

Multivariate data in the news

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Overview of Lesson

Data visualizations are a common feature in news media, and their level of complexity is considerably greater than in the past. Such data visualizations provide a good starting point for a classroom activity to help students think about the data behind the graphics.

Type of Data

- More than two variables
- Publicly available dataset

Audience

- Grade 10-12 students, GAISE Level C students (see the GAISE II report for reference on Level C: https://www.amstat.org/asa/files/pdfs/GAISE/GAISEIIPreK-12_Full.pdf).
- *Prerequisites:* Prior to this lesson, students should have experience with collecting and displaying categorical and quantitative data. Students should have experience with using data analysis software to make graphs, e.g., Common Online Data Analysis Platform (CODAP <https://codap.concord.org/>).

Time Required

Three to four 50-60 min sessions.

Technology and Other Materials

- *Technology:* statistical software to analyze the data e.g., CODAP
- *Technology:* access to internet

Background for GAISE Level C

Teachers should present this background to students.

At Level C, students understand how to use questioning throughout the statistical problem-solving process and how to use information from data to answer appropriately framed statistical investigative questions. They also recognize non-traditional data (text, sounds, pictures) alongside traditional data (numbers with context) and choose and use appropriate data analysis tools (graphical displays, tabular displays, and numerical summaries). In addition, students engage in multivariable thinking and the types of statistical investigative questions expand to include questions concerning causality and prediction. (Bargagliotti et al., 2020, p. 72)

Statistical problem-solving process

At Level C students are engaging in all stages of the statistical problem-solving process (Figure 1), from forming statistical investigative questions, to determining how to collect and analyze data to provide an answer. They are also sourcing secondary data if that is more appropriate to answer their statistical investigative question. They are learning about good practice in survey and experimental design and how to use technology to subset and filter datasets. They use statistical evidence from analyses to answer statistical investigative questions and communicate results through more formal reports and presentations. There is a focus on working with multivariate data and displays. Questioning plays an important role in moving students through the statistical problem-solving process (Arnold & Franklin, 2021, Bargagliotti et al, 2020). This lesson plan on using questioning <https://www.statisticsteacher.org/files/2021/12/Section-1.pdf> is a good resource for teachers that want to focus on questioning prior to engaging in this lesson..

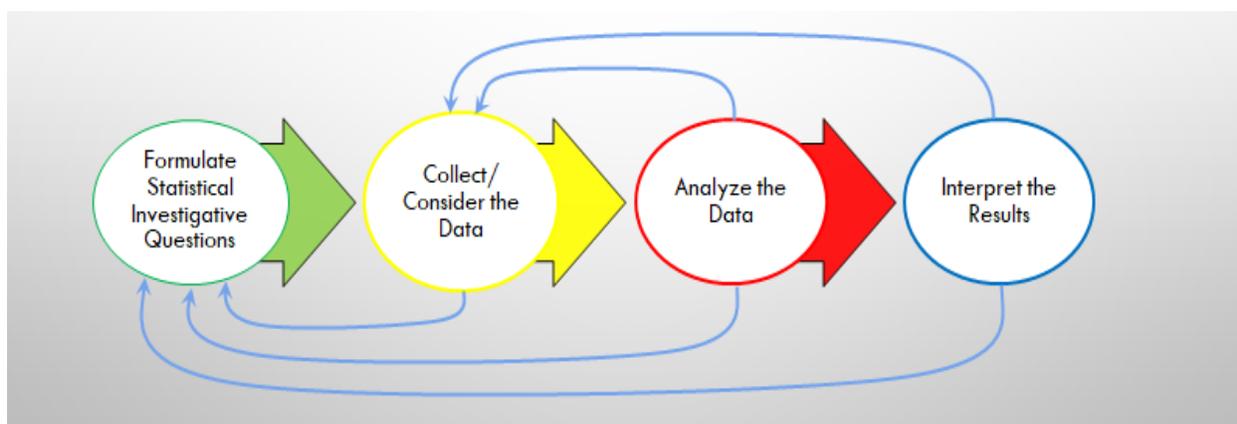


Figure 1. Statistical problem-solving process (Bargagliotti et al., 2020, p.13)

Lesson Plan: Multivariate data in the news

The teaching sequence is written up as a single plan, however it is likely to take three to four 50–60-minute class sessions to complete. Possible breaks in the plan are indicated, teachers should plan to take the break with their class where it is appropriate as some activities will take longer with some groups and less with others.

Background of Lesson

Each week, the New York Times (NYT) and the American Statistical Association (ASA) in partnership select a data visualization from the NYT and present it in the [What's Going on in This Graph](#) (WGOITG) feature section of the NYT. WGOITG is a moderated forum where students across the U.S. and around the world can reflect on the chosen data visualization considering questions such as:

- What do you notice?
- What do you wonder?
- What impact does this have on you and your community?
- What is a catchy headline that captures “what’s going on this graph”?

These data visualizations can provide opportunities to engage students at GAISE levels A, B and C (see the GAISE II report for reference here:

https://www.amstat.org/asa/files/pdfs/GAISE/GAISEIIPreK-12_Full.pdf). At Level C students should be on their way to being "healthy skeptics" of statistical information, and thus should be asking questions about the data provenance (the process that brought the data behind the visualization into existence): "Where and what data were utilized to create this visualization?" "Why was this visualization created and by whom?" "Who collected the data and why?" "How were the data collected?" "Who funded the data collection?"

In Level C, students engage in analyzing increasingly complex data sets, and pose their own statistical investigative questions in order to serve their own research questions. The WGOITG feature can provide a stepping stone to such datasets. Teachers are encouraged to introduce students to WGOITG and have them partake in the discussion on any given week.

This lesson sequence uses the [WGOITG post from Sept 15, 2021](#). The lesson plan can be adapted to other data visualizations of WGOITG.

SESSION ONE

Consider data - Interrogating the data visualization

Data visualizations in the news can provide a starting point for Level C explorations. Students should examine and question the data visualization, they should research the origins of the data that was used to make the visualization and they can interrogate (question) the data visualization to develop a sense of who, what, when, where, why and how. They can do this in small groups.

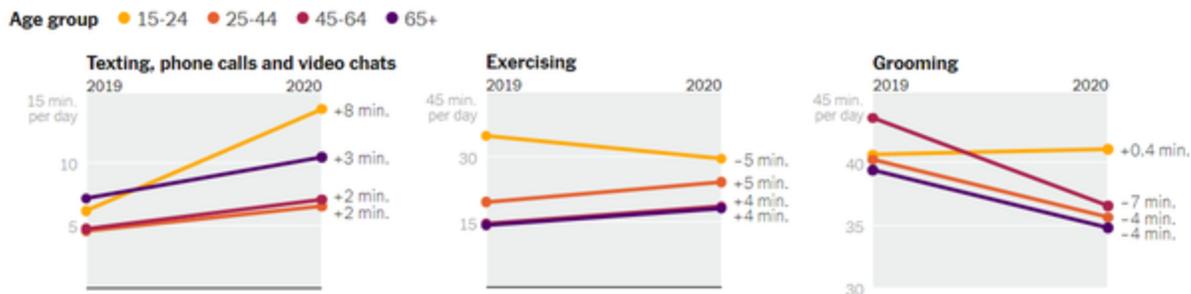
I. Introducing the data visualization - (15-20 minutes)

Teachers introduce the data visualization to students, explaining that they are going to look behind the data visualization and gain a deeper understanding of how the data was collected and what data is available to use.

Show the students the data visualization (or hand them a copy of the data visualization)

- WGOITG Sept 15, 2021: *How did the pandemic change how we spend our free time?*
- [What's Going On in This Graph? | Sept. 15, 2021 - The New York Times](#)
- Large size graphic:
<https://static01.nyt.com/images/2021/09/09/learning/PandemicTimeGraphLN/PandemicTimeGraphLN-superJumbo.png>

Average non-work and non-school time spent per day, by age, May through December in 2020 vs. 2019



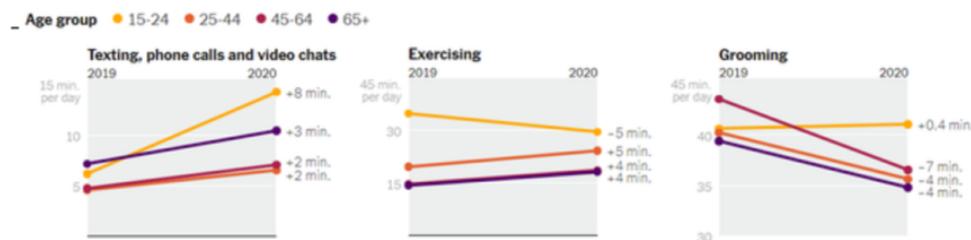
Source: U.S. Department of Labor Bureau of Labor Statistics, American Time Survey

Figure 3. WGOITG on time spent per day on texting, phone calls and video chats; exercising; and grooming. The data visualizations compare time spent for 2019 with time spent for 2020. (The Learning Network, 2021)

Ask students to think (independently) about what they notice and what they wonder about the three graphs (Figure 3). After a few minutes of independent thinking time, get students to pair up or work in small groups to capture what they notice and what they wonder. This can be through putting their thoughts into a [shared electronic space](#) (Figure 4) or writing onto big paper to share with the class.

How did the pandemic change how we spend our free time?

Average non-work and non-school time spent per day, by age, May through December in 2020 vs. 2019



What do you notice?

- There are four age-groups represented.
- Time spent texting etc went up from 2019 to 2020.
- Grooming time went down for those 25+.
- The age group bands are unequal.

What do you wonder?

- Why younger people exercised less
- How they worked out the times
- Who was surveyed to get the information

Figure 4. Example of a group's noticing and wondering

Groups share back their noticing and wondering. Teachers should note that from the students' noticing and wondering, some of the ideas about interrogating the data visualization might come up. For example: Who was surveyed to get the information? How was the data collected? Other ideas that might come up include descriptions of the data visualization, for example, the time spent texting etc went up from 2019 to 2020 for all age groups. Students might also include questions that we cannot answer with the data available, for example, why younger people exercised less from 2019 to 2020.

II. Interrogating the data visualization - (20-25 mins)

After an initial look at the data visualization, teachers can pose a series of interrogative questions about the data using who, what, when, where, why and how questions. Specifically, interrogative questions of the data visualization overall such as the following can be posed:

1. What was the purpose for collecting the data? (Initial investigator's problem/purpose)
2. Who collected the data?
3. Who funded the data collection and research?
4. Was the data collected using an observational study or an experiment?
5. Who was the data collected from?
6. When was the data collected?
7. Where was the data collected?
8. How many people participated?

These questions can be answered as a class discussion or in small groups.

Some questions may be answered directly from the data visualization, others may require some background research. The WGOITG post on Sept 15, 2021 used data from the [American Time Use Survey](#) (ATUS). To find information that is not obvious from the provided data visualization, suggest that they use the [Frequently Asked Questions](#) and the respondent files at [American Time Use Survey—2020 Microdata Files](#) and [American Time Use Survey—2019 Microdata Files](#).

Possible responses to general overall interrogative questions are outlined in Table 1. The table outlines the interrogative question, the information found for the question and where the information came from, or what it was based on.

Table 1. Information about the data visualization overall

Interrogative question	Information about the interrogative question	Information source
1. What was the purpose for collecting the data?	Time-use surveys measure the amount of time people spend doing various activities, such as work, childcare, housework, watching television, volunteering, and socializing.	Frequently Asked Questions (FAQs)
2. Who collected the data?	ATUS is sponsored by the Bureau of Labor Statistics and conducted by the U.S. Census Bureau. The Census Bureau collects and processes the data.	Frequently Asked Questions (FAQs)
3. Who funded the data collection and research?		
4. Observational study or an experiment?	Observational study	Knowing it is from the ATUS
5. Who was the data collected from?	People in the U.S. aged 15 and older	ATUS, and age groups on the data visualizations
	Households that have completed their final (8th) month of the Current Population Survey are eligible for the ATUS. From this eligible group, households are selected that represent a range of demographic characteristics. Then, one person aged 15 or over is randomly chosen from the household to answer questions about his or her time use. This person is interviewed for the ATUS 2-5 months after the household's final CPS interview.	Frequently Asked Questions (FAQs)
6. When was the data collected?	May to December 2019 and May to December 2020	From the title of the data visualization
7. Where was the data collected?	In the U.S.	ATUS
8. How many people participated?	8,782 observations in 2020 9,435 observations in 2019	American Time Use Survey—2020 Microdata Files American Time Use Survey—2019 Microdata Files

Get students to reflect on the documents they had to use to answer the interrogative questions about the data visualization overall, the information about who, what, when, where, why and how. They should reflect that the data visualization doesn't always tell us everything we need to know about the data collection process and that we can search for information. Some of the information needed for the overall interrogative questions came from the frequently asked questions, so these might be a good place to go in the future to find similar information. These reflections could be written through guided questions or could be discussed as a whole group.

III. Interrogating the VARIABLES (10-15 mins)

The data interrogation in the previous activity helped students understand where the data came from and the units (people) that were measured. Now we turn our attention to the variables themselves: what attributes of these people were measured and how? To *interrogate* each variable the following interrogative questions are asked:

9. What is the variable?
10. What was the data collection or survey question asked to collect the data?
11. How was the variable measured?
12. What are the units, if any, for the variable?
13. What are the possible outcomes for the variable?
14. What type of data is it? Categorical or quantitative?

Ask the students which of these questions they think they could answer from the data visualization. They might suggest 9, 12, 13, 14. Ask why not 10 and 11? There is nothing on the data visualization that indicates what the survey question asked was, or how the variable is measured. Again, these questions can be discussed in small groups or as a class discussion.

As a group, identify the variables that are present in the data visualization.

- all three graphs have age and year
- then they have a different time per day
 - texting, phone calls and video chats
 - exercising
 - grooming

Get students to complete Table 2 for the information they can get from the data visualizations.

Table 2. Information about the variables in the data visualization

9. What is the variable?	Age Group	Year	Time per day		
			Texting, phone calls and video chats	Exercising	Grooming
12. What are the units of the variables?					
13. What are the possible outcomes of the variables?					
14. What type of variables are they?					

Potential responses are given in Table 3.

Table 3. Information about the variables in the data visualization

9. What is the variable?	Age Group	Year	Time per day		
			Texting, phone calls and video chats	Exercising	Grooming
12. What are the units of the variables?	categories of years	NA	mins per day	mins per day	mins per day
13. What are the possible outcomes of the variables?	15-24, 25-44, 45-64, 65+	2019, 2020	0-1440	0-1440	0-1440
14. What type of variables are they?	Categorical	Quantitative (but treated as an ordered categorical value)	Quantitative	Quantitative	Quantitative

Explain that we will look at the actual survey questions and how the variable was measured later on.

SESSION TWO

Consider data - Understanding the Structure of the Data

Data structure (10-15 mins)

In this session, students are introduced to the idea of underlying data structure that was used to create the visualization.

Level C students should understand that visualizations such as these represent multiple variables, are created using computers that rely on algorithms that map data into an interpretable (and high level) visualization, and are thoughtfully created to convey information in meaningful ways. While many of the visualizations in WGOITG are perhaps too complex for students to recreate themselves (see for example, [What's Going On in This Graph? | First Vaccinated - The New York Times](#)), they can still ask and answer questions about the shape and structure of the data that produced the graph. Many data sets, particularly those ready for analysis by most statistical software, are in a case-attribute (i.e. "spreadsheet") format. Students should be able to identify the variables measured, and conjecture on who or what was measured and how.

Teachers should lead students to imagine they were one of the participants in the survey and their information has been recorded on a data card. What information would the data card contain? Draw a blank data card on the board like the one in Figure 5A.

Variable	Outcome

A

Variable	Outcome
Subject ID	
Age group	
Year	
Time exercising	
Time texting etc	
Time grooming	

B

Figure 5. (A) Blank data card (B) Data card set up to collect data

Through discussion with the students identify what information we are collecting (the variables) to support making the data visualization. Hopefully, students will connect back to the list of variables identified previously. The one that is likely to be missing is the Subject ID. Give the students a copy of the blank data card in Figure 5B (see Additional materials for photocopyable master) and ask them to fill it in with some made up data that might represent a participant in the American Time Use Survey (ATUS).

In a group, students can collate their data into a dataset that can be used to create data visualizations similar to those in Figure 3. Figure 6 gives example outcomes for the variables, in Table 2 and 3, for four hypothetical respondents.

Subject ID	Year	Age Group	Exercising	Texting, etc.	Grooming
1	2019	25-44	15	40	32
2	2019	15-25	45	50	40
3	2020	45-64	90	10	30
4	2020	45-64	80	12	18

Figure 6. Sample data structure in spreadsheet form

The purpose of such an exercise is not to perfectly recreate the dataset, but instead to help students build a mental map from data to graph. Students may find this challenging because they will have to grapple with questions about data collection and provenance of the data.

Not every data visualization is as straightforward as this. Some visualizations in WGOITG are quite complex, and require nested (hierarchical) data structures or are perhaps based on several datasets spread across a database (e.g., [What's Going On in This Graph? | 2020 US Census - The New York Times](#)). Even so, students should be encouraged to always think about the structure of the data behind the graph, since such thoughts lead to other important critical questions about data collection and data provenance.

Collect data - 35-40 mins

By considering the potential structure of the data behind the visualization, questions will be raised about the methods used to collect the data (e.g., Were the same people sampled from year to year?). Before investigating the actual ATUS survey design, students can design their own "time use" survey using their class to collect the same variables as in Figure 3 and Tables 2 and 3.

Defining variables, posing survey questions, and planning for data collection

In small groups ask students to discuss how they think they could collect the data, from the class, needed to make the data visualization in Figure 3. They can also think about other time use data to collect.

- We know the variables we want: age group, year, and time per day for texting, phone calls and video chats, exercising and grooming.
- What survey questions will they ask?
- How will they define variables such as exercising, grooming (what counts as exercising, what counts as grooming)?
- How will they gather the data to make it useful for analysis?
- How will data from individual students be compiled into classroom data?

- Using an electronic spreadsheet?
- A poster board?
- What will the columns and rows represent?
- Are there other activities students might be interested in in tracking? (e.g., sleep, amount of time spent on devices)?
- Do they notice any biases that might creep into the data collection process?
 - Perhaps there is an urge to exaggerate the time spent grooming and exercising and downplay the time spent texting?
 - What might they do, as researchers, to minimize these potential biases?

Ideas from students could include:

- We might ask people to report their memories for the last 24 hours and to judge for themselves how much time was spent.
- We might ask them to pay attention in the next 24 hours and record the amount of time spent.
- Another approach (closer to the ATUS survey) is to keep a diary and, perhaps every hour record activities that were taken and the length of time spent doing them.
- Defining variables, for example, grooming - this includes all activities where someone is cleaning or tidying themselves, e.g, showering, dressing, cleaning teeth, brushing hair, putting on makeup etc.

Overall, students should discuss which data collection decisions they think will lead to more accurate, useful, and practical data.

As a class, come to an agreed set of variable definitions and an agreed way to collect and record the data. This will include the survey questions they want to ask and any additional directions for recording the data.

Data provenance

Today, it should be common practice for students to investigate the source of the data when possible. It is a challenging activity for students to partake in, and one that in the past often has not been a focus in the classroom. Oftentimes, classroom data is taken for granted and little time is spent understanding its origins. However, as the accessibility to data has increased drastically, considering the provenance of data within the statistical investigative process necessitates proper time and care in the classroom. Interrogative questions such as those suggested in session one can be used to understand the origin of secondary data sets and provide a full picture of the scope of the data. Such **data documentation** is an important piece of good statistical practice.

SESSION THREE

ATUS dataset

As noted previously, ATUS is sponsored by the Bureau of Labor Statistics and conducted by the U.S. Census Bureau. The Census Bureau collects and processes the data. The ATUS is undertaken on a yearly basis. To understand the provenance of the data set, the documentation provided by the Bureau can be consulted.

ATUS Documentation (15-20 mins)

Documentation for the dataset can be found on the [website](#). The ATUS Survey Documentation consists of several different files, ranging from a User's Guide to variable codes to the ATUS Questionnaires (see Figure 7).



Figure 7. Ten different documents that are available on the website that discuss the data provenance for ATUS

Students look at the [ATUS User's Guide](#) as a starting point. A possible approach could be to assign different groups of students to different chapters (Figure 8) to read through and pick out 2-3 points to share back. Allocate 5 mins for a quick scan of chapter, 5 mins to pick out and prepare points to share back. Allow 1 min per group to share back.

CHAPTER 1: SURVEY OBJECTIVES	3
CHAPTER 2: HISTORY OF THE AMERICAN TIME USE SURVEY	5
CHAPTER 3: SURVEY DESIGN	11
CHAPTER 4: DATA COLLECTION	15
CHAPTER 5: CODING THE DATA	21
Exhibit 5.1: Travel Codes	
CHAPTER 6: DATA EDITING, IMPUTATION, AND ITEM NONRESPONSE	26
Exhibit 6.1: Imputation Methods	
Exhibit 6.2: ATUS Data Files	
CHAPTER 7: WEIGHTS, LINKING, AND ESTIMATION	35
CHAPTER 8: PUBLICATIONS AND DATA FILES	44
CHAPTER 9: SPECIAL TOPICS	47
CHAPTER 10: DATA QUALITY.....	53
CONCEPTS AND DEFINITIONS	55

Figure 8. Chapter headings for November 2021 version of the ATUS User’s Guide (Bureau of Labor Statistics, 2021, p.2)

Students need to understand that part of good statistical practice is to look at the data documents to notice and wonder about how the data were collected, what survey questions were used and how the data were recorded. When reading the documentation, students will see that much care is put into collecting good data. Documentation is key to creating good datasets and it reveals the complexity of good data collection.

Further work on survey questions and how the variables were measured (15-20 mins)

In this next activity students are to use the ATUS documentation to source the survey questions used for the five variables in the WGOITG data visualization. Students open the [current ATUS questionnaire](#) and search for the variables used in the data visualization. The following question prompts could be used.

1. Direct the students to the contents page and ask them where they think they would find the survey question that was asked about age.
 - As a hint suggest they go to each section and read the initial paragraph.
 - S2: household roster includes... name, sex, birth date and age of each household member.
 - The screenshot of the data entry fields on the same page shows the variables that are collected for the household roster.

Ask them to copy (e.g., take a screenshot) of the actual survey question(s) that are asked to get the information about age.

2. Section 4 is the time-use diary. Direct students to this section and get them to read through the initial page. Ask them which of the activities in the WGOITG are in the pre-coded activities list (as on the screenshot). And which activities are not pre-coded.
 - Grooming (self) is the second pre-coded activity
 - Exercising is not pre-coded
 - Texting, phone class and video chats is not pre-coded
3. What information do they collect in the time-use diary for every activity (if they can)?
 - Where you were and who you were with

4. For what time period does the time-use diary record?
 - Yesterday 4 am until 4 am this morning.
5. What are the main survey questions asked as the time-use diary information is collected?
 - Yesterday at 4 am, what were you doing? What did you do next?
 - How long did you spend on that activity?
 - Who was with you? Who accompanied you?
 - Where were you while you were [ACTIVITY]?

Trying out the ATUS Time-Use Diary (15-20 mins)

Get the students to “take” the time-use survey for the Time-use Diary section.

- They should use the pre-set codes for those activities that are pre-coded, open response for other activities.
- Enter start and finish time and collect total time in hours and minutes for each activity.
- Who was with you? This can be an open response.
- Where were you while you were [ACTIVITY]? Use pre-set codes given in the survey questionnaire.

Students could create their own recording table, or they could use the one provided in the additional materials section.

After they have had time to have a good go at completing the time-use diary, ask them to reflect in their small groups about doing it. Share back one big idea from each group.

SESSION FOUR

Using ATUS in the Classroom

In addition to considering the ATUS data collection method, teachers and students may want to access and utilize the dataset in their classroom. And herein lies a challenge. While the ATUS data is available and downloadable at the U.S. Bureau of Labor Statistics and the data.gov websites, preparing it so that it is usable for Level C students in the classroom requires skills in coding, data wrangling, and considerable patience. Some teachers might have it within their skill-set to download and clean such data for themselves. The rest of us, however, will have to rely on finding curated rich and complex data Level C students should encounter. To help with this, the authors have prepared their own curated version of the ATUS. The authors provide a cleaned version of the full ATUS dataset that has over 600,000 observations as well as a dataset of 4,000 people randomly sampled from the full dataset that might be more tangible for the classroom (using the random sample also allows for inferential questions to be explored with the population being the full 600,000 people).

Pose investigative questions (~10 minutes)

A useful exercise for Level C students is to pose multivariate statistical investigative questions based upon an examination of the variables provided by the data at hand.

In the context of the ATUS data, students will note that the response variables in the data visualization -- time spent exercising, grooming, and texting -- do not appear in the dataset.

Instead, each of these high level activities is represented with more detailed variables. For example, time spent exercising was obtained by adding time for a number of activities from archery to yoga.

When students understand that new variables can be created through transformations and combinations of existing variables, a new realm of possibilities opens up. At this stage, students can pose new investigative questions that mirror, and yet go beyond, those provided in Figure 3.

For example, using the ATUS dataset students might investigate whether:

- U.S. adults (aged 15 and older) in 2020 with a higher income [tend to] spend more time on leisure activities than U.S adults in 2020 with a lower income.
- There are gender differences in the time spent doing certain activities, e.g., paid work, non-paid work, caring for elderly parents; for U.S. adults aged 15 and older.
- U.S. adults (aged 15 and older) with a higher income [tend to] have more children than U.S adults with a lower income.

Students should be encouraged to pose their own statistical investigative questions and brainstorm as a class.

Consider data (~10 - 15 minutes)

To answer newly posed investigative questions students will need to define the somewhat vague notions of "leisure" using the data available, and will see ways in which reasonable analysis might produce slightly different results.

The ability for students to apply "data moves" to tackle these investigative questions depends to a great extent on the availability of technology. The use of technology is essential to data science, but might pose challenges in the classroom, raising issues of equity, technical expertise, and more. While the use of technology is imperative for data science, understanding the possibilities granted by using data moves to curate and manipulate data can help students see the possibilities of different statistical investigations that can be undertaken with the same dataset.

If technology access is available, students should be encouraged to load their data into the technology (e.g. CODAP) and manipulate the data. Using technology, students can understand the number of observations present in the data, the number of variables, the types of variables, etc. As stated above, this process of getting to know your data is an important part of data science that has historically not been a focus in the classroom.

Analyze the data (~15 minutes)

Using the curated random sample from the ATUS, we can make data visualizations to answer the investigative questions posed. For example, we can focus on the question posed above on whether there are gender differences in the time spent doing certain activities. Specifically, we can focus on non-paid work. Students can explore different definitions of non-paid work. For example, they can define a "non-paid work" variable as the sum of hours spent doing:

tidying indoors, laundry, sewing, storing items, food prep, food presentation, food clean up, interior maintenance, cleaning exterior, repair exterior, yardwork, and pet exercise

Or, students might define unpaid work to include childcare, or include in-home unpaid work (namely, tidying indoors, laundry, sewing, storing items, food prep, food presentation, food clean up, interior maintenance) and childcare.

The ATUS sample data can be used to explore the relationship between gender and the time spent on unpaid work. Students can create visualizations in CODAP to examine how these different definitions of unpaid work are related to gender for the different age categories. We uploaded the data already in CODAP and it can be found here:

<https://codap.concord.org/app/static/dg/en/cert/index.html#shared=https%3A%2F%2Fcfm-shared.concord.org%2FDm4kMJEYLrfFwHDq3rvj%2Ffile.json>

Using the definition of unpaid work as that encompassing childcare and inside housework, we can create the following visualizations to help shed light on potential gender differences.

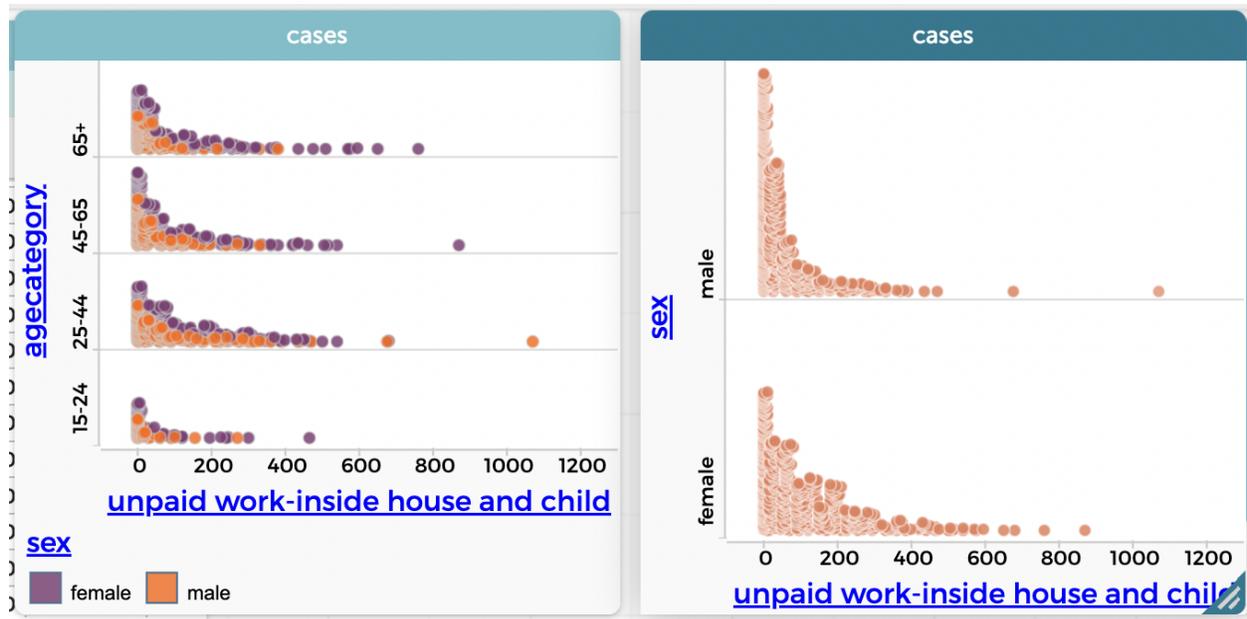


Figure 9. Distribution of time spent on unpaid work by sex and by sex and age. Graphs created in CODAP using atus201920sample data.

Interpret the results (~10 - 15 minutes)

Figure 9 shows that people of all age categories appear to have similar shaped distributions of amount of unpaid work inside the house and with childcare. However, while the general right skewed shape of the distributions are similar, the average amount of time spent on unpaid work seems to increase with age. The tails of the distributions for the older appear longer. There also appears to be a gender effect. Across all age brackets, it appears that females are more prominent at the higher amount of unpaid work. On the graph comparing just males and females unpaid

work, this pattern can be seen with females having a distribution with a longer tail and larger mean. Overall, a gender and age effect can both be seen in through the data.

References

Arnold, P., & Franklin, C. (2021). What Makes a Good Statistical Question?. *Journal of Statistics and Data Science Education*, 1-11.

Bargagliotti, A., Franklin, C., Arnold, P., Gould, R., Johnson, S., Perez, L., & Spangler, D. (2020). *Pre-K-12 Guidelines for Assessment and Instruction in Statistics Education (GAISE) report II*. American Statistical Association and National Council of Teachers of Mathematics. <https://www.amstat.org/asa/education/Guidelines-for-Assessment-and-Instruction-in-Statistics-Education-Reports.aspx>

Bureau of Labor Statistics. (2021). American Time Use Survey User's Guide.

CODAP – Common Online Data Analysis Platform <https://codap.concord.org/>

WGOITG - What's going on in this graph
<https://www.nytimes.com/column/whats-going-on-in-this-graph>

Attached Materials

- Blank data cards
- Time use diary recording sheet

Blank data cards

Variable	Outcome
Subject ID	
Age group	
Year	
Time exercising	
Time texting etc	
Time grooming	

Variable	Outcome
Subject ID	
Age group	
Year	
Time exercising	
Time texting etc	
Time grooming	

Variable	Outcome
Subject ID	
Age group	
Year	
Time exercising	
Time texting etc	
Time grooming	

Variable	Outcome
Subject ID	
Age group	
Year	
Time exercising	
Time texting etc	
Time grooming	

Variable	Outcome
Subject ID	
Age group	
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Time exercising	
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Time grooming	

Variable	Outcome
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Time grooming	

