Can Your Students do PISA?

Peter Kloosterman and Arnulfo Pérez

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Background Questions

• Are the mathematics skills of U.S. students better, worse, or about the same as students from 20 years ago?

• How do U.S. students’ mathematics skills compare to those of students in other countries?
  – Relative to other countries, are U.S. students better, worse, or about the same as they were 30 years ago?

• How do Indiana elementary students’ mathematics skills compare to those of students in other states and countries?
Periodic International Mathematics Assessment Programs

• Trends in International Mathematics and Science Study (TIMSS) - grades 4, 8, and 12 depending on the year administered

• Program of International Student Assessment (PISA) - 15 year olds
PISA

• PISA: Program for International Student Assessment
  – Purpose: How effectively can students use their knowledge and skills in *practical situations* from the real world?
PISA

• Sponsored by the Organization for Economic Cooperation and Development (OECD), a group of economically developed nations, predominantly in Europe.
  – Nations or parts of nations can participate regardless of whether they are members of OECD
• Students: age 15
• Countries: In 2009, 67 countries participated and in 2012, 68 countries participated (half of these were members of OECD).
• PISA assesses reading, mathematics, and science with each playing a major role every three years.
• Mathematics was the major content area in 2003 and 2012.
Support for the President Item

• In Zedland, opinion polls were conducted to find out the level of support for the President in the forthcoming election. Four newspaper publishers did separate nationwide polls. The results for the four newspaper polls are shown below:
  – Newspaper 1: 36.5% (poll conducted on January 6, with a sample of 500 randomly selected citizens with voting rights)
  – Newspaper 2: 41.0% (poll conducted on January 20, with a sample of 500 randomly selected citizens with voting rights)
  – Newspaper 3: 39.0% (poll conducted on January 20, with a sample of 1000 randomly selected citizens with voting rights)
  – Newspaper 4: 44.5% (poll conducted on January 20, with 1000 readers phoning in to vote).

• Which newspaper’s result is likely to be the best for predicting the level of support for the President if the election is held on January 25? Give two reasons to support your answer.
The diagram above illustrates a staircase with 14 steps and a total height of 252 cm. What is the height of each of the 14 steps?
Earthquake Item

A documentary was broadcast about earthquakes and how often earthquakes occur. It included a discussion about the predictability of earthquakes. A geologist stated: “In the next twenty years, the chance that an earthquake will occur in Zed City is two out of three”. Which of the following best reflects the meaning of the geologist’s statement?

A. $\frac{2}{3} \times 20 = 13.3$, so between 13 and 14 years from now there will be an earthquake in Zed City.

B. $\frac{2}{3}$ is more than $\frac{1}{2}$, so you can be sure there will be an earthquake in Zed City at some time during the next 20 years.

C. The likelihood that there will be an earthquake in Zed City at some time during the next 20 years is higher than the likelihood of no earthquake.

D. You cannot tell what will happen, because nobody can be sure when an earthquake will occur.
The diagram below shows the results on a Science test for two groups, labeled as Group A and Group B. The mean score for Group A is 62.0 and the mean for Group B is 64.5. Students pass this test when their score is 50 or above.

Looking at the diagram, the teacher claims that Group B did better than Group A in this test. The students in Group A don’t agree with their teacher. They try to convince the teacher that Group B may not necessarily have done better. Give one mathematical argument, using the graph, that the students in Group A could use.
Litter Item

For a homework assignment, students collected information on the decomposition time of several types of litter that people throw away. A student thinks of displaying the results in a bar graph.

Give one reason why a bar graph is unsuitable for displaying these data.
Exchange Rate Item

Mei-Ling from Singapore was preparing to go to South Africa for 3 months as an exchange student. She needed to change some Singapore dollars (SGD) into South African rand (ZAR).

• **Question 1:** Mei-Ling found out that the exchange rate between Singapore dollars and South African rand was 1 SGD = 4.2 ZAR. Mei-Ling changed 3000 Singapore dollars into South African rand at this exchange rate. How much money in South African rand did Mei-Ling get?

• **Question 2:** On returning to Singapore after 3 months, Mei-Ling had 3,900 ZAR left. She changed this back to Singapore dollars, noting that the exchange rate had changed to 1 SGD = 4.0 ZAR. How much money in Singapore dollars did Mei-Ling get?

• **Question 3:** During these 3 months the exchange rate had changed from 4.2 to 4.0 ZAR per SGD. Was it in Mei-Ling’s favor that the exchange rate now was 4.0 ZAR instead of 4.2 ZAR, when she changed her South African rand back to Singapore dollars? Give an explanation to support your answer.
Tickets Creative Problem Solving Item

TICKETS

A train station has an automated ticketing machine. You use the touch screen on the right to buy a ticket. You must make three choices:
- Choose the train network you want (subway or country).
- Choose the type of fare (full or concession).
- Choose a daily ticket or a ticket for a specified number of trips. Daily tickets give you unlimited travel on the day of purchase. If you buy a ticket with a specified number of trips, you can use the trips on different days.

The BUY button appears when you have made these three choices. There is a CANCEL button that can be used at any time before you press the BUY button.

Question 1: TICKETS CP038Q02
Buy a full fare, country train ticket with two individual trips.
Once you have pressed BUY, you cannot return to the question.

Question 2: TICKETS CP038Q01
You plan to take four trips around the city on the subway today. You are a student, so you can use concession fares.
Use the ticketing machine to find the cheapest ticket and press BUY.
Once you have pressed BUY, you cannot return to the question.

Question 3: TICKETS CP038Q03
You want to buy a ticket with two individual trips for the city subway. You are a student, so you can use concession fares.
Use the ticketing machine to purchase the best ticket available.
At the Market Financial Literacy Item

You can buy tomatoes at the market for 2.75 zeds per lb or 22 zeds for 10 lb box.

- **Question 1:** The box of tomatoes is a better value for the money than the loose tomatoes. Give a reason to support this statement.

- **Question 2:** Buying a box of tomatoes may be a bad financial decision for some people. Explain why.
2013 PISA Overall Results: Math

• Average scores in mathematics literacy ranged from 613 in Shanghai – China to 368 in Peru. The US average score was 481, which is lower than OECD average of 494.

• In terms of rank, the US performed significantly below 22 of the 33 other OECD countries.
TIMSS Grade 4 Mathematics: 2011

- Indiana did not participate as a “country” at grade 4.
- Singapore, South Korea and Japan scored higher than the U.S.
- Finland, Russia, The Netherlands, and Denmark were statistically equal to the U.S.
- The other 31 countries participating at grade 4 scored below the U.S.
TIMSS Grade 8 Mathematics: 2013

- Singapore, South Korea, Japan, and the Russian Federation scored significantly higher than the U.S.
- Israel, Finland, Australia, Slovenia, Hungary, and Lithuania were statistically equal to the U.S.
- The other 27 countries participating at grade 8 scored below the U.S.
- Indiana participated as a “country” at grade 8. The Indiana grade 8 score was 522 which is significantly above the U.S. average but still below the 4 countries that scored higher than the U.S.
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