Chief Reader Report on Student Responses:

2023 AP® Human Geography Set 1

Free-Response Questions

• Number of Students Scored	247,043			
• Number of Readers	1,030			
• Score Distribution	Exam Score	N	%At	
	5	39,620	16.04	
	4	49,299	19.96	
	3	45,447	18.40	
	2	34,514	13.97	
	1	78,163	31.64	
• Global Mean	2.75			

The following comments on the 2023 free-response questions for AP® Human Geography were written by the Chief Reader, Lisa Benton-Short, Professor of Geography at the George Washington University. They give an overview of each free-response question and of how students performed on the question, including typical student errors. General comments regarding the skills and content that students frequently have the most problems with are included. Some suggestions for improving student preparation in these areas are also provided. Teachers are encouraged to attend a College Board workshop to learn strategies for improving student performance in specific areas.

Question 1

Task: Free-Response Question
Topic: Rate of Natural Increase (RNI) and Population Growth and Decline
Max Score: 7
Mean Score: 2.12

What were the responses to this question expected to demonstrate?

In this zero-stimulus question, students were expected to examine how the concept of rate of natural increase (RNI) is used to help understand population growth and decline. Students were expected to draw from two main units for this question: Unit 2 (Population and Migration Patterns and Processes) and Unit 4 (Political Patterns and Processes). The main skills for this question were found in Skill Category 1 (Concepts and Processes) and Skill Category 2 (Spatial Relationships).

In part A students were asked to define the concept of RNI.

In part B students were asked to describe how a country may have a negative RNI.

Two common concepts in the study of population growth and change are RNI and total fertility rate (TFR). In part C students were asked to compare one difference between these two concepts as indicators of population change.

Recognizing that RNI could vary from one place to another within the same country, part D asked the students to explain one reason why RNI in urban areas may vary significantly from RNI in rural areas in the same country.

As rates of growth may vary from country to country, in part E students were asked to explain why the population growth rate indicator, doubling time, is often different between less developed countries (LDCs) and more developed countries (MDCs).

Part F asked students to make connections between the political geography concept of ethnonationalism and pronatalist policies. This part asked students to explain one reason ethnonationalism might lead a government to promote pronatalist policies.

Part G asked students to make connections between political geography and population change by asking them to explain the degree to which a unitary government may be more effective than a federal government in enforcing antinatalist policies.

How well did the responses address the course content related to this question? How well did the responses integrate the skills required on this question?

Overall, students were able to effectively demonstrate their knowledge on many parts of this FRQ. Qualified students were generally limited to scoring points in Parts A, B, and E. Highly qualified students also scored in parts C, D, and F. Parts F and G were the most challenging for students. The point in Part G was the least accessible, as students struggled with "explain the degree to which," one of the more advanced skills (Skill 2.E).

Many students earned a point for part A by correctly defining RNI. RNI is found in IMP-2.A.2 in Topic 2.2 (Population Dynamics). The most common response defined RNI as the crude birth rate minus the crude death rate. In part A students who did not receive a point either defined RNI as the crude death rate minus the crude

birth rate (the reverse of the correct relationship) or did not respond with a complete definition by just defining RNI as population change in a country.

The highest percentage of students earning points on this FRQ earned them on part B. Most students correctly described that a country can have a negative RNI if its crude death rate exceeds its crude birth rate (IMP-2.A.2 in Topic 2.2: Population Dynamics and Skill 1.A: Describe geographic concepts).

Part C asked students to compare RNI and total fertility rate as indicators of population change. Students did not do as well on this part largely because, while some students knew what RNI and TFR are, they did not compare the two, as asked in the question, nor did they address how they were indicators of population change (IMP-2.A.1 in Topic 2.2: Population Dynamics and Skill 1.C: Compare geographic concepts).

Part D asked students to explain why RNI may vary significantly from urban areas to rural areas in the same country. Some students were successful in addressing multiple reasons why RNI varies from rural to urban areas because they answered using the correct scales (IMP-2.A.3 in Topic 2.2: Population Dynamics and Skill 5.B in scale analysis). However, some students did not earn the point because they did not reference both urban and rural areas in their answers.

Part E asked students to explain differences often occurring in doubling times between LDCs and MDCs. Many students earned a point for correctly explaining why LDCs often have shorter doubling times than MDCs and why MDCs have longer doubling times than LDCs. They were also successful in identifying social and economic factors leading to differing doubling times (IMP-2.A.2 in Topic 2.2: Population Dynamics and Skill 2.D: Explain the geographic similarities and differences among different locations). However, some students did not earn the point because they incorrectly stated that LDCs generally have longer doubling times than MDCs or made an erroneous connection between doubling time and the initial total population of a country.

Part F asked students to explain one reason why ethnonationalism might lead a government to promote pronatalist policies. Students who correctly answered the question had to first demonstrate that they understood the concepts of ethnonationalism and pronatalist policies; second, make the correct connection between the two concepts; third, explain a reason why one would influence the other (SPS-4.C.2 in Topic 4.10 on centripetal forces and SPS-2.A.1 in Topic 2.7: Population Policies, and Skill 2.C: Explain a likely outcome in a geographic scenario using geographic concepts, processes, models, or theories).

Students who earned the point for part F most commonly connected pronatalist policies to ethnonationalism, noting that ethnonationalism deals with national pride and promotes population growth of ethnic groups through the encouragement of more births to improve social and cultural cohesion. Students who did not earn the point struggled to make a cross-unit connection between ethnonationalism (Unit 4) and pronatalist policies (Unit 2).

Part G asked students to state the degree to which the government of a unitary or federal state may be effective in enforcing antinatalist policies and explain why. This part required students to understand the difference between a unitary and federal state and to show that they could make a connection between the type of state and antinatalist policies. It also expected students to explain a reason why the type of state would be effective to a high, moderate, or low degree in enforcing such policies (IMP-4.D.1 in Topic 4.7: Forms of Governance and SPS-2.A.1 in Topic 2.7: Population Policies; Skill 2.E: Explain the degree to which a geographic concept, process, model or theory effectively explains geographic effects in different contexts and regions of the world). Many students responded that a unitary state is more highly effective in enforcing policy than a federal state. It is possible that most students chose this option because the question stem led to the "more effective" option. Many students understood the difference between a unitary and federal state, even if some had trouble applying these concepts to the level of enforcement of antinatalist policies.

What common student misconceptions or gaps in knowledge were seen in the responses to this question?

Common Misconceptions/Knowledge Gaps	*Responses that Demonstrate Understanding*
• Part A had incomplete definitions of RNI that did not show how to calculate this measure. Some students also incorrectly included immigration and emigration in their definitions of RNI.	• In part A students who earned a point wrote that RNI can be defined as the crude birth rate minus the crude death rate.
• In part B some students incorrectly included a low TFR in their description of a negative RNI.	• In part B the most common answer that earned a point was that a country has a negative RNI if its crude death rate exceeds its crude birth rate.
• In part C common misperceptions provided definitions of both concepts without indicating these were different or that each measured a different type of population change.	• Students who earned a point in part C responded that RNI includes both birth rates and death rates, while TFR measures the average number of children born per woman of child-bearing age. A response could also earn a point by stating that, unlike RNI, TFR does not include mortality in its calculation.
• In part D some students did not earn the point because they did not reference both urban and rural areas in their answers.	• In part D students who earned a point were able to explain that rural populations tend to have a higher RNI than urban populations because rural areas may need more children to help with labor-intensive agriculture.
• In part E some students did not earn the point because they incorrectly stated that LDCs generally have longer doubling times than MDCs and/or made an erroneous connection between doubling time and the initial total population of a country.	• In part E students who earned a point explained that doubling times may vary because LDCs have higher RNIs than MDCs due to social and economic conditions, such as lower age of marriage, higher infant mortality rates, and/or lower availability of family planning resources.
• In part F students who did not earn the point struggled to make a cross-unit connection between ethnonationalism and pronatalist policies.	• In part F many students were able to explain that ethnonationalism is pride in one's nation/ethnicity/culture and can lead an ethnonationalist government to promote the population growth of their ethnic group through the encouragement of more births to improve social and cultural cohesion.

• In part G students who did not earn the point struggled to make a cross-unit connection between type of government and the enforcement of antinatalist policies.	• In part G the most common responses that earned a point explained that a unitary government could be effective to a high degree in enforcing antinatalist policies because its policies can be enforced uniformly across a country, whereas a federal system might have different interpretations of laws at different subnational scales.

Based on your experience at the AP® Reading with student responses, what advice would you offer teachers to help them improve the student performance on the exam?

- **Teach content from Population and Migration unit (doubling time, demographic transition model, difference between RNI and total fertility rate)**
  - o Help students understand that higher population growth rates correlate with lower doubling times.
  - o Address doubling times when teaching the demographic transition model to help students connect doubling time and RNI with specific demographic characteristics and geographic locations.
- **Encourage students to write complete definitions**
  - o Encourage students to write process-based definitions that describe a term as one of the following:
    - ▪ a spatial concept or spatial relationship
    - ▪ a feature or attribute that changes over time
    - ▪ a part of a theory or model
- **Make cross-unit connections**
  - o Geography is highly interconnected, and many units relate to each other. As the academic year progresses, teachers should integrate concepts from previous units into quizzes, exams, and other forms of assessments to have students practice making connections across units. Students should expect FRQs to include topics from more than one unit.
  - o For example, have students make frequent connections across course units throughout the course (e.g., how changes in economic geographies, from Unit 7, can impact urban development, from Unit 6).
- **Teach students how to respond to the "compare" task verb**
  - o On compare prompts, coach students to address both concepts as they relate to the prompt. "Compare" prompts require more than just definitions of the concepts; students need to compare the similarities and differences.
  - o Provide sentence stems for students to scaffold student writing (example: RNI varies in urban locations because _____ whereas rural locations _____.)
- **Train students how to respond to the "explain the degree to which" task verb phrase:** Students must understand that the "explain the degree" task verb phrase requires the student to indicate a degree, then to support this assertion with a statement that completes the explanation.
  - o **Best practices for stating the degree**: Teach students to use the words *high*, *moderate*, or *low*. Other acceptable indicators of the degree may include minimal, a little, moderate, somewhat, a great deal, high, widely, substantial, etc.
  - o **Teach students it is best to begin the response by stating one of the degrees above**. For example, "A unitary government may be more effective to a **higher degree** than a federal government at enforcing antinatalist policies …"

- o **Teach students to complete the explanation:** Students often stop short of providing a sufficient explanation. Teaching students to use words that link causes to effects, such as because, whereas, and therefore, among others, may help them reach the threshold for a sufficient explanation.
    - Supporting students with sentence stems would be helpful in writing answers to "explain the degree" questions. (For example, A unitary government may be more effective than a federal government in enforcing antinatalist policies to a _____ degree. This is because _____).

What resources would you recommend to teachers to better prepare their students for the content and skill(s) required on this question?

- The Course and Exam Description provides a section on "Developing the Course Skills" on pages 143–151. This section provides examples of questions and instructional strategies for incorporating the course skills into classroom instruction.
- Sign into AP Classroom to access AP Daily videos and questions on the topics and skills addressed in this question. AP teachers can assign students short AP Daily videos as homework, warm-ups, lectures, reviews, and more. AP teachers can also use the AP Question Bank in AP Classroom to enable students to practice and get feedback on formative topic questions and past AP Exam questions.
- Resources related specifically to this prompt include:
    - o 2.4: Daily Video 1 discusses the demographic factors that determine a population's growth and decline, including fertility, mortality, and migration.
    - o 2.4: Daily Video 2 discusses the social, cultural, political, and economic factors that influence fertility, mortality, and migration rates.
    - o 4.10: Daily Video 2 discusses how centripetal forces can lead to ethnonationalism, more equitable infrastructure development, and increased cultural cohesion.
    - o Unit 2 Progress Check: MCQ
    - o Unit 2 Progress Check: FRQ
- Additional resources may be found on the AP Human Geography Course Page on AP Central at: https://apcentral.collegeboard.org/courses/ap-human-geography
- The AP Human Geography Online Teaching Community (OTC) is another great resource, which includes materials and resources posted not only by the College Board but also by other teachers. The OTC Discussion Board is the place to ask questions, share resources, and exchange teaching ideas at: https://apcommunity.collegeboard.org/group/aphumangeo/

Question 2

Task: Free-Response Question
Topic: Crop Domestication and Globalization
Max Score: 7
Mean Score: 3.24

What were the responses to this question expected to demonstrate?

This one-stimulus question is centered on agriculture and globalization. The stimulus was a table titled "Per Capita Production of Staple Food Crops in Hearth-of-Domestication Countries," with data from five countries (Brazil, China, Mexico, Nigeria, and Peru) and five crops (corn, potato, rice, yam, and cassava).

In answering this question, students were expected to demonstrate knowledge from two different units of the course: Unit 3: Cultural Patterns and Processes and Unit 5: Agriculture and Rural Land-Use Patterns and Processes. Students were expected to use skills from across the course skills matrix; however, the two skill areas most used were those from Skill Category 2 (Spatial Relations) and Skill Category 3 (Data Analysis).

In part A of this question, students were asked to describe the concept of an early hearth of domestication.

In part B students were asked to identify from the table the crop that has diffused the least from its hearth of domestication to the countries listed in the table. Students needed to read and understand the chart to answer part B.

In part C students were to explain how food preferences can be a culture trait.

In part D students were asked to explain how the Columbian Exchange contributed to a crop's diffusion beyond its hearth of domestication.

In part E students were asked to explain how the data in the table support the concept of a crop's consumption pattern being the result of globalization. Students needed to use their table reading and comprehension skills, as well as their mental world maps, to identify where the hearths were and then connect this to levels of production in various parts of the world. They also needed to realize that the production of a crop in a country outside its hearth country/area implies that the crop is being consumed (at least in some part) in the countries that are producing it today.

In part F students were to explain why a crop may be farmed intensively in a less developed country and be farmed extensively in a more developed country.

In part G students were asked to explain one way global supply chains link crops (such as those listed in the table) to consumers in other countries.

How well did the responses address the course content related to this question? How well did the responses integrate the skills required on this question?

This was the highest mean FRQ of Set 1. Qualified students generally earned points in parts A, B, and D. Highly qualified students also scored in parts C, E, and F. Parts F and G were the most challenging for many students. The point in part G was least accessible, as many students did not fully understand the concept of a global supply chain.

Part A asked students to describe a concept tied to the origins of agriculture. Most students were able to convey a sense of what is meant by "hearth of domestication" (SPS-5.A.1: Early hearths of domestication). Students were asked to respond that early hearths of domestication were locations where new crops or practices first developed (Skill 2.A: Describe spatial patterns, networks, and relationships). Most students were able to at least define a hearth or hearth of domestication.

Part B asked students to identify in the data a specific parameter (crop that has diffused the least). Part B was the easiest part of this question, as most students correctly identified the crop that has diffused the least from its hearth as the yam (SPS-5.A.1: Early hearths of domestication; Skill 3.A: Identify the different types of data presented in maps and in quantitative and geospatial data).

Part C asked students to explain the concept of a culture trait and connect it to the concept of food preferences (PSO-3.A.2: Culture traits include such things as food …). Students were asked to respond that many foods have distinct characteristics (ingredients and/or ways of preparing; beliefs about what is forbidden) that are associated with a specific cultural group (Skill 1.B: Explain geographic concepts, processes, models, and theories). Most students were able to provide some form of this answer. Many students could provide an explanation of the ways food preferences may be tied to culture, for example by making a connection to the culture's location or region, by discussing a particular dish associated with specific cultures, or by linking food preferences to a belief system (especially religion). However, some students did not provide a clear explanation.

Part D asked students to explain how the data in the stimulus reflect the impact of the Columbian Exchange (Skill 3.C: Explain patterns and trends in maps and in quantitative and geospatial data to draw conclusions). Many students were able to explain either that conquest/colonialism/trade led to the movement of crops from one part of the world to another or that changing food preferences/cultural assimilation/changing agricultural practices led to the movement of crops from one part of the world to another (IMP-3.A.1: Relocation and expansion … are types of diffusion; SPS-5.B.1: Patterns of diffusion, such as the Columbian Exchange and the agricultural revolutions, resulted in the global spread of various plants and animals). Those responses that did not earn a point often did not provide a sufficient explanation.

Part E asked students to explain how the data about crop production support the concept of a crop's consumption pattern being the result of globalization (Skill 3.E: Explain what maps or data imply or illustrate about geographic principles, processes, and outcomes). Some students found this to be challenging. Students who were successful were able to recognize that high per-capita production of crops far from the hearth supports the idea of the crop being globalized, often using the example of corn (with its hearth in Mexico; with Brazil producing more corn today than Mexico does); (SPS-3.A.3: Cultural ideas and practices are socially constructed and change through both small-scale and large-scale processes such as urbanization and globalization). Those who did not successfully answer the question either did not correctly read the table or did not discuss globalization.

Part F asked students to explain geographic characteristics and processes at different scales, specifically by contrasting intensive agriculture in a less developed country to extensive agriculture in a more developed country (Skill 5.C: Compare geographic characteristics and processes at various scales). Many students successfully answered this question. Some discussed how in less developed countries many farmers practice intensive subsistence agriculture to feed their families, while in more developed countries extensive commercial agriculture is practiced. Other students successfully answered the question by differentiating the amount of intensive human labor versus the amount of limited human labor involved in each. Still others successfully explained how access to capital, equipment, hybridized seeds, and/or chemicals differed between less and more developed countries, resulting in less developed countries requiring more human labor as they cannot afford or do not have access to these resources (PSO-5.C.1: Agricultural practices are influenced by the

physical environment and climatic conditions; PSO-5.C.2: Intensive Farming; PSO-5.C.3: Extensive Farming). Students often missed this point by not addressing both sides of the comparison.

Part G asked students to explain the geographic phenomenon of a global supply chain (Skill 2.C: Explain a likely outcome in a geographic scenario using geographic concepts, processes, models, or theories). Many students found this question to be the most challenging, but there were some who were successful at conveying that the chain linking crops to consumers involves not only transportation but also some additional stop or transformation of the crop (such as storing, packaging, processing, wholesaling, and/or retailing), (PSO-5.E.1: Food and other agricultural products are part of a global supply chain; PSO-5.E.3: The main elements of global food distribution networks are affected by political relationships, infrastructure, and patterns of world trade). Responses that did not earn a point often just focused on transportation and did not include any additional stop or transformation.

What common student misperceptions or gaps in knowledge were seen in response to this question?

Common Misconceptions/Knowledge Gaps	*Responses that Demonstrate Understanding*
• In part C many students did not understand that culture traits are tied to practices that vary by location because of physical geography and available resources.	• In part C the most common responses that earned a point explained that cultures often incorporate foods native to their region in their diets, developing distinct dishes or ways of preparing these foods that are unique to this cultural group. Some responses also explained that certain religions have dietary restrictions (taboos, exclusions, restrictions) that are associated with their belief systems (e.g., Muslims, Hindus, and Jews avoid eating pork; Hindus and Buddhists avoid eating beef; some Christians restrict meat and fish on certain days or for observances).
• In part D students who did not earn a point often confused the Columbian Exchange with the country Colombia.	• In part D students who earned a point correctly explained that the Columbian Exchange was the exchange of plants, animals, diseases, and technologies between the Americas (New World) and Europe/Africa/Asia (Old World). As crops with hearths in the Americas (e.g., corn, potatoes, tobacco, cacao) were introduced to Europe, they were adopted and further diffused to other countries via trade among different countries in different regions.

• In part E some students did not understand how to use the data in the chart to support the concept of a crop's consumption pattern being a result of globalization.	• In part E the most common responses that earned a point explained that the high production of staple food crops in locations far from the hearth support the idea that the crop's consumption is a result of globalization.
• In part G many students did not understand the concept of a global supply chain. Some students confused a global supply chain with a short commodity chain.	• In part G students who earned a point explained that crops can be grown in one country, transported, stored, processed, and/or packaged in another country, and then sold to consumers.

Based on your experience at the AP® Reading with student responses, what advice would you offer teachers to help them improve the student performance on the exam?

- **Teach vocabulary from the Curriculum Framework**
  - o Although the task verb "define" was not used in this FRQ, nevertheless, vocabulary was important. Key terms such as **culture trait**, **Columbian Exchange**, and **global supply chain** were important for student success. Students were expected to know these terms and apply them within the geographic context.
- **Build skills in reading and interpreting maps, graphs, charts, and tables**
  - o Throughout the year, have students practice reading charts, tables, and graphs and answering different questions using the same set of data.
  - o Teach students to expect that using stimuli will be required in some parts of a question. For example, part B directed students to "identify the crop listed in the table that has diffused the least"; part E directed students to "explain how the data in the table support …". It was expected that responses that earned a point would include specific data or information from the table.
- **Teach students to understand how to respond to all <u>five task verbs</u> (identify, define, describe, compare, and explain)**
  - o Work with students so they understand what is required in their answers based on the task verb in each; emphasize especially that the task verb "explain" requires an explanation of why/because and how this differs from "identify" and "describe."
  - o Train students to know that the task verb "compare" requires both elements to be addressed in their response (as in part F, "close the loop" on compare).

What resources would you recommend to teachers to better prepare their students for the content and skill(s) required on the question?

- The Course and Exam Description provides a section on "Developing the Course Skills" on pages 143–151. This section provides examples of questions and instructional strategies for incorporating the course skills into classroom instruction.
- Sign into AP Classroom to access AP Daily videos and questions on the topics and skills addressed in this question. AP teachers can assign students short AP Daily videos as homework, warm-ups, lectures, reviews, and more. AP teachers can also use the AP Question Bank in AP Classroom to enable students to practice and get feedback on formative topic questions and past AP Exam questions.
- Resources related specifically to this prompt include:

- o 3.6: Daily Video discusses how cultural ideas change and diffuse through many processes, including globalization and urbanization.
  - o Unit 3 Progress Check: MCQ
  - o Unit 3 Progress Check: FRQ
  - o 5.3: Daily Video 1 discusses how early hearths of domestication of plants and animals arose in the Fertile Crescent and several other regions of the world, including the Indus River Valley, Southeast Asia, and Central America.
  - o 5.9: Daily Video 1 discusses how food and other agricultural products are part of a global supply chain.
  - o Unit 5 Progress Check: MCQ
- Additional resources may be found on the AP Human Geography Course Page on AP Central at: https://apcentral.collegeboard.org/courses/ap-human-geography
- The AP Human Geography Online Teaching Community (OTC) is another great resource, which includes materials and resources posted not only by the College Board, but also by other teachers. The OTC Discussion Board is the place to ask questions, share resources, and exchange teaching ideas at: https://apcommunity.collegeboard.org/group/aphumangeo/

Task: Free-Response Question
Topic: Medical and Biotechnological Research Institutions and Industries in the Boston Region
Max Score: 7
Mean Score: 2.77

What were the responses to this question expected to demonstrate?

In this two-stimulus question, students were expected to interpret two maps of major medical and biotechnological research institutions and industries in the Boston region: one larger Boston-area regional map and one inset map focused specifically on Boston and Cambridge. The maps showed the locations of major research and corporate centers as indicated in the map legend and, on the larger regional map, the location of major highways. The students were also asked to apply qualitative data from a table that listed selected medical research and development areas.

The responses to this question were expected to demonstrate students' abilities across several aspects of the course, requiring students to draw primarily from Unit 6: Cities and Urban Land-Use Patterns and Processes and Unit 7: Industrial and Economic Development Patterns and Processes. Responses required students to make use of Skill Category 2 (Spatial Relationships) and Skill Category 4 (Source Analysis).

In part A students were asked to interpret the inset map and describe the spatial pattern of the companies and institutions shown in Boston and Cambridge.

In part B students were asked to describe the economic geography concept of a growth pole.

Given the close ties between university medical schools and medical research and development, students were expected to broaden their perspectives in part C by explaining one way in which educational infrastructure affects a region's potential for high-technology development. Students could answer this in the positive (that a high degree of educational infrastructure could have a positive impact on high-tech development in a region) or in the negative (that a lack of educational infrastructure could limit high-tech development in a region).

In part D students were to use the map to show how the Boston region resembles one of the main 21st-century models of North American urban areas, the galactic city model.

Part E asked students to discuss local economic sector change by explaining how economic change can result from deindustrialization, meaning a decline in the secondary sector of a local economy.

In part F students were asked to explain how the products and services listed on the table demonstrate that the economy of this region has moved into the quaternary sector.

Finally, in part G, students were asked to explain why a regional map (such as the one of Boston showing medical and biotechnological research institutions) could not be used to draw countrywide conclusions because the regional scale map does not provide sufficient information to draw countrywide conclusions, i.e., the ecological fallacy.

How well did the responses address the course content related to this question? How well did the responses integrate the skills required on this question?

Overall, students were able to effectively demonstrate their knowledge on many parts of this FRQ. Qualified students were generally limited to scoring points in parts A, B, and C. Highly qualified students also scored in parts E and F. Parts D and G were the most challenging for the majority of students. The point in part G was least accessible as students struggled with "explain the limitations of," one of the more advanced skills (Skill 4.F).

In part A many students were able to describe the spatial pattern on the inset map (Skill 4.B) as similar economic activities being agglomerated or clustered (PSO-7.A.7).

Part B was one of the more difficult parts for students to answer correctly, as many students were unable to describe the concept of a growth pole. Growth pole is identified as a concept in PSO-7.A.7, which discusses the current economic landscape.

In part C many students were able to explain one way that education infrastructure affects a region's potential for high-technology development. Most students explained how a strong educational infrastructure could positively affect a region's potential for high-technology development by providing highly educated graduates who would be a labor force for these industries. Other students explained how a lack of a strong educational infrastructure could be a hindrance to developing a high-technology sector. Both ways of answering the question are correct and employ Skill 2.C (Explain a likely outcome in a geographic scenario …) in the answer.

Part D was one of the most difficult parts for students to answer correctly as many were not able to explain how the pattern on the map of the Boston region resembled the galactic city model. Many students did not seem to be aware of or understand the galactic city model itself (PSO-6.D.1) or how to apply the model in the "real-world" situation shown on the map (Skill 4.E: Explain how maps … illustrate or relate to geographic principles, processes, and outcomes).

In part E students were able to explain how local economic changes may be a result of deindustrialization. Most students explained the shift from secondary to tertiary and quaternary sector economies. The shift in economies is part of PSO-7.A.7, which discusses the current economic landscape.

In part F most students were able to explain how the medical research and development table demonstrates that the economy has moved into the quaternary sector, as many students demonstrated they knew what the quaternary sector is (PSO-7.A.7).

In part G some students were able to explain a limitation of drawing country scale conclusions from a regional scale map such as the one in the FRQ. Students recognized that the urban and economic dynamics of Boston do not necessarily apply to the rest of the country, and there is no evidence with the maps to suggest that they do (Skill Category 4.F: Explain possible limitations of visual sources provided).

What common student misconceptions or gaps in knowledge were seen in the responses to this question?

Common Misconceptions/Knowledge Gaps	Responses that Demonstrate Understanding
• In part B some students did not earn a point because they did not know the concept of a growth pole and/or confused the concept of a growth pole with the concept of agglomeration.	• In part B the most common responses that earned a point described a growth pole as a clustered area of economic activity, usually high-technology research and industry, which leads to the development of new products and/or services.
• In part D many students did not earn a point because they did not know or understand the galactic city model and/or often confused it with the multiple nuclei and sector models.	• In part D those students who did earn a point correctly explained that the galactic city model is a complex urban model with a CBD and multiple specialized centers of development, usually along a ring road and/or major highway intersections.

Based on your experience at the AP® Reading with student responses, what advice would you offer teachers to help them improve the student performance on the exam?

- **Make connections across units**
    - As the academic year progresses, teachers should integrate concepts from previous units into quizzes, exams, and other forms of assessments to have students practice connecting across units. Students should expect FRQs to include topics from more than one unit.
    - In this FRQ, students engaged with a topic that is mostly economic in nature, but also connected to Unit 6 (Cities and Land Use) in parts D and E.
    - Teachers should reassure students that a shift from one unit topic to another unit is perfectly normal and to answer the prompt that is posed to them.
- **Set aside time to adequately cover the content in Unit 6 and Unit 7**
    - Most teachers teach Unit 6 and Unit 7 at the end of the course. If pressed for time, they may not be able to adequately cover the content in these units. However, these are the most difficult conceptual units and teachers are encouraged to devote more time to these last units.
    - Work with students on understanding contemporary urban models (galactic city model, etc.) and how to apply these in a real-world situation.
    - Work with students on understanding the ways in which economic changes impact urban land use.
- **Teach vocabulary from the Curriculum Framework**
    - Although the task verb "define" was not used in this FRQ, nevertheless, vocabulary was important to student success. Key terms such as **growth pole**, **quaternary sector**, and **deindustrialization** were important as students were expected to know them and apply them within the geographic context.

What resources would you recommend to teachers to better prepare their students for the content and skill(s) required on this question?

- The Course and Exam Description provides a section on "Developing the Course Skills" on pages 143–151. This section provides examples of questions and instructional strategies for incorporating the course skills into classroom instruction.
- Sign into AP Classroom to access AP Daily videos and questions on the topics and skills addressed in this question. AP teachers can assign students short AP Daily videos as homework, warm-ups, lectures, reviews, and more. AP teachers can also use the AP Question Bank in AP Classroom to enable students to practice and get feedback on formative topic questions and past AP Exam questions.
- Resources related specifically to this prompt include:
  - 6.5: Daily Video 2 discusses the internal structure of cities using two models: the Harris and Ullman multiple nuclei model and the galactic city (peripheral) model.
  - Unit 6 Progress Check: MCQ
  - 7.2: Daily Video 1 examines how the different economic sectors—including primary, secondary, tertiary, quaternary, and quinary—characterize distinct development patterns.
  - 7.7: Daily Video 2 explores economic changes such as the increase in international trade, deindustrialization, and growing interdependence on the world economy.
  - Unit 7 Progress Check: FRQ
  - Review Session 6: Developing the Skill of Scale Analysis analyzes geographic theories, concepts, and models across geographic scales to explain spatial relationships.
- Additional resources may be found on the AP Human Geography Course Page on AP Central at: https://apcentral.collegeboard.org/courses/ap-human-geography
- The AP Human Geography Online Teaching Community (OTC) is another great resource, which includes materials and resources posted not only by the College Board, but also by other teachers. The OTC Discussion Board is the place to ask questions, share resources, and exchange teaching ideas at: https://apcommunity.collegeboard.org/group/aphumangeo/