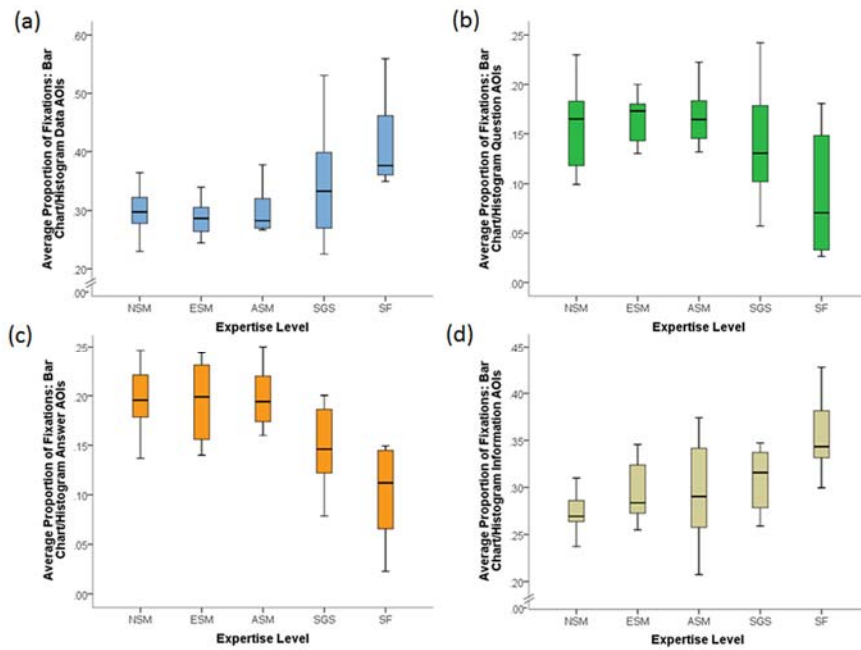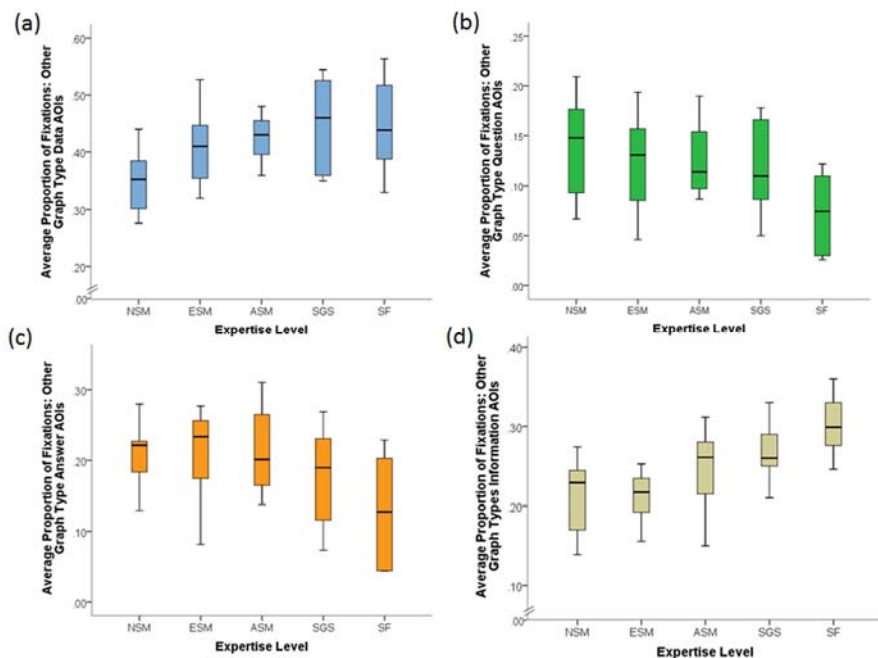# Supplemental Material

CBE—Life Sciences Education

Harsh *et al.*

Supplemental Figure 1. Boxplots representing (thick line indicates median) average proportion of fixations for bar graphs/histograms to (a) Graph Data, (b) Questions, (c) Answer Options, and (d) Graph Information AOIs by expertise. ET data were collected from 36 participants including, 9 NSM, 7 ESM, 8 ASM, 6 SGS and 6 SF.

Supplemental Figure 2. Boxplots representing (thick line indicates median) average proportion of fixations for other graph types to (a) Graph Data, (b) Questions, (c) Answer Options, and (d) Graph Information AOIs by expertise. ET data were collected from 36 participants including, 9 NSM, 7 ESM, 8 ASM, 6 SGS and 6 SF.

Table 1. Description of graphing tasks used in the study

Graph	Graph Type (Category)	Context of Graph	Nature of Question	Graph Reading Level(based on Curcio, 1987)	Unique Feature(s)	Source of graph	Source of graph task
1	Time Series (Line)	Concentration of three greenhouse gases over time from 0 to 2005	Identification of x-axis variable	Reading the data	Second y-axis; Different units (ppm v. ppb) for greenhouse gas concentrations	International Panel on Climate Change: AR4 Climate Change Report (2007)	Maltese et al., 2015

Graph	Graph Type (Category)	Context of Graph	Nature of Question	Graph Reading Level (based on Curcio, 1987)	Unique Feature(s)	Source of graph	Source of graph task
2	Vertical Bar Graph (Bar/Histogram)	Estimated AIDS cases in young children from 1992-2005	Identification of dependent variable	Reading the data		CDC National Health Report: leading causes of morbidity and mortality and associated behavioral risk and protective factors (2014)	Maltese et al., 2015
3	Vertical Bar Graph (Bar/Histogram)	Competitive eating records of 19 differing food by weight and rate of ingestion	Interpretation of data point	Reading the data	Second y-axis; Images of food types on graph	Brown University: Visualizing Information course page	Maltese et al., 2015
4	Pie Chart (Other)	Sources of Nitrogen (n=9) in the Chesapeake Bay	Interpretation of data point relative to others	Reading between the data		Chesapeake Bay Program. Milestones for Reducing Nitrogen and Phosphorus (2011)	Maltese et al., 2015
5	Whitaker Diagram (Other)	Diagram of biome (n=8) precipitation and temperature	Interpretation of data point relative to others	Reading between the data		Miller & Levine (2010) Biology (high school textbook)	Maltese et al., 2015
6	Combined Graph: Vertical Bar & Line Graph (Other)	Daily and total tornado events in the US during 2008	Interpretation of data point relative to others	Reading between the data	Second y-axis; Combination bar and line graph	NOAA National Centers for Environmental Information, State of the Climate: Tornadoes for Annual 2008 (2009)	Maltese et al., 2015
7	Line Graph (Line)	Automobile fuel economy by speed over three decades	Estimate fuel usage of vehicles using slope between data points	Reading between the data		Department of Energy Transportation Energy Book, Edition 20 (2000)	Maltese et al., 2015
8	Horizontal Bar Graph (Bar/Histogram)	Percentage of overweight and obese adults by country (n=7) in 1980 and 2008	Identification of multiple independent variables	Reading between the data	Multi-bar graph	Overseas Development Institute Future Diets Report (2014)	Designed for this study
Graph	Graph Type (Category)	Context of Graph	Nature of Question	Graph Reading Level (based on Curcio, 1987)	Unique Feature(s)	Source of graph	Source of graph task
9	Scatterplot (Other)	Measurement of Nitrogen and Phosphorus pollution from agricultural fertilizer in four ecosystems	Inferring the relationship between nitrogen and phosphorus inputs by ecosystem type	Reading between the data		Picone, Chris, et al. "Assessing gains in undergraduate students' abilities to analyze graphical data." Teaching Issues and Experiments in	Piccone et al., 2007

						Ecology 5 (2007): 1-54.	
10	Time Series (Line)	Concentration of three greenhouse gases over time from 0 to 2005	Determination of highest gain in greenhouse gas concentration over time by taking into account variable units and relative rate of change	Reading beyond the data	Second y-axis; Different units (ppm v. ppb) for greenhouse gas concentrations	International Panel on Climate Change: AR4 Climate Change Report (2007)	Maltese et al., 2015
11	Connected Scatter Plot (Line)	Physics of a baseball player's throw at three different speeds	Predict the minimum speed a baseball player would need to throw a ball to clear a tree at a given distance	Reading between the data		Blog by Dr. M. Richmond from RIT in response to a Wired article	Designed for this study
12	Time Series (Line)	Three panel time series graph showing global climate changes in temperature, sea level, and snow cover from 1961-1990	Identification of a data point	Reading between the data	Multiple panel display	IPCC, 2007: Climate Change 2007: the physical science basis.	Maltese et al., 2015
13	Combined Graph: Histogram & Line Graph (Other)	Actual and projected human population size and growth every ten years from 1750 to 2050	Determination of population growth between two time periods	Reading between the data	Histogram and line graph combination; second y-axis with different units	United Nations Population Division :The World at Six Billion (2002)	Maltese et al., 2015

Graph	Graph Type (Category)	Context of Graph	Nature of Question	Graph Reading Level(based on Curcio, 1987)	Unique Feature(s)	Source of graph	Source of graph task
14	Connected Scatter Plot (Line)	Percent chance of a mother having a baby with Down Syndrome by age	Comparisons between five year periods of age to determine the greatest change in probability a mother will have a child with Down Syndrome	Reading between the data		Graph common to webpages about Down Syndrome: Newberger, D. (2000) Down Syndrome: Prenatal Risk Assessment and Diagnosis. Am Fam Physician. 62(4):825-832.	Maltese et al., 2015
15	Line Graph (Line)	Multiple line graph depicting energy consumption by six renewable and nonrewable resources from 1970 to 2020	Determination of which resource has the highest rate of relative growth over the period shown	Reading between the data		Tarbuck and Lutgens (2007) Foundations of Earth Science (middle school textbook)	Maltese et al., 2015
16	Line Graph (Line)	Multiple line graph depicting the relationship between sunshine, nutrients, phytoplankton, and zooplankton over a 12-month period in the Atlantic Ocean	Identify potential abiotic and biotic factors that contribute to increases in phytoplankton populations between August to September	Reading beyond the data		Tarbuck and Lutgens (2007) Foundations of Earth Science (middle school textbook)	Maltese et al., 2015
17	Stacked Bar Graph (Bar/Histogram)	Three expanded stacked-bars depicting the distribution of Earth's water in ten categories	Identify the percentage of freshwater on Earth found in lakes	Reading between the data		Withgott (2011) Environmental Science: Your World, Your Turn (high school textbook)	Designed for this study
18	Three-Dimensional Bar Graph (Other)	Incidence of cardiovascular disease predicted by the number of four	Determine rate of heart disease between individuals dependent on the	Reading between the data	3-D graph	Roger, Véronique L., et al. "Heart disease and stroke statistics--2012 update: a report from the American Heart Association." *Circulation* 125.1	Designed for this study

Graph	Graph Type (Category)	Context of Graph	Nature of Question	Graph Reading Level(based on Curcio, 1987)	Unique Feature(s)	Source of graph	Source of graph task
		ideal health behaviors and four health risk factors.	number of their risk factors			(2012): e2-e220.	
19	Stacked Bar Graph (Bar/Histogram)	Diagram depicting changes in the global consumption of animal-source food between 1961 and 2009 by type and by region	Identification of the regions with the smallest change in the consumption of a given animal-source food during the charted time.	Reading between the data	Complex stacked bar graph plotting four food types in 11 regions over two time periods	Overseas Development Institute Future Diets Report (2014)	Designed for this study
20	Age Pyramid (Other)	Projected population age and sex structure of the US in 2010, 2030, and 2050	Identify the age range and gender with the least predicted population growth between 2010-2030	Reading between the data		Vincent, Grayson K., and Victoria AverilVelkoff. The next four decades: The older population in the United States: 2010 to 2050. No. 1138. US Department of Commerce, Economics and Statistics Administration, US Census Bureau, 2010.	Maltese et al., 2015
21	Pie Chart (Other)	Three pie charts in image displaying the most common pollutants to the Chesapeake Bay and the nine sources of the pollutants	Identification of the dependent variable	Reading between the data	Three pie charts included in same image	United States Geological Society (USGS) Report	Maltese et al., 2015
22	Bar Graph (Bar/Histogram)	Details the total and average abundance of an annual citizen science Western Monarch count at overwintering sites from 1997-2013	Interpret largest differences in the average number of butterflies caught over the time period	Reading between the data	Standard error bars	Xerxes Society website (a citizen science program) with graph also discussed in a 2014 Discover Magazine citizen science blog	Designed for this study
23	Scatterplot (Other)	Annual number of days of lake ice on Lake Mendota, WI (from 1850 to 2000)	Differentiate between long-term trends and short-term fluctuations	Reading between the data	Apply the concept of slope	Picone, Chris, et al. "Assessing gains in undergraduate students' abilities to analyze graphical data." *Teaching Issues and Experiments in Ecology* 5	Piccone et al., 2007

| Graph | | | | | | | (2007): 1-54. | |

Graph	Graph Type (Category)	Context of Graph	Nature of Question	Graph Reading Level(based on Curcio, 1987)	Unique Feature(s)	Source of graph	Source of graph task
24	Time Series (Line)	Two line graph demonstrating the predator-prey interaction between snowshoe hares and lynx from 1850-1950	Identify the relationship in data trends between species	Reading between the data	Second y-axis	Miller & Levine (2010) Biology (high school textbook)	Designed for this study
25	Histogram (Bar/Histogram)	Two panel histogram, based on Peter and Rosemary Grant's work, representing the beak depth of the Galapagos finches before and after a drought event	Identify how the beak depth of the finch population changed from before to after the drought	Reading between the data	Two panel histogram	Miller & Levine (2010) Biology (high school textbook)	Maltese et al., 2015
26	Bubble Chart (Other)	Electricity consumption per person by gross domestic product for 24 countries	Distinguish what relationship is being demonstrated by the visualization	Reading between the data	Bubble chart	International Energy Agency (2009) Key World Energy Statistics 2009	Designed for this study