New AP® Course Proposal

GEOGRAPHIC INFORMATION SCIENCE AND TECHNOLOGY

AAG
American Association of Geographers

EXECUTIVE SUMMARY

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The American Association of Geographers (AAG) has developed a proposal for a new Advanced Placement® course in Geographic Information Science and Technology (AP GIS&T).

The proposed AP GIS&T course is based on extensive original research and consultation with key geography organizations and stakeholders, including academic geographers, high school teachers, and public and private sector GIS professionals. It consists of a course description, a recommended assessment, a plan for teacher professional development, a collection of representative college syllabi, and a list of endorsing scientific and professional organizations.

This course, if approved by the College Board, will be an unparalleled opportunity for high school students to experience one of the most dynamic, innovative, and transformative scientific fields of the 21st Century. Along with Advanced Placement® Human Geography, the popularity of which continues to grow considerably (approximately 180,000 high school students took the APHG exam in May 2016), AP GIS&T can serve a vital educational role in providing students with the geographic knowledge, skills, and abilities they need to make sense of a rapidly changing planet.

In making its recommendations for the course, the AAG made every effort to ensure that high schools will not have to purchase expensive specialized software to offer AP GIS&T. Much of the content can be delivered with textbooks, videos, and other traditional instructional materials. For some individual and group learning activities and assessments, students will need access to computers connected to the Internet. A wide array of free and user-friendly software platforms, compatible with Macs and PCs, are available to support these activities and assessments.

By helping expand access to outstanding geographic learning experiences in high schools, AP GIS&T can serve as another valuable recruitment mechanism to attract new Geography and GIS college majors.

The following are highlights from the proposal.

I. COURSE DESCRIPTION

The course description represents the standard, commonly offered college course upon which the proposed AP GIS&T course will be modeled. It is based on a content analysis of 30 syllabi for introductory GIS&T courses. This sample was randomly drawn from a database of 451 postsecondary institutions that offer undergraduate Geography and GIS degrees and certificate programs.

The Geographic Information Science and Technology Body of Knowledge (GIS&T BoK) was used to classify and code the knowledge, skills, learning objectives, and course catalog descriptions in the sample of course syllabi. This analysis identified 16 topical units that are generally representative of the content of introductory GIS&T courses. These topics fall under six GIS&T knowledge areas: 1) Analytical Methods, 2) Conceptual Foundations, 3) Cartography and Visualization, 4) Data Modeling, 5) Geospatial Data, and 6) GIS&T and Society.

Recommended Course Topics for AP GIS&T

I. Analytical Methods
- A. Basic Analytical Operations
- B. Basic Analytical Methods

II. Conceptual Foundations
- A. Domains of Geographic Information
- B. Elements of Geographic Information

III. Cartography and Visualization
- A. Data Considerations
- B. Principles of Map Design
- C. Map Use and Evaluation

IV. Data Modeling
- A. Database Management Systems
- B. Tessellation Data Models
- C. Vector and Object Data Models

V. Geospatial Data
- A. Georeferencing Systems
- B. Map Projections
- C. Data Quality
- D. Satellite and Shipboard Remote Sensing
- E. Metadata, Standards, and Infrastructures

VI. GIS&T and Society
- A. Ethical aspects of geospatial information and technology

Course Prerequisites

Introductory undergraduate AP GIS&T courses do not typically have prerequisites. Nearly 75% of the syllabi analyzed for this proposal do not specify a prerequisite. At institutions where a prerequisite course is recommended, it is usually a course in basic mathematics.

Description of the Sequent Course

Students who continue coursework in GIS&T build upon the foundational knowledge of the introductory course. This happens in two ways: 1) The sequent course typically introduces more advanced topics within the six knowledge areas that appear in the proposed AP GIS&T syllabus. 2) The sequent course often delves into the other four knowledge areas identified in the GIS&T BoK publication.

Recommended AP Course Classification

AP GIS&T should be classified as a STEM offering in the AP program (potentially as an addition to the current Math and Computer Science AP offerings).

II. ASSESSMENT

The AP GIS&T course proposal includes a description of how knowledge, skills, and abilities are assessed in GIS&T at the college level, including assessment formats and evidence of learning.

The recommended assessment for AP GIS&T is a hybrid assessment model that includes a summative assessment in the form of an exam (multiple-choice and free response) and a final digital GIS project. The final digital GIS project should include written and visual elements to support the inquiry-based approach to learning favored in GIS&T and other STEM disciplines.

This recommended assessment is based on three considerations: 1) a review of assessment methods currently used in introductory undergraduate GIS&T courses; 2) a review of assessment types and methods commonly used in AP courses; and 3) the evolving movement to make STEM-based learning more inquiry-oriented, as confirmed by the latest academic literature.

III. PROFESSIONAL DEVELOPMENT

The majority of high school GIS&T courses are offered exclusively under the Career and Technical Education curriculum. As such, these courses are primarily focused on software training and technical skills development. A few states offer a sequence of GIS&T courses that include more advanced and analytical content.

AP GIS&T will complement these existing courses by introducing high school students to fundamentals of information science, spatial data, spatial database development and management, spatial reasoning, cartographic design, and other topics commonly taught at the introductory college level.

There are many existing GIS&T professional development programs that support the needs of teachers. Overall, the intent of these programs is to help teachers adopt and use GIS as a teaching tool. Few existing programs focus on teaching the core knowledge areas of geographic information science. Prospective AP GIS&T teachers will therefore require additional specialized professional development that provides, at a minimum, the following knowledge and skills:

> **Knowledge:** Teachers will need to know fundamental principles and concepts of geographic information science (as outlined in the AP GIS&T course description). Teachers will need to have an understanding of what constitutes spatial data, how spatial data are collected, and sources of error affecting the accuracy and utility of spatial data. Teachers must also be able to work with spatial data and perform an analysis using GIS. Additionally, teachers should learn the principles of analytical methods, data modeling, and geovisualization.
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> **Skills:** Teachers will need to master a variety of geospatial skills to teach AP GIS&T. For example, teachers should be comfortable employing and demonstrating various GIS graphical user interfaces (GUI), particularly those associated with their GIS software platform of choice. It is important for teachers to have the ability to create, query, and manage databases (e.g., data entry, editing, and conversion). Teachers should have general cartographic skills, including knowledge of the use of map elements and projections. To answer geographic questions, teachers will need to use a GIS to analyze data, including, but not limited to, carrying out vector analysis (e.g. overlays) and raster manipulation (e.g. raster calculations).

A GIS&T Summer AP Institute, with a training agenda framed around 30 hours of training over a consecutive number of days (5-8 days), should provide the necessary amount of professional development for teaching AP GIS&T.

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V. DISCLAIMER