International Society of the Learning Sciences

# Changes in the Media Landscape in the Wake of COVID-19 as a Catalyst for Data Literacy Development thru Life Routines

Iris Tabak, Ben-Gurion University of the Negev, itabak@bgu.ac.il
Ilana Dubovi, Tel-Aviv University, ilanadubovi@tauex.tau.ac.il

**Abstract:** Do life circumstances introduce opportunities to learn? COVID-19 created a public need for information on the epidemiological developments of this pandemic, resulting in an upsurge in graphical representations in the media. Using a survey, we examine whether, in the wake of COVID-19, people make greater use of data representations, and whether this relates to their confidence in interpreting these representations. We also evaluate their graph interpretation skills. To understand the role of rudimentary education in this process, we report on participants with 12 or less years of education. We found that people mostly increased their use of graphs, and that this explains an increase in their confidence to interpret graphs. People with stronger skills had a higher increase in graph use. People with weaker skills, also increased, rather than avoided, graph use. Life experiences can prompt change and growth, and the media landscape can play a role in this process.

## Introduction

Visual representations of data are prevalent in many facets of everyday life (Wise, 2020): in news media (Allen, 2018; Bao, Cao, Xiong, & Tang, 2020), in lifestyle tracking apps (Byrne, O'Grady, Collier, & O'Hare, 2020), in personal health records (Sharit et al., 2014), and others, making proficiency in interpreting such representations key to civic participation. In fact, data literacy is defined as "the desire and ability to constructively engage in society through and about data" (Bhargava et al., 2015). Consequently, there is increasing interest in the learning sciences in understanding the nature of data literacy and how to cultivate data literacy (Wilkerson & Polman, 2020). One of the hallmarks of research in the learning sciences is drawing on research of everyday reasoning and learning in order to reconceptualize formal education (Hoadley, 2018; Kolodner, 2004) so that it creates usable knowledge, and better equips learners to participate more centrally in various contexts of practice (Lave & Wenger, 1991). We follow this tradition by examining how people reason with data representations in the wake of COVID-19.

The COVID-19 pandemic brought income instability and emotional burden, which as recent reports state, also fueled public interest in COVID-19 data (Bowe, Simmons, & Mattern, 2020). Within a few weeks into the year 2020, COVID-19 became a trending topic worldwide. Production and consumption of COVID-19 data was so high and widespread that the term 'infodemic' (Cuan-Baltazar, Muñoz-Perez, Robledo-Vega, Pérez-Zepeda, & Soto-Vega, 2020) was coined to mark and highlight this striking phenomenon. The high public consumption of COVID-19 data in terms of visualizations, open data repositories, simulations and infographics motivates interest in understanding how the public interpret and effectively use the data (Alberda, Alamalhodaei, & Feigenbaum, 2020).

International standardized tests among both children and adults, public surveys, and educational research reports suggest that data literacy and graph interpretation pose a challenge (Assessment, 2013; Bragdon, Pandiscio, & Speer, 2019; Gonzalez, 2018; Highlights of the U.S. PIAAC Results, 2017; Pérez-Echeverría, Postigo, & Marín, 2018). However, other lines of research highlight the discrepancy that can exist between formal school-like assessments and people's competence and performance in everyday contexts (Lave, 1984; Saxe, 2015; Suad Nasir, 2000). Overall, studies of everyday contexts demonstrate that people are more productive in everyday contexts than what might have been predicted based on formal school-like assessments. COVID-19 has created unique circumstances in which we can gain insights into the ways in which diverse people make use of and interpret graphs.

In this paper, we report on a subset of data from a larger study. The larger study examined a cross-sectional national representative sample of people's information behavior prior to and during COVID-19, and examined how people interpret COVID-related graphs. In the present paper, we focus only on the sub-sample who have up to 12 years of formal schooling. Our goal is to use this sub-sample to better understand the role that rudimentary (K-12) education plays in people's use of data literacy in everyday contexts, and in their trajectories of data literacy development.

## Background: Graph interpretation skills

 

Data literacy builds on the literacies of: numerical literacy; information literacy (including critical thinking about sources); scientific literacy; statistical literacy; computational literacy; and digital literacy. (Bhargava, 2019). In this paper, we focus more specifically on graph comprehension.

Despite the increasing importance of graph interpretation skills, many adults have low graph literacy (Galesic & Garcia-Retamero, 2010; Herrmann, Brumby, & Oreszczyn, 2016). Though people vary in their ability to interpret graphs based on the type of graphical representation, with bar graphs yielding higher performance (Dowding et al., 2017). Full competence in reading graphs is not achieved even by college and university graduates (Nayak et al., 2016; Roth, Bowen, & McGinn, 1999). Facets that are involved in graph comprehension are: understanding representational conventions and understanding the content and context related to the data that is represented (Maltese, Harsh, & Svetina, 2015). One way in which stronger skills are distinguished from weaker skills is in the ability to focus on those aspects of a graph that are most pertinent to the questions that people want to answer by interpreting the graph (Okan, Galesic, & Garcia-Retamero, 2016).

## Methods

### Participants

500 participants were recruited through a stratified random sample from a panel (N=500). Stratification categories were gender, age, religious status (e.g., ultra-orthodox, secular), and geographic region (e.g., northern Israel, greater Tel Aviv area, etc…). Category sample quotas were established to represent the population demographics of Israel. In this paper, we focus on a sub-sample of N=170 participants who reported that they have up to 12 years of formal education.

### Instrument

We developed a 21-question survey to elicit self-reports of information behavior, COVID19 attitudes and behaviors, trust in science, as well as questions assessing graph interpretation skills.

The survey included 1 question collecting demographic information; 4 questions about information behavior addressing: what information sources (e.g., WHO, FaceBook) do participants employ and with what frequency – before and during COVID19, and how reliable they consider the sources; what data representations (e.g., graph, table) they encounter, how frequently, and how confident they are in interpreting the various data representations; 1 question asked about the frequency with which participants employ COVID19 health-protective behaviors (e.g., distancing, wearing a mask) (adapted from: Plohl & Musil, 2020); 14 questions presented different types of graphs with related multiple choice questions that required direct lookup of information in the graph (e.g., which age group in a bar-graph is the age group that does not show symptoms), as well as inferencing (e.g., the table shows the smallest number of infected individuals in the 90 and older age group, yet they are considered a high risk group, how can that be explained based on the data in the table?). This set of questions also included some open-ended questions that required participants to apply the information in the graph to decisions such as whether they would pursue international travel or whether schools should re-open. All but one of the 14 graph interpretation questions were set in the context of COVID19 and were similar to graphs that have appeared in news reports on COVID19. The one graph interpretation question that was not set in a COVID19 context was a question that appeared in the PEW Research Center survey (Kennedy & Hefferon, 2019) and was included in this survey as a way to compare responses in this pool of adult Israeli participants with the Pew's pool of adults in the United States. The last question in the survey was a Likert scale assessing trust in science and scientists (adapted from: Nadelson et al., 2014), and COVID19 risk perceptions (adapted from: Plohl & Musil, 2020).

Face validity was established by having four scholars review the survey. The scholars are experts in public health, mathematics education, and visual representations in cognition and learning with extensive experience in developing and validating research instruments. The survey was refined based on their comments. The survey was further refined by having four volunteers with different levels and fields of education complete the survey.

### Procedure

After receiving IRB approval, the survey was distributed online in a cross-sectional study. The survey was implemented in Qualtrics (version September, 2020, Qualtrics, Provo, UT). The survey was distributed through iPanel (https://www.ipanel.co.il/en/), one of the largest polling services in Israel, which adheres to the high-quality research code of the European Society for Opinion and Marketing Research (ESOMAR; Bodas & Peleg, 2020). The survey was distributed during September 2020, during the second wave of COVID19 outbreak in Israel, and at the beginning of a second nation-wide lockdown.

In the present paper, we analyzed data only from those participants who reported that they had up to 12 years of formal education (N=170). We computed descriptive statistics (means, standard deviations, frequencies and percentages) to describe participants tendency to use COVID-19 related data and information sources, as well as their degree of frequency and confidence in using different modes of representation. We used t-tests to examine whether there were significant changes in frequency and confidence prior and during COVID-19. To understand the impact of the participants' characteristics, graphs interpretation skills, frequency of graph use on the confidence of using graph representations following COVID-19 outbreak, we conducted hierarchical regression analysis. Preliminary analyses were conducted to ensure that there were no violations of the assumptions of normality, linearity, and homoscedasticity. In addition, interaction effects between high and low graph interpretation skills were evaluated using repeated measures analysis of variance (ANOVAs). Data was analyzed using SPSS (version 25, IBM Corporation, Armonk, NY).

## Findings

Descriptive statistics (Table 1) show that this sub-set of participants were fairly evenly distributed between male and female participants, with about half the participants under 30 years of age, and predominantly of average and below average income.

TABLE 1: Socio-demographic characteristics

| ***Variables*** | ***Participants (n=170)*** |
|---|---|
| | **M(SD)** |
| *Education (years)* | 11.7 ± 1.2 |
| | **N (%)** |
| *Age (years)* | |
| *18-22 years* | 45 (26%) |
| *23-29 years* | 40 (24%) |
| *30-39 years* | 24 (14%) |
| *40-49 years* | 17 (10) |
| *50-70 years* | 45 (26%) |
| *Gender* | |
| *Female* | 82 (48%) |
| *Male* | 89 (52%) |
| *Income level* | |
| *Above average* | 20 (12%) |
| *Average* | 45 (26%) |
| *Less than average* | 106 (62%) |

### Increase in consulting information sources during COVID-19

Participants' primary sources for COVID-19 information were media and television news, Google search engine, friends and family, WhatsApp messenger and Facebook. Surprisingly, health organization websites such as the WHO and twitter were listed as the venues least used for COVID-19 information. Correspondingly, participants rated the most frequently used sites as more reliable and the least frequently used sites as least reliable. There was a significant increase from before to during COVID-19 in the frequency of use of all information sources (Table 2), with the largest shift in greater use of health organization sites such as the WHO or the Ministry of Health site.

TABLE 2: Information Sources before and during COVID-19 pandemic

| | Before COVID-19 | During COVID-19 | t-test | | Before COVID-19 | During COVID-19 | t-test |
|---|---|---|---|---|---|---|---|
| Media News and TV | 3.9 ± 1.8 | 4.6 ± 1.7 | -6.818*** | Physician | 2.8 ± 1.2 | 3.2 ± 1.4 | -4.827*** |
| Google search engine | 3.7 ± 1.6 | 4.5 ± 1.4 | -7.507*** | Workplace | 2.7 ± 1.7 | 3.3 ± 1.9 | -5.898*** |

 

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Friends and family | 3.6 ± 1.6 | 4.2 ± 1.6 | -6.472*** | Religious leaders | 1.9 ± 1.3 | 2.5 ± 1.7 | -6.082*** |
| WhatsApp messenger | 3.3 ± 2.2 | 3.7 ± 2.1 | -3.837*** | Health Ministry website or HMO | 2.5 ± 1.2 | 3.4 ± 1.5 | -8.996*** |
| Facebook | 3.3 ± 2.0 | 3.6 ± 2.0 | -3.870*** | Scientific and medical journals | 2.1 ± 1.4 | 2.5 ± 1.6 | -4.496*** |
| YouTube | 3.1 ± 1.9 | 3.3 ± 1.9 | -2.132*** | Health related websites (e.g., Infomed, WHO) | 1.7 ± 1.2 | 2.3 ± 1.5 | -6.293*** |
| Newspaper | 2.9 ± 1.7 | 3.5 ± 1.8 | -6.167*** | | | | |
| Wikipedia | 2.9 ± 1.5 | 3.2 ± 1.6 | -3.998*** | Twitter | 1.6 ± 1.3 | 1.8 ± 1.5 | -2.580*** |

Data are presented in percentage mean ± SD; *** $p < .001$

## Increase in reading graphs and in confidence to interpret graphs

We asked participants how often they used different modes of data representation such as tables, simulations, text and graphs, before and during COVID-19, in addition for each mode of representation we asked them to rank their confidence in interpreting the information in that mode. There was an increase in the frequency of use in all modes of representation, and a significant increase in interpretation confidence in all but text and lectures. Graphs showed the highest change before and during COVID-19 in both frequency and confidence (Figure 1).

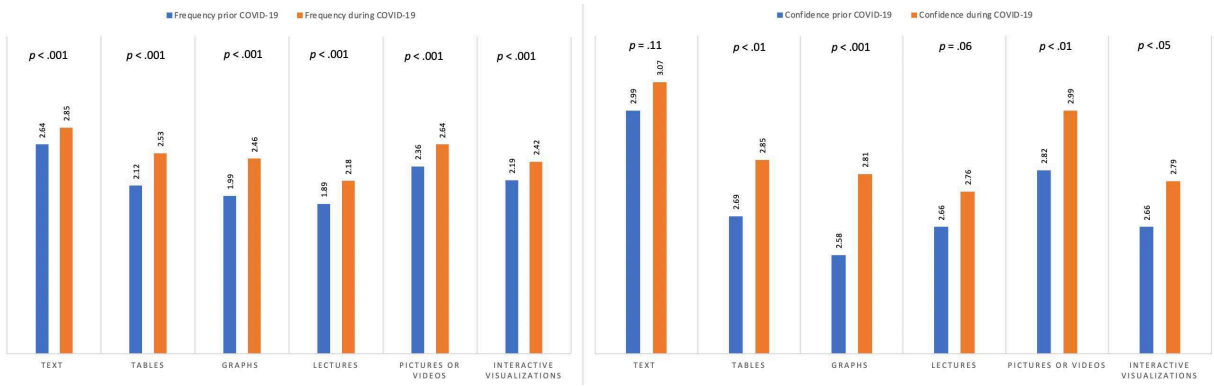


Figure 1. Changes following COVID-19 in frequency and confidence in use of modes of data representation

## Graph interpretation skill and its correlates

Graph interpretation questions that involved looking up information in the graph were answered correctly on average by at least half of the respondents. These graphs included both bar graphs and line graphs. One question showed two version of a graph, where the second version includes two additional data points, which have a much higher value than all of the data points in the previous graph. Participants were asked what would happen to the average when these two data points were added to the measurements. 61% of the respondents correctly answered that the average would increase (61±49), demonstrating an understanding of the relationship between individual data points, and represented aggregate information such as average. The most challenging questions for participants, where less than 50% responded correctly, were questions relating to rates of change (36±48), and to changes in numerator or denominator (39±49).

To further understand the impact of participants' characteristics, their graph interpretation skill, frequency of using graphs, on the levels of confidence in using graphs as a result of COVID-19, a hierarchical multiple regression analysis was performed (Table 3). In model 1, contribution of sociodemographic characteristics, only age variable had a significant contribution to the explanation of participants' confidence levels, $F_{(3,\ 162)} = 3.02$, $p < 0.05$, explaining 5% in variance in confidence levels. Incorporation of graphs interpretation skill in and frequency in graph use in model 2 significantly explained additional 37% of the variance in confidence levels, and the entire model 3 explained 42% of the variance in confidence, $F_{(2,\ 160)} = 51.43$, $p < 0.001$.

TABLE 3: Summary of hierarchical regression analysis for variables predicting confidence in using graph representations following COVID-19 outbreak ($N$ = 170)

| Variable | Model 1 | Model 2 |
|---|---|---|
| | *β* | *β* |
| Age | -.19* | -.03 |
| Gender (male) | -.05 | .01 |
| Family income level (above average/below average) | .01 | .00 |
| Graph interpretation skill | | .32*** |
| Frequency in Graph use following COVID-19 outbreak | | .48*** |
| $R^2$ | 0.05 | 0.42 |
| $F$ for change in $R^2$ | 3.01* | 51.43*** |
| $\Delta R^2$ | 0.05 | 0.37 |

*$p$ < .05; ***$p$ < .001.

In order to better understand the role of graph interpretation skills in the use of graphs during COVID-19, we split the sample based on their total score on the graph interpretation questions, using the median as the splitting point. We conducted a repeated measures ANOVA with time as the within subjects factor using the measures of frequency of graph and of confidence in the ability to interpret graphs, graph skill was the between subjects factor. There were significant differences within each group in both measures across time, and there were significant differences between groups at both time points (Figure 2). There was a significant interaction between time and skill level for frequency $F(1,168)=4.141$, p <.05, but not for confidence ($F(1,168)=0.25$, p=.62). There was a significant difference in the rate of change (slope) between the lower graph skill group (0.34) and the high skill group (0.6), $t(84)=2.2$ p=.029.

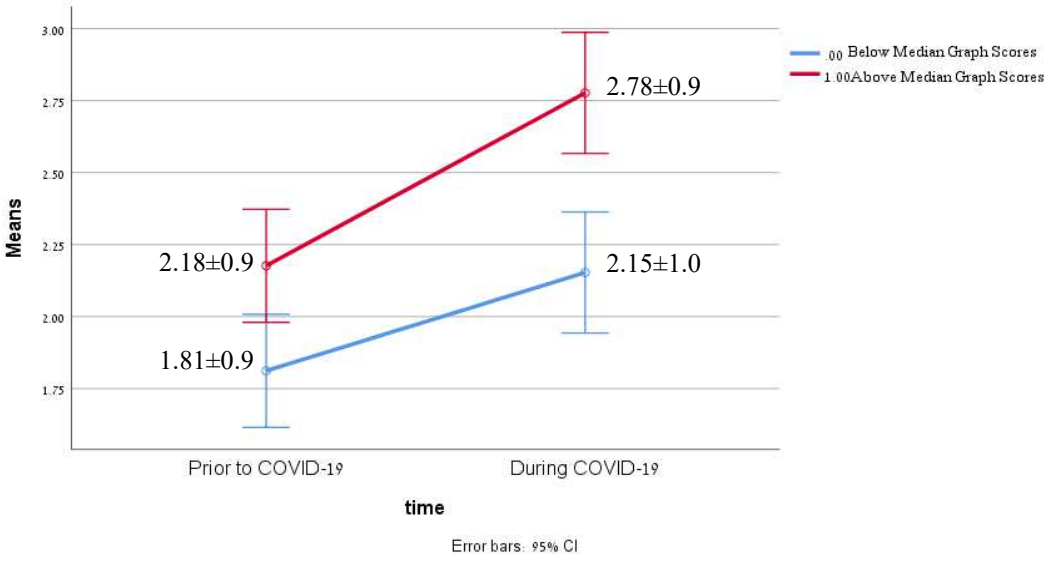


Figure 2. Rate of Change of Frequency of Viewing Graphs Prior to and During COVID-19

## Discussion

Our goal in this paper is to connect to research in the learning sciences that considers productive activity in real-world contexts as the prism through which we should understand learning and design in education. Research from

 

this tradition has exposed that performance on highly formalized, decontextualized and abstract assessments can obscure how well people might perform, in context, in response to real-world demands (Lave, 1984; Saxe, 2015; Suad Nasir, 2000). In the present study, we capitalized on the unique circumstances of the COVID-19 pandemic to gain insight into the ways in which the public might interpret and use data representations in a period in which such representations are prevalent in the media, and in which attending to this information carries strong purchase for the course of people's lives. In this paper, we also focus on participants who have up to 12 years of education as a way of reflecting the role of rudimentary education in preparing people for civic participation.

We found that information behavior changed in the wake of COVID-19, and that our participants reported the greatest change in their consumption or use of graphs over other modes of representation. In this discussion, we do not focus on assessing participants' ability to interpret COVID-19-related graphs per se. Instead, we examine what this study teaches us about how information behavior, skills and beliefs interact and influence how we might realize the opportunities to learn that everyday life experiences offer. Our survey includes graph interpretation questions, and our findings reflect prior research (e.g., Galesic & Garcia-Retamero, 2010; Herrmann et al., 2016): at least 50% of the 170 participants were able to correctly respond to most questions. As noted, we will discuss how this knowledge is related to other factors, and how this might affect propensity for change.

As might be expected, proficiency was correlated with confidence in one's ability to interpret graphs. Participants along the full range of proficiency and confidence levels reported statistically significant increases in graph consumption during the pandemic, and in confidence in their ability to interpret graphs. For those with lower confidence in their ability, this is a somewhat surprising result, because people who doubt themselves might tend to avoid graphs. Given the relationship that we found between consuming graphs and feeling confident about interpreting graphs, the fact that even low-confidence participants increased their graph consumption during the pandemic, carries important implications for propensity for change.

Our findings suggest that changes in graph consumption explain confidence, so that increased use of graphs is associated with higher levels of confidence. This finding can advance our understanding of reasoning and change in everyday contexts. Conceivably, experience and practice should lead to increased confidence in one's ability. This is more likely if these experiences are successful. However, in routine life experiences, rather than intentional learning environments, people may not be able to discern whether they were successful, because they may not receive feedback on their performance. In the present context of COVID-19, the media landscape includes a higher number of data representations that are key to understanding and navigating life during the pandemic, and there is increased use or consumption of these graphs, but people do not receive any clear indication as to how well they are interpreting these graphs. Despite this ambiguity, our findings suggest that increased use of graphs led to increased confidence.

However, the process and relationship between use and confidence is complex. When we consider differences between higher and lower performers on the graph interpretation questions, within our sample of individuals with up to 12 years of education, we find that there are significant differences between these groups in terms of graph use and confidence, before and during COVID-19. Moreover, in terms of graph use, the changes during COVID-19 are higher for the higher performing group, but there are no significant differences in the rate of change in confidence between the two groups. We see that prior proficiency with graph interpretation leads to greater changes in using graphs when life circumstances call for consuming this type of information, creating an advantage for those with prior higher proficiency. However, confidence in graph interpretation operates differently, and follows similar patterns of change regardless of prior proficiency. These similarities in rates of change in confidence might be a function of the general lack of feedback on success in everyday contexts, as discussed above.

We would also like to consider some of the limitations of our study and analysis. First, while our goal is to understand how people reason within the media landscape of everyday life, we did not observe people in situ. In order to mitigate this issue, we designed our graph analyses questions to reflect the types of representations that have appeared in the media, and raised questions that reflected some of the public discourse during the COVID-19 pandemic. Another concern might be that people may have reported higher ratings for the COVID-19 period than for the preceding period out of social desirability considerations, sensing that this is the pattern of responses for which the study aims. However, if responses were biased in this way, we would expect this same pattern of bias across all responses, but we found different patterns for different modes of representation, including a decrease in consumption of tables. Similarly, ratings may have been higher for graphs over other modes of representation, given that the survey included graph-interpretation questions. However, the graph interpretation questions appeared only after a sequence of Likert-scale questions concerning information behavior, which we believe reduces the risk of such bias. Finally, we did not have a way to obtain a measure of participants' graph interpretation skills prior to the COVID-19 outbreak, and therefore, cannot ascertain whether people improved

their graph interpretation skills. Uncovering how patterns of everyday media use affect learning is an important goal for future research.

## Conclusion

The main implications of our research are: (1) that lower graph interpretation ability does not necessarily imply low or no consumption of graphs as part of information behavior; and (2) that people can undergo change and growth as part of life experiences and as a function of the media landscape. However, existing knowledge and skills can affect propensity for change, and therefore we cannot simply rely on people's ability to learn what they need to learn as needs arise over the course of the life span. This study motivates future research into how we can understand and design informal learning in the community.

## References


Alberda, A., Alamalhodaei, A., & Feigenbaum, A. (2020). COVID-19 Data Literacy is for Everyone. . Retrieved from Retrieved November 3, 2020, from Nightingale: The Journal of the Data Visualization Society website: https://medium.com/nightingale/covid-19-data-literacy-is-for-everyone-46120b58cec9

Allen, W. L. (2018). Visual brokerage: Communicating data and research through visualisation. *Public Understanding of Science, 27*(8), 906-922. doi:10.1177/0963662518756853

Assessment, T. (2013). International Association for the Evaluation of Educational Achievement (IEA). In.

Bao, H., Cao, B., Xiong, Y., & Tang, W. (2020). Digital Media's Role in the COVID-19 Pandemic. *JMIR mHealth uHealth, 8*(9), e20156. doi:10.2196/20156

Bhargava, R. (2019). Data Literacy. In R. Hobbs & P. Mihailidis (Eds.), *The International Encyclopedia of Media Literacy* (pp. 1-5). Hoboken, NJ: Wiley.

Bhargava, R., Deahl, E., Letouzé, E., Noonan, A., Sangokoya, D., & Shoup, N. (2015). *Beyond data literacy: reinventing community engagement and empowerment in the age of data*. Retrieved from Cambridge, MA:

Bodas, M., & Peleg, K. (2020). Self-Isolation Compliance In The COVID-19 Era Influenced By Compensation: Findings From A Recent Survey In Israel. *Health Affairs, 39*(6), 936-941. doi:10.1377/hlthaff.2020.00382

Bowe, E., Simmons, E., & Mattern, S. (2020). Learning from lines: Critical COVID data visualizations and the quarantine quotidian. Big Data & Society, 7(2), 2053951720939236. doi:10.1177/2053951720939236

Bragdon, D., Pandiscio, E., & Speer, N. (2019). University students' graph interpretation and comprehension abilities. *Investigations in Mathematics Learning, 11*(4), 275-290. doi:10.1080/19477503.2018.1480862

Byrne, C. A., O'Grady, M., Collier, R., & O'Hare, G. M. (2020). An Evaluation of Graphical Formats for the Summary of Activities of Daily Living (ADLs). *Healthcare, 8*(3), 194.

Cuan-Baltazar, J. Y., Muñoz-Perez, M. J., Robledo-Vega, C., Pérez-Zepeda, M. F., & Soto-Vega, E. (2020). Misinformation of COVID-19 on the Internet: Infodemiology Study. *JMIR Public Health Surveill, 6*(2), e18444. doi:10.2196/18444

Dowding, D., Merrill, J. A., Onorato, N., Barrón, Y., Rosati, R. J., & Russell, D. (2017). The impact of home care nurses' numeracy and graph literacy on comprehension of visual display information: implications for dashboard design. *Journal of the American Medical Informatics Association, 25*(2), 175-182. doi:10.1093/jamia/ocx042

Galesic, M., & Garcia-Retamero, R. (2010). Graph Literacy: A Cross-Cultural Comparison. *Medical Decision Making, 31*(3), 444-457. doi:10.1177/0272989X10373805

Gonzalez, L. S. (2018). *Aspects of a Literacy of Infographics: Results from an Empirical-Qualitative Study.* UC Santa Barbara,

Herrmann, M. R., Brumby, D. P., & Oreszczyn, T. (2016). *How much electricity do you use at home? An investigation into householders' literacy for comprehending domestic electricity data.* Paper presented at the Behave 2016: 4th European Conference on Behaviour and Energy Efficiency.

Highlights of the U.S. PIAAC Results. (2017). *Web Report (NCES 2020-777).* Retrieved from U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics: https://nces.ed.gov/surveys/piaac/current_results.asp.

Hoadley, C. (2018). A short history of the learning sciences. In *International Handbook of the Learning Sciences* (pp. 11-23).

Kennedy, B., & Hefferon, M. (2019). What Americans Know about Science: Science Knowledge Levels Remain Strongly Tied to Education; Republicans and Democrats Are about Equally Knowledgeable. *Pew Research Center*.

Kolodner, J. L. (2004). The learning sciences: Past, present, future. *Educational Technology, 44*(3), 34-40.
Lave, J. (1984). The values of quantification*. *The Sociological Review, 32*, 88-111. doi:10.1111/j.1467-954X.1984.tb00108.x
Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York, NY: Cambridge University Press.
Maltese, A. V., Harsh, J. A., & Svetina, D. (2015). Data Visualization Literacy: Investigating Data Interpretation Along the Novice-Expert Continuum. *Journal of College Science Teaching, 45*(1), 84-90. Retrieved from www.jstor.org/stable/43631889
Nadelson, L., Jorcyk, C., Yang, D., Jarratt Smith, M., Matson, S., Cornell, K., & Husting, V. (2014). I Just Don't Trust Them: The Development and Validation of an Assessment Instrument to Measure Trust in Science and Scientists. *School Science and Mathematics, 114*(2), 76-86. doi:10.1111/ssm.12051
Nayak, J. G., Hartzler, A. L., Macleod, L. C., Izard, J. P., Dalkin, B. M., & Gore, J. L. (2016). Relevance of graph literacy in the development of patient-centered communication tools. *Patient Education and Counseling, 99*(3), 448-454. doi:https://doi.org/10.1016/j.pec.2015.09.009
Okan, Y., Galesic, M., & Garcia-Retamero, R. (2016). How People with Low and High Graph Literacy Process Health Graphs: Evidence from Eye-tracking. *Journal of Behavioral Decision Making, 29*(2-3), 271-294. doi:10.1002/bdm.1891
Pérez-Echeverría, M. d. P., Postigo, Y., & Marín, C. (2018). Understanding of graphs in social science undergraduate students: selection and interpretation of graphs. *Irish Educational Studies, 37*(1), 89-111. doi:10.1080/03323315.2018.1440248
Plohl, N., & Musil, B. (2020). Modeling compliance with COVID-19 prevention guidelines: the critical role of trust in science. *Psychology, Health & Medicine*, 1-12. doi:10.1080/13548506.2020.1772988
Roth, W. M., Bowen, G. M., & McGinn, M. K. (1999). Differences in graph-related practices between high school biology textbooks and scientific ecology journals. *Journal of Research in Science Teaching, 36*(9), 977-1019. Retrieved from <Go to ISI>://000083281500003
Saxe, G. B. (2015). Studying culture-cognition relations in collective practices of daily life: a research framework / El estudio de las relaciones cultura-cognición en las prácticas colectivas cotidianas: un modelo de investigación. *Journal for the Study of Education and Development, 38*(3), 473-508. doi:10.1080/02103702.2015.1054669
Sharit, J., Lisigurski, M., Andrade, A. D., Karanam, C., Nazi, K. M., Lewis, J. R., & Ruiz, J. G. (2014). The roles of health literacy, numeracy, and graph literacy on the usability of the VA's personal health record by veterans. *J. Usability Studies, 9*(4), 173–193.
Suad Nasir, N. i. (2000). 'Points ain't everything': Emergent goals and average and precent understandings in the play of basketball among African American students. *Anthropology and Education Quarterly, 31*(3), 283-305.
Wilkerson, M. H., & Polman, J. L. (2020). Situating Data Science: Exploring How Relationships to Data Shape Learning. *Journal of the Learning Sciences, 29*(1), 1-10. doi:10.1080/10508406.2019.1705664
Wise, A. F. (2020). Educating Data Scientists and Data Literate Citizens for a New Generation of Data. *Journal of the Learning Sciences, 29*(1), 165-181. doi:10.1080/10508406.2019.1705678

## Acknowledgments

Funding provided, in part, from a research support grant from the Department of Education at Ben-Gurion University of the Negev to Iris Tabak, and by the Department of Nursing at the Tel-Aviv University to Ilana Dubovi. Panel recruitment provided by iPanel (ipanel.co.il). All data and conclusions in the paper are of the authors' only, and do not represent or carry the interests of the supporting agencies.