 101:** Students can explore the question "What is programming?" as a group brainstorming activity and summarize their ideas in a Google doc.
2. **Frayer Model (Graphic Organizer):** Students can utilize the Frayer Model to define programming terms. (See Attachments.)
3. **Venn Diagram (Graphic Organizer) :** Students can compare a few of the programming languages using a complex Venn Diagram. This enables students to grasp the different features and uses of each language.
4. **Application:** Students can write a basic program. Instead of testing out the program, they will express their expected outcome using a tableau (See Attachment for information). Students can perform the expected outcome with their bodies, while being asked to question the solution of their outcome and to prove it prior to running the programmed language.
5. **Independent and Group Practice:** Students can explore HTML, CSS, and Java at a single time using JSFiddle, Notepad, or another similar application or interface. Then, they can use a program or their website to run their programmed languages together to see the full effect of their task.
6. **Application:** Students can write programs that can be added into their "Problem Solving" website. Students can add extra features to enhance their mission to solve the problem using programming.
7. **Problem Solving to Create a Widget:** Students can use programming language to write a widget that can be added to their website. They should test and make sure the widget runs effectively before adding it to the live website.

Resources

* Frayer Model (<http://www.adlit.org/strategies/22369/>)

Technology Integration

1. computers
2. Internet connection
3. Notepad

Resources

* JSFiddle: A Platform for Programming in More Than One Language (<https://jsfiddle.net/>)

Grades 9-12 Technology  
Fundamentals of Computer Science

Robotics

Stage 1: Desired Results

Catholic Standards

DOC All Grades DOC: Catholic Standards

The Profession of Faith

Students will be able to

1. Recognize God in the world's order, beauty, and goodness (CCC 32).

8. Understand that the world was made for the glory of God, the Creator of all things (CCC 290; 293).

Targeted Standards

ISTE All Grades ISTE: Educational Technology (2007) - OBSOLETE

ISTE Standards for Students

Creativity and Innovation Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:

c. use models and simulations to explore complex systems and issues.

Communication and Collaboration Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:

d. contribute to project teams to produce original works or solve problems.

Critical Thinking, Problem-Solving & Decision-Making Students use critical thinking skills to plan and conduct research, manage projects, solve problems and make informed decisions using appropriate digital tools and resources. Students:

a. identify and define authentic problems and significant questions for investigation.

b. plan and manage activities to develop a solution or complete a project.

Digital Citizenship Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:

d. exhibit leadership for digital citizenship.

Technology Operations and Concepts Students demonstrate a sound understanding of technology concepts, systems and operations. Students:

a. understand and use technology systems.

b. select and use applications effectively and productively.

c. troubleshoot systems and applications.

d. transfer current knowledge to learning of new technologies.

ISTE Standards for Students, Second Edition, ©2007, ISTE® (International Society for Technology in Education), iste.org. All rights reserved.

ISTE ISTE-S: Grades 912 ISTE-S: Student Profiles - OBSOLETE

for Technology (ICT) Literate Students

The following experiences with technology and digital resources are examples of learning activities in which students might engage during Grades 912 (ages 1418):

4. Employ curriculum-specific simulations to practice critical-thinking processes. (1, 4)

6. Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs. (4, 5, 6)

ISTE Standards for Students, Second Edition, ©2007, ISTE® (International Society for Technology in Education), iste.org. All rights reserved.

OH Grades 11-12 OH: English Language Arts 6-12

Writing

Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

W.11-12.2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

Research to Build and Present Knowledge 7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

W.11-12.7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.

W.11-12.8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

Speaking & Listening

Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

SL.11-12.2. Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Life and Dignity of the Human Person

Rights and Responsibilities

The Dignity of Work and the Rights of Workers

Option for the Poor and Vulnerable

Care for God's Creation

The Rights of Children

2. THE RIGHT TO A SAFE ENVIRONMENT that promotes care, protection, and security.

3. THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.

8. THE RIGHT TO LEARN RESPONSIBILITY for themselves and their actions.

Summary

This unit introduces robotics as an advanced application of Computer Science that can be used to solve problems in a variety of settings from business to healthcare. Students will also see how robotics enables innovation by automating processes that may be dangerous or otherwise problematic for humans. Students explore how to integrate hardware and software in order to solve problems. Students will see the effect of software and hardware design on the resulting product. Students will apply previously learned topics to the study of robotics.

Unit Goals

1. Students will design, construct, and program a robot that completes a given set of tasks.
2. Students will modify and adjust existing design plans to accommodate necessary changes in process.
3. Students will understand how robotics can be used to solve problems.
4. Students will understand how to integrate hardware and software in order to solve problems.

Big Ideas

1. programming
2. robotics
3. constructs

Enduring Understandings

1. Robotics is used for universal design and to solve problems found in society.
2. Robotics automates processes that may be dangerous or otherwise problematic for humans.

Content

1. characteristics of robots
2. robot body designs
3. algorithms and abstraction
4. connections between mathematics and Computer Science
5. programming
6. societal impacts of computing
7. hardware designs

Skills

1. Identify the criteria that describe a robot and determine if something is a robot.
2. Match the actions of the robot to the corresponding parts of the program.
3. Build, code, and test a robot that solves a stated problem.
4. Explain ways in which different hardware designs affect the function of a machine.
5. Describe the tradeoffs among multiple ways to program a robot to achieve a goal.
6. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem.
8. Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems.

Essential Questions

1. How will robotics help shape the future of society?
2. How can the troubleshooting of robotics help improve real world problem solving?

Stage 2: Assessment Evidence

Robot Activity

Summative: Cooperative Group Work

Students will design a robot OR a robot simulation that will complete a given set of tasks. This assignment should include several steps.

Analysis of Artificial Intelligence

Summative: Report

Students will select a career that they are interested in possibly pursuing. They will then develop a fictional robot that will fill that career role. Students will compare and contrast the robot in the career vs. a human filling that role. They will use research to identify the answers and then present their findings to the class.

Computer Science Test

Diagnostic: Self Assessment

Students self-test using CS4HS's Lesson 1. See Attachment.

Stage 3: Learning Plan

Learning Experiences

1. **Exploration/Graphic Organizer:** What is a robot? Students explore criteria that characterize a robot and demonstrate their findings on a graphic organizer.
2. **Brainstorming:** Students can build a marionette that will function as the student hopes that their robot will function.
3. **Writing:** Students can watch the attached news segment "The Future of Robots" and write an analysis that answers the following questions:

What is the author's perspective on robotics?

What audience was this specific segment intended to target?

What are the implications of the future using robotics?

What makes robotics a crowd-centric activity?

1. **Problem Solving**: Students can develop a robotic concept that could potentially take over their ideal future career. What would it do? Why would it perform the task better than a person? What limitations might it have?

Resources

* The Future of Robots and Artificial Intelligence (<http://www.cbsnews.com/videos/the-future-of-robots-and-artificial-intelligence>)

Technology Integration

1. robotic sets
2. programming software

Resources

Many of the attached unit/lesson plans require the purchase of a Mindstorm Robot kit. However, the learning experiences for this unit do not require the purchase of this kit.

Resources

* Discovery Education Robotics Lesson Plan (<http://www.discoveryeducation.com/teachers/free-lesson-plans/robots.cfm>)