Who Clicks On Advertisements During an Online Reading Assessment? An Analysis of ePIRLS 2016 Process Data

# Introduction

[intro to ePIRLS]

Just like everyone else in the modern society, students around the world are having increasing access to and consumption of online information both in and out of school. How well can students read online? How does their online reading literacy compare in a global context? The international assessment, ePIRLS (hyperlink), was first administered in 2016 to answer that. This innovative assessment of online reading measures how well 4th-grade students around the world read, interpret, and critique information online. The findings (links) have been published and the dataset (link) made available, both of which provide policy makers with information essential to developing appropriate public policies in our age of online information.

[Online distractions – advertisements]

While online reading provides new opportunities that offline reading does not, it also presents challenges for readers, one of which is the potential for distractions (pop-up: Goldstein et al., 2014). Remember that time when you were reading an article online, where half-way through, there’s an advertisement that caught your eye, and 10 minutes later, you finished purchasing whatever that was and completely forgot about the article? The designers of ePIRLS surely remember such moments, so they put advertisements in many webpages from which students are supposed to read and collect information. The hypothesis is that, students working on school assignments or research projects will finish sooner if they focus on finding critical information and are not distracted (pop-up: Mullis et al., 2017).

As a digitally based assessment, ePIRLS collects data on the test-taking process, including whether or not students have clicked on those advertisements. This can provide insights into the relationship between students’ performance and their testing behavior. However, little process data research has been conducted on ePIRLS or on other international large-scale assessments for that matter. In this post, I use ePIRLS data to test the hypothesis above, and to explore further about how students around the world read and behave when presented with the distraction of online advertisements.

[optional fun: insert an ad somewhere: it could have an hover effect. It may read something like “Apply now for data analysis workshop”, then users click on it, say something like “hey! you can’t resists in clickcing on this ad as well? Let’s see how students who took ePIRL deal with such similar distraction, you can now safely close this pop up window and I promise there’s no more trolling”]

# Data and Methods

Let’s first understand how the ePIRLS assessment works and where the advertisements appear in the assessment.

The ePIRLS 2016 assessment was participated by 4th-grade students in 16 education systems. (hover over, tooltip showing a list including benchmarking) The assessment consists of five modules (hover over showing list) of science and social studies topics, with each module lasting up to 40 minutes.

Each participating student took a randomly-assigned combination of two of the five modules. Each module was structured as a class project, and represented in a simulated internet environment that contains advertisements, such as the screenshots shown below.

[img]

The module "Mars" and "Dr. Elizabeth blackwell" (out of five modules) have been released online, so they can be viewed in the same way as they were presented to participating students. Below is a video walk-through (also available online) about the logistics of the assessment.

[video]

ePIRLS recorded information on how many times each student clicks on the advertisements. This information along with student’s online reading performance is used for my analyses. All analyses account for the complex survey design of ePIRLS and use all five plausible values (link to read more about plausible values) of the online reading achievement scale.

# Findings

Let’s dive in to the results, which are categorized into 4 research questions.

**RQ1: What are students’ advertisement-clicking patterns in each of the five modules?**

[place holder text to explain the plot as it appears on the screen]

[basic skeleton of the plot appearing to the right] In the plot to your right, you will see the range of students' ad-clicks in each module and in each education system.

[show dots and animation] The dots on the left are the minimum number of ad-clicks and the dots on the right is the maximum. In each module, an ePIRLS participating student clicked on advertisements as few as zero times and as many as 604 times.

[show annotation] Look at that outlier student in Chinese Taipei who clicked the ad in the “Rainforests” module more than 600 times!.

[change to the percentage plot, animation]

We can also view it in percentage terms. Each bar to the right represents the percentage of students who clicked on ads (regardless of how many times they have clicked) in each module in a given education system.

The percentage of students who clicked on advertisements ranged from 2.5 percent in Sweden in the “Zebra and Wildebeest Migration” module to 19.9 percent in Abu Dhabi in the “Mars” module.

In 13 of the 16 participating education systems, a higher percentage of students clicked on the advertisements in the “Mars” module than in the other modules. Differential advertisement-clicking patterns across modules may be attributed to how relevant the advertisements are to the reading theme of each module. As a comparison of the two released modules shows, the “Mars” module advertisements are about "trips to the stars” and “having a star named after you or your friend,” which are highly relevant to the space theme of the module, while the advertisements in the “Dr. Elizabeth Blackwell” module are about “unlimited free calls” or “low interest loans,” which are less relevant to the biographical theme of the module. (If accepted, these insights will be illustrated by showing examples of the advertisements and released modules.)

**RQ2: What percentage of students clicked on advertisements at least once in the assessment?**

Remember that each student was randomly assigned two modules? Throughout the assessment, the percentage of students who clicked on advertisements at least once ranged from 6.7 percent in Sweden to 27.7 percent in Chinese Taipei. In the United States, 13.1 percent of students clicked on advertisements at least once.

To break it down by gender, the percentage of boys who clicked on advertisement ranged from 8.3 percent in Sweden to 35.7 percent in Chinese Taipei, and the percentage of girls who clicked on advertisements ranged from 5.1 percent in Sweden to 19.1 percent in Chinese Taipei. Across all education systems, the percentage of boys who clicked on advertisement was significantly higher than the percentage of girls.

**RQ3: How are students’ advertisement-clicking** **patterns associated with their online reading achievement?**

The bars represent the average score for students who did not click on ads and those who did click on ads, in a given education system. And the two vertical lines indicates that, across all participating education systems, on average, students who clicked on advertisements scored 502.1 points on the ePIRLS assessment while students who did not click on advertisements scored 537.5 points.

In all participating education systems, except in Singapore, students who clicked on advertisements scored significantly lower than their peers who did not click on advertisements. In Singapore, the gap was not significantly different from zero. The gap favoring students who did not click on advertisements ranged from 11.4 points in Norway to 89.7 points in Abu Dhabi. In the United States, the achievement gap was 20.5 points in favor of students who did not click on advertisements.

**RQ4: How are students’ advertisement-clicking patterns associated with time spent completing the assessment?**

The bars represent the average time students spent on the ePIRLS assessment (from start to log-out) among students who did not click on ads and those who did click on ads, in a given education system.

In 13 of the 16 participating education systems, there was no measurable difference in time spent on the ePIRLS assessment between the two groups of students. There are three exceptions. In Italy, students who clicked on advertisements spent, on average, 2.8 more minutes on the assessment than their peers who did not click on advertisements. In the United Arab Emirates and Abu Dhabi (part of UAE) it’s the other way around.

[no action] This finding does not lend support to the hypothesis that students who are distracted tend to take more time to complete the assessment. One reason is likely that the ePIRLS assessment only tracks the action of students clicking on advertisements but never actually take them to the advertisement page (or a pop-up window) where students may spend more time being distracted. If ePIRLS would really like to test out this hypothesis (which it claims to be (LINK)), future design of the assessment may consider enhancing this testing feature.

# Conclusions

We just did some initial exploration of how students around the world read and behave when presented with the distraction of online advertisements, using the process data from ePIRLS 2016! If you reach this point and have not been distracted as some of the students were while taking the assessment, you will hopefully take away the following highlights.

* We observed some variation of students’ ad-click patterns by module and by education system.
* We observed higher proportions of boys than girls who clicked on advertisements during the assessment time.
* In most education systems, students who clicked on advertisements tended to score lower than their peers who did not click on advertisements while seemed to spend the same amount of time completing the assessment.
* To test out if students really spend the same amount of time completing the assessment with or without the presence of advertisement, the ePIRLS assesement may need need to improve its design for future administration.

This close look at the process data will hopefully encourage more analyses in the future to gain more insight into students’ online reading and testing behaviors, including their advertisement-clicking patterns.

# References

Goldstein, D. G., Suri, S., McAfee, R. P., Ekstrand-Abueg, M., & Diaz, F. (2014). The Economic and Cognitive Costs of Annoying Display Advertisements. *Journal of Marketing Research*, *51*(6), 742–752. <https://doi.org/10.1509/jmr.13.0439>

Mullis, I. V. S., Martin, M. O., Foy, P., & Hooper, M. (2017). ePIRLS 2016 International Results in Online Informational Reading. Retrieved from Boston College, TIMSS & PIRLS International Study Center website: <http://timssandpirls.bc.edu/pirls2016/international-results/>

# Data and Credits

This analysis uses the ePIRLS 2016 data available here. The R script used to process the data, the code for this data story, and a static write up, could all be found on this GitHub repository.

This project is made possible thanks to the multitude of resources available online (tutorials for learning and implementing use D3.js, [Scrollama](https://github.com/russellgoldenberg/scrollama) and [D3-legend](https://d3-legend.susielu.com/), to name a few). A special shout out to xxx, whose data story provides inspiration and the code structure for this project. Also thanks to Marty Hooper, xxx, and xxx for xxx.