

## Guidance Document

**Computer Science - Introduction to Geographic Information Systems** introduces fundamental concepts of geographic map interpretation, creation and analysis. Technologies employed include geographic information systems (GIS), global positioning systems (GPS), basic remote sensing, geo-visualization and interpretation, Internet mapping, and spatial statistics. Students will explore how geospatial technologies and tools are used in data collection, analysis, presentation, and problem solving.

The goals of this course are threefold: 1) to help students to think spatially, analytically, and critically; 2) to help students become better problem solvers; and 3) to teach students the fundamentals of Geographic Information Science and Technology. Geospatial technology might be used to find wetlands that need protection from pollution; help track the spread of a disease; or be used by a company to site a new business location. Ultimately, geospatial technology helps you answer questions and solve problems.

*Computer Science – Introduction to Geographic Information Systems may be counted as a third science elective credit course and must be taught by a certified 9-12 science teacher.*

*It is recommended that teachers and students use the organizational account, <http://wvstudentmaps.maps.arcgis.com/home/index.html> to complete their activities. Instructions on creating and setting up accounts can be found [here](#). At this site, students and teachers may log in to create an account with their Office365 email and password. Teachers may create groups for their students to organize classroom projects. Students can share maps with their teachers and classmates. All organizational accounts will also allow for download and usage of ArcPro Desktop Software.*

*If desired, teachers may request an organizational account for their school or program through <https://www.esri.com/en-us/industries/education/schools/schools-mapping-software-bundle> instead of using the wvstudentmaps single sign on (SSO) accounts.*

**This guidance document contains information, lessons, readings, and activities that can be used for instructional purposes in this class. The resources, lessons, readings, and activities are included below each of the standards for this course.**

<b>Computational Thinking</b>	
<b>TCS.GIS.1</b>	Demonstrate an understanding of the basics of cartography.  <b>Lessons:</b> <a href="http://www.nationalgeographic.com/xpeditions/lessons/09/g68/cartographyguidestudent.pdf">http://www.nationalgeographic.com/xpeditions/lessons/09/g68/cartographyguidestudent.pdf</a>  <b>Readings:</b> <a href="https://saylordotorg.github.io/text_essentials-of-geographic-information-systems/s05-introduction.html">https://saylordotorg.github.io/text_essentials-of-geographic-information-systems/s05-introduction.html</a> (Chapter 1, 2, and 9)  <b>Lessons:</b>

	<a href="https://learn.arcgis.com/en/arcgis-book/chapter1/">https://learn.arcgis.com/en/arcgis-book/chapter1/</a> <a href="https://learn.arcgis.com/en/arcgis-book/chapter2/">https://learn.arcgis.com/en/arcgis-book/chapter2/</a>
<b>TCS.GIS. 2</b>	<p>Demonstrate a basic proficiency in map reading; an understanding of scale; an understanding of the power of analysis; and an understanding of the history of map creation and use.</p> <p><b>Resources:</b>  <a href="http://giscommons.org/introduction-concepts/">http://giscommons.org/introduction-concepts/</a></p> <p><b>Lessons:</b>  <a href="http://doc.arcgis.com/en/arcgis-online/create-maps/make-your-first-map.htm">http://doc.arcgis.com/en/arcgis-online/create-maps/make-your-first-map.htm</a>  <a href="http://learn.arcgis.com/en/projects/the-power-of-maps/">http://learn.arcgis.com/en/projects/the-power-of-maps/</a>  <a href="https://www.esri.com/training/catalog/57630432851d31e02a43ee8c/getting-information-from-a-gis-map/">https://www.esri.com/training/catalog/57630432851d31e02a43ee8c/getting-information-from-a-gis-map/</a></p>
<b>TCS.GIS. 3</b>	<p>Analyze GIS data to identify spatial relationships or display results of analyses, using maps, graphs, or tabular data.</p> <p><b>Lessons:</b>  <a href="http://learn.arcgis.com/en/projects/i-can-see-for-miles-and-miles/">http://learn.arcgis.com/en/projects/i-can-see-for-miles-and-miles/</a>  <a href="http://learn.arcgis.com/en/projects/track-crime-patterns-to-aid-law-enforcement/">http://learn.arcgis.com/en/projects/track-crime-patterns-to-aid-law-enforcement/</a>  <a href="http://learn.arcgis.com/en/projects/evaluate-locations-for-mixed-use-development/">http://learn.arcgis.com/en/projects/evaluate-locations-for-mixed-use-development/</a></p>
<b>Collaboration</b>	
<b>TCS.GIS. 4</b>	<p>Collect data using a student-created online data collection technology.</p> <p><b>Technologies</b>  <a href="http://doc.arcgis.com/en/collector/">http://doc.arcgis.com/en/collector/</a>  <a href="https://survey123.arcgis.com">https://survey123.arcgis.com</a>  <a href="https://www.esri.com/en-us/arcgis/products/arcgis-quickcapture/overview">https://www.esri.com/en-us/arcgis/products/arcgis-quickcapture/overview</a></p>
<b>TCS.GIS. 5</b>	<p>Identify a community need related to a human impact on the environment; create a capstone mapping project that describes a solution for that human impact using student collected and generated GIS data; and evaluate competing solutions in terms of effectiveness at mitigating the human impact.</p> <p><b>Connection to Next Generation Science Standards:</b>  <a href="http://www.nextgenscience.org/sites/default/files/evidence_statement/black_w_hite/HS-ESS3-4%20Evidence%20Statements%20June%202015%20asterisks.pdf">http://www.nextgenscience.org/sites/default/files/evidence_statement/black_w_hite/HS-ESS3-4%20Evidence%20Statements%20June%202015%20asterisks.pdf</a></p> <p><b>UN Sustainable Development Goals</b>  <a href="https://www.un.org/sustainabledevelopment/sustainable-development-goals/">https://www.un.org/sustainabledevelopment/sustainable-development-goals/</a></p> <p><b>Resources:</b>  <a href="https://doc.arcgis.com/en/arcgis-online/create-maps/create-presentations.htm">https://doc.arcgis.com/en/arcgis-online/create-maps/create-presentations.htm</a></p>

<b>TCS.GIS. 6</b>	<p>Create an internet-based map product (story map application or web application) that describes a solution for mitigating a human impact on the environment using students collected and generated GIS data.</p> <p><b>Resources:</b>  <a href="https://www.esri.com/en-us/arcgis/products/arcgis-storymaps/overview">https://www.esri.com/en-us/arcgis/products/arcgis-storymaps/overview</a>  <a href="https://storymaps.arcgis.com/en/app-list/map-tour/tutorial/">https://storymaps.arcgis.com/en/app-list/map-tour/tutorial/</a>  <a href="https://www.esri.com/en-us/arcgis/products/arcgis-storymaps/overview">https://www.esri.com/en-us/arcgis/products/arcgis-storymaps/overview</a>  <a href="https://doc.arcgis.com/en/arcgis-online/create-maps/create-map-apps.htm">https://doc.arcgis.com/en/arcgis-online/create-maps/create-map-apps.htm</a></p>
<b>TCS.GIS. 7</b>	<p>Use a student-created online data collection technology to groundtruth basemap orthophotographs.</p> <p><b>Resources:</b> Survey 123 is recommended  <a href="http://doc.arcgis.com/en/collector/">http://doc.arcgis.com/en/collector/</a>  <a href="https://survey123.arcgis.com">https://survey123.arcgis.com</a></p>
<b>TCS.GIS. 8</b>	<p>Create a presentation using an online map system displaying a student-created map with a purpose of educating the public on a community, state or national social issue.</p> <p><b>Resources:</b>  <a href="https://doc.arcgis.com/en/arcgis-online/create-maps/create-presentations.htm">https://doc.arcgis.com/en/arcgis-online/create-maps/create-presentations.htm</a></p>
<b>Computing Practice and Programming</b>	
<b>TCS.GIS. 9</b>	<p>Use a web-based GIS to answer questions about the earth and the environment.</p> <p><b>Lessons:</b>          Geoinquiries are written for teachers to deliver content, but can be easily adapted for students to use as introductions to material.          Geoinquiries can be found at <a href="https://www.esri.com/en-us/industries/education/schools/geoinquiries-collections">https://www.esri.com/en-us/industries/education/schools/geoinquiries-collections</a>          The following Geoinquiries from the Earth Science and Advanced Environmental Science Collection are appropriate for this standard.</p> <ul style="list-style-type: none"> <li>• Cracked plates (tectonics)</li> <li>• The earth moves under our feet (earthquakes)</li> <li>• Plate type effect on volcanoes</li> <li>• A river runs through it (freshwater)</li> <li>• Primary productivity</li> <li>• Tropical Deforestation</li> <li>• Marine debris</li> <li>• El Nino (and climate)</li> </ul>
<b>TCS.GIS.</b>	Demonstrate basic proficiency in map creation, including adding layers, adding

10	<p>additional data, changing data symbology, configuring pop-up, saving and sharing maps.</p> <p><b>Lessons:</b>  <a href="http://learn.arcgis.com/en/projects/get-started-with-arcgis-online/">http://learn.arcgis.com/en/projects/get-started-with-arcgis-online/</a>  <a href="https://www.esri.com/training/catalog/57630432851d31e02a43ee86/exploring-gis-maps/">https://www.esri.com/training/catalog/57630432851d31e02a43ee86/exploring-gis-maps/</a></p>
TCS.GIS. 11	<p>Use geospatial technology to explore and investigate environmental problems such as:</p> <ul style="list-style-type: none"> <li>• resource management</li> <li>• impact assessment</li> </ul> <p><b>Lessons:</b>  <a href="http://learn.arcgis.com/en/projects/analyze-volcano-shelter-access-in-hawaii/">http://learn.arcgis.com/en/projects/analyze-volcano-shelter-access-in-hawaii/</a>  <a href="http://learn.arcgis.com/en/projects/identify-landslide-risk-areas-in-colorado/">http://learn.arcgis.com/en/projects/identify-landslide-risk-areas-in-colorado/</a>  <a href="http://learn.arcgis.com/en/projects/assess-burn-scars-with-satellite-imagery/">http://learn.arcgis.com/en/projects/assess-burn-scars-with-satellite-imagery/</a>  <a href="http://learn.arcgis.com/en/projects/no-dumping-drains-to-ocean/">http://learn.arcgis.com/en/projects/no-dumping-drains-to-ocean/</a>  <a href="https://learn.arcgis.com/en/projects/use-multidimensional-data-to-predict-coral-bleaching-events/">https://learn.arcgis.com/en/projects/use-multidimensional-data-to-predict-coral-bleaching-events/</a></p>
TCS.GIS. 12	<p>Use geospatial technology to explore and investigate rural and urban issues such as:</p> <ul style="list-style-type: none"> <li>• urban planning</li> <li>• transportation</li> <li>• logistics</li> <li>• emergency planning to calculate emergency response times in the event of a natural disaster.</li> </ul> <p><b>Lessons:</b>  <a href="http://learn.arcgis.com/en/projects/plan-routes-for-food-inspectors/">http://learn.arcgis.com/en/projects/plan-routes-for-food-inspectors/</a>  <a href="http://learn.arcgis.com/en/projects/evaluate-locations-for-mixed-use-development/">http://learn.arcgis.com/en/projects/evaluate-locations-for-mixed-use-development/</a>  <a href="http://learn.arcgis.com/en/projects/i-can-see-for-miles-and-miles/">http://learn.arcgis.com/en/projects/i-can-see-for-miles-and-miles/</a>  <a href="https://learn.arcgis.com/en/projects/create-a-report-in-arcgis-insights/">https://learn.arcgis.com/en/projects/create-a-report-in-arcgis-insights/</a></p>
TCS.GIS. 13	<p>Explore uses of geospatial technology by law enforcement to map, visualize, and analyze crime incident patterns.</p> <p><b>Lessons:</b>  <a href="http://learn.arcgis.com/en/projects/track-crime-patterns-to-aid-law-enforcement/">http://learn.arcgis.com/en/projects/track-crime-patterns-to-aid-law-enforcement/</a>  <a href="https://learn.arcgis.com/en/paths/combating-crime-with-gis/">https://learn.arcgis.com/en/paths/combating-crime-with-gis/</a></p>
TCS.GIS. 14	<p>Use geospatial technology to explore and investigate business problems related to asset management.</p> <p><b>Lessons:</b></p>

	<p><a href="http://learn.arcgis.com/en/projects/manage-a-mobile-workforce/">http://learn.arcgis.com/en/projects/manage-a-mobile-workforce/</a>  <a href="https://learn.arcgis.com/en/projects/identify-popular-places-with-spatiotemporal-data-science/">https://learn.arcgis.com/en/projects/identify-popular-places-with-spatiotemporal-data-science/</a>  <a href="https://learn.arcgis.com/en/projects/select-a-business-site-with-competitive-analysis/">https://learn.arcgis.com/en/projects/select-a-business-site-with-competitive-analysis/</a>  <a href="https://learn.arcgis.com/en/projects/expand-a-small-business/">https://learn.arcgis.com/en/projects/expand-a-small-business/</a>  *lesson requires desktop install of ArcGIS (Great introduction!).</p>
<b>TCS.GIS. 15</b>	<p>Use geospatial technology to explore and investigate problems related to medical geography and epidemiology.</p> <p><b>Lessons:</b>  <a href="http://learn.arcgis.com/en/projects/monitor-real-time-emergencies/">http://learn.arcgis.com/en/projects/monitor-real-time-emergencies/</a>  <a href="https://learn.arcgis.com/en/projects/map-a-historic-cholera-outbreak/">https://learn.arcgis.com/en/projects/map-a-historic-cholera-outbreak/</a><a href="https://learn.arcgis.com/en/projects/calculate-environmental-equity-for-public-policy/">https://learn.arcgis.com/en/projects/calculate-environmental-equity-for-public-policy/</a>  <a href="https://learn.arcgis.com/en/projects/policy-mapping-improve-newborn-health/">https://learn.arcgis.com/en/projects/policy-mapping-improve-newborn-health/</a>  <b>John Snow:</b> <a href="http://ehsc.oregonstate.edu/files/ehsc7/John%20Snow%202.05.pdf">http://ehsc.oregonstate.edu/files/ehsc7/John%20Snow%202.05.pdf</a>  <a href="http://learn.arcgis.com/en/projects/bridging-the-breast-cancer-divide/">http://learn.arcgis.com/en/projects/bridging-the-breast-cancer-divide/</a></p>
<b>TCS.GIS. 16</b>	<p>Research a career related to GIS and present a career summary, projected job outlook, and roles and responsibilities.</p> <p><b>Resources:</b>  <a href="http://esriurl.com/careerswithgis">http://esriurl.com/careerswithgis</a>  <a href="http://www.cartogis.org/docs/cartogis_careers.pdf">http://www.cartogis.org/docs/cartogis_careers.pdf</a>  <a href="https://www.esri.com/training/catalog/5763042c851d31e02a43ed82/putting-your-gis-skills-to-work/">https://www.esri.com/training/catalog/5763042c851d31e02a43ed82/putting-your-gis-skills-to-work/</a></p>
<b>Computers and Communication Devices</b>	
<b>TCS.GIS. 17</b>	<p>Demonstrates an understanding of GPS technology, data collection, and data layer creation in an online mapping system.</p> <p><b>Resources:</b>  <a href="https://www.gps.gov/">https://www.gps.gov/</a>  <a href="https://doc.arcgis.com/en/arcgis-online/reference/csv-gpx.htm">https://doc.arcgis.com/en/arcgis-online/reference/csv-gpx.htm</a>  <a href="https://learn.arcgis.com/en/projects/oversee-snowplows-in-real-time/">https://learn.arcgis.com/en/projects/oversee-snowplows-in-real-time/</a></p>
<b>TCS.GIS. 18</b>	<p>Collect GPS data using a GPS unit, compile it into a .csv file, and add it to a saved web map.</p> <p><a href="https://doc.arcgis.com/en/arcgis-online/reference/csv-gpx.htm">https://doc.arcgis.com/en/arcgis-online/reference/csv-gpx.htm</a>  <a href="https://learn.arcgis.com/en/projects/get-started-with-map-viewer/arcgis-online/">https://learn.arcgis.com/en/projects/get-started-with-map-viewer/arcgis-online/</a></p>
<b>Community, Global and Ethical Impacts</b>	
<b>TCS.GIS. 19</b>	<p>Use geospatial technology to explore and investigate the history of cartography.</p>

	<p><b>Reading:</b>  <a href="http://www.theatlantic.com/international/archive/2013/12/12-maps-that-changed-the-world/282666/">http://www.theatlantic.com/international/archive/2013/12/12-maps-that-changed-the-world/282666/</a></p> <p><b>Historical Maps:</b>  <a href="http://hub.arcgis.com/search?tags=David%20Rumsey">http://hub.arcgis.com/search?tags=David%20Rumsey</a>  <a href="https://livingatlas.arcgis.com/topoexplorer/index.html">https://livingatlas.arcgis.com/topoexplorer/index.html</a></p>
<p><b>TCS.GIS. 20</b></p>	<p>Demonstrate an awareness of the ethical and social implications of the use of GIS and GPS system, including system reliability, privacy, legal issues, and the social and ethical ramifications of their use.</p> <p><b>Reading:</b>  <a href="https://www.gislounge.com/need-ethics-gis/">https://www.gislounge.com/need-ethics-gis/</a> (Look at references, as well)  <a href="https://www.urisa.org/about-us/gis-code-of-ethics/">https://www.urisa.org/about-us/gis-code-of-ethics/</a>  Teaching ethics in GIS <a href="https://youtu.be/W9aA_sERUNY">https://youtu.be/W9aA_sERUNY</a></p>
<p><b>TCS.GIS. 21</b></p>	<p>Identify the impacts GIS and GPS systems have on individuals, society, commercial markets, and innovation.</p> <p><b>Videos:</b>  <a href="http://geospatialrevolution.psu.edu">http://geospatialrevolution.psu.edu</a> (Episodes 1 – 4)</p>