Western Carolina University

A student-focused checklist for creating infographics

By: **Scottie Kapel** and **Krista D. Schmidt**

Abstract

Purpose - This paper discusses efforts to produce instructional support objects for undergraduate students engaged in creating infographics, an alternative assignment growing in popularity at the authors' university.

Design/methodology/approach - The authors examined scholarly, professional, trade and open-web sources to identify best practices for design and data visualization for this type of assignment. They categorized their findings and used a preponderance-of-evidence method for final selection of relevant practices. The authors detail the creation of their support products (instructional checklists and example infographics) and offer recommendations for librarians engaged in similar efforts.

Findings - Despite the growing popularity of alternative assignments, guidance for best practices in data and design as they relate to student-created infographics is nascent, and best practices for design and data visualization in this context have yet to be concretely identified. Without extant guidance for student-created infographics, the authors developed a checklist of potential best practices for design and data visualization.

Practical implications - The use of alternative projects assigned in lieu of traditional research papers is growing. Additional guidance may be required for students creating non-traditional works as standards and best practices for these projects are under-developed in the academic setting. Librarians will want to consider their role in supporting students assigned to create an alternative project.

Originality/value – A consideration of best practices for data and design visualization for students designing research infographics has not yet been written.

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Paper Type: Research Paper

Introduction

Academic teaching and research librarians in the United States are well versed in the traditional research assignment that most students must complete during their undergraduate career. The students select or have a topic assigned to them, research the topic, and write a paper on that topic–adhering to guidelines pertaining to the number of sources, page length, and citation style. Or perhaps the students are required to work in a group and give an in-class presentation where similar requirements are outlined. In the past decade, however, more professors and their students have explored alternative ways to present research

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findings. At Western Carolina University, for example, we have observed poster presentations gaining ground in recent years, not just for capstone or upper-level research classes, but for introductory courses too. Instructor interest has also increased in students exploring other graphical ways to present information, especially quantitative and qualitative data, as part of a class's scholarly output.

Like more traditional projects, alternative projects may come with topic guidelines, a list of expectations, and a grading rubric, such as described in Anderson *et al.* (2019). However, alternative projects might include new or unfamiliar elements or tools like graphic design software or data visualization platforms. Instructors may fail to provide guidance regarding the mechanics of using new tools or integrating unfamiliar elements. Researchers note that not all students feel comfortable with or have experience with these technologies (Jones *et al.*, 2019). Our concern is that a lack of guidance may create barriers for students who may recognize the type of item they are asked to produce but lack experience in creating these items. There are also issues of timeliness to be considered. As Anderson *et al.* (2019, p. 45) noted, "A small portion of the students underestimated the time and labor involved in locating data and designing the infographic as well as their own skills in interpreting and communicating through visual means."

The work described in this paper began after a summer teaching institute where several faculty members indicated an intent to incorporate a particular type of alternative assignment—an infographic—into their upcoming courses. During those discussions, we identified several stumbling blocks students might encounter—outside of the usual issues with finding and using information resources. These impediments include using graphics to tell a story (in this case, the majority of the student's research on the topic), identifying data to use, determining how to present the chosen data, and overcoming previous exposure to many examples of misleading or ineffective infographics. To support students tasked with creating an infographic, we developed structured checklists (one for information/data considerations and one for design/visual considerations) and visual examples that provide rudimentary guidance—key components to an infographic's success.

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We had planned to implement these checklists in the 2020-2021 academic year; however, COVID-19 disrupted those plans. Though we were not able to pilot the checklists as planned in 2020-2021, these checklists are part of a multi-session infographic pilot project in the 2021-2022 academic year. During the pilot project, we will work with an undergraduate-research-focused STEM learning community, and students will use the checklists both to evaluate existing infographics and build their own. We have planned several assessments, including pre- and post-workshop surveys and exercises to be completed during and after the workshops. For example, in a pre-workshop assessment, we will ask students to identify a specific infographic's design and data strengths and weaknesses, in their opinion, before we provide classroom instruction on the checklists. Post-workshop, we will ask students to perform a second assessment of infographics, this time using the checklists. We will also have the opportunity to do an ungraded review of the student-created infographics to evaluate the extent to which the students incorporated checklist concepts and identify any checklist content that we need to further refine or better clarify.

So why present this information now? We have chosen to present the checklists and the work associated with them now rather than wait for multiple assessments over several iterations as there is a pressing need for instructional support, including tools and best practices, that is designed specifically for academic research infographics, and rubrics do not meet this need. It is our intention to disseminate this information so other academic librarians working with students on creating an alternative research project—in this case, research-based infographics—have a starting structure to help guide the process. Therefore, this paper is intended to be a tool construction and presentation paper rather than a paper reporting results of a pilot or assessed project.

Institutional Context

Western Carolina University (WCU) is a medium-sized, regional comprehensive university. WCU sits on the ancestral homelands of the Cherokee people [I] and is the westernmost university in the University of North Carolina System. Total enrollment at WCU is approximately 12,000 students, and undergraduate

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students make up the large majority of our population at approximately 10,000 students (Western Carolina University Office of Institutional Planning and Effectiveness, 2021). WCU is committed to both community engagement and undergraduate research, and students have many opportunities to work with faculty on real-world projects and research.

WCU's Hunter Library serves the entire campus population as well as the local community. Both authors are members of Hunter Library's Research and Instruction Services (RIS) department and serve as the Scholarly Communications Librarian (Scottie) and the STEM liaison (Krista). RIS librarians support a vibrant information literacy program and are responsible for providing both disciplinary and general information literacy instruction. Additionally, many RIS librarians provide workshops on special topics such as copyright, genealogy, and research product design. Since 2016, we have worked with previous iterations of the learning community with whom we are piloting our infographic checklists. The STEM liaison has provided information literacy instruction, and the Scholarly Communication Librarian has provided research poster design workshops. The infographic pilot we are leading in the 2021-22 academic year will be the first time we have co-taught the learning community students.

Literature Review

Literature about infographics spans many disciplines including education, health, marketing and public relations, design, visual communications, and more. When we began planning our project, we knew our primary interests were rooted in infographic literature related to pedagogy as well as writings and research about design/visual communication. Thus, our foray into the scholarly and trade literature was rooted firmly in those areas rather than in related areas such as learning theory and instructional design that were not as relevant to our immediate needs.

Literature Related to Use of Infographics in the Classroom

Professional and scholarly literature regarding infographics in the classroom is nascent and situated within disciplines. With a pool that is relatively small and widely dispersed, we took a broad look at both

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the K-12 and higher education literature and gleaned current perspectives. In K-12 (primary and secondary education in the U.S.) and higher education literature, the focus is twofold: first, use of infographics as a way to enhance traditional learning; second, the pedagogical value and related factors of student-created infographic projects on student learning.

Literature Related to Use of Infographics in the Classroom: Use of Infographics to Enhance Learning

Literature analyzing infographics within the classroom focuses primarily on increasing knowledge, understanding, and retention via visual representations of a topic in both K-12 and higher education settings. Researchers discuss the efficacy of visual media like infographics as teaching tools (Bradshaw and Porter, 2017; Carter, 2015; Gallagher *et al.*, 2017; Yarbrough, 2019) and as a way to lower the barrier of entry for understanding concepts (Waskie-Laura and LeBlanc, 2015). Some researchers also perceive infographics as an avenue to increase student engagement with topics or complex concepts (Bradshaw and Porter, 2017; Gallagher *et al.*, 2017). Though engagement findings vary, researchers' overwhelming consensus is that use of images—including infographics—to convey concepts in the classroom has the capability to increase students' comprehension (Carter, 2015; Waskie-Laura and LeBlanc, 2015; Yarborough, 2019).

Literature Related to Use of Infographics in the Classroom: Pedagogical Value of Student-Created Infographics

The pedagogical literature related to student-created infographics has several useful themes and is more applicable to our project than the literature analyzing infographics as an instructional tool. Researchers writing about student-created infographics agree the activity provides excellent opportunities for engaging students' critical thinking skills. Analytical and decision-making skills are also engaged, and the projects provide opportunities for students to practice effective synthesis of concepts and information (Matrix and Jaigris, 2014; Ortiz and Redmon, 2020). Creating infographics offers another useful pathway for increasing students' visual literacy (Anderson *et al.*, 2019; Dyjur and Li, 2015; Kardgar *et al.*, 2017), a topic receiving increased attention within education. Finally, researchers note an extra opportunity

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afforded by student-created infographics: developing and refining digital media skills (Dyjur and Li, 2015; Jones *et al.*, 2019; Matrix and Jaigris, 2014). Employers increasingly place importance on a candidate's ability to use not only standard technologies such as word processing or spreadsheet programs, but also more specialized tools and technologies such as image editing software and graphic design platforms (Jones *et al.*, 2019). Researchers also acknowledge a wide array of skill levels regarding students' existing digital media skills (Jones *et al.*, 2019; Kos and Sims, 2014; Matrix and Jaigris, 2014; Waddell and Clariza, 2018). Anderson *et al.* (2019) emphasize that not all students come to the classroom with identical levels of skill or access to resources to build those skills and that instructors must plan accordingly.

Researchers indicated that incorporating peer-review and self-reflective writing are crucial elements for increasing the success and effectiveness of alternative projects such as infographics. Dyjur and Li (2015); Jones *et al.* (2019); and Matrix and Jaigris (2014) use or recommend incorporating peer-review before the final work is submitted for a grade. Most note this formative feedback helps students recognize and address weaknesses in their infographics, thus creating the potential for a more effective product. Jones *et al.* (2019); Matrix and Jaigris (2014); and Ortiz and Redmon (2020) also note that students benefit from conducting a self-reflection after the project is complete. This self-reflection can help solidify a student's understanding of the process and may, more importantly, help students identify what conceptual or technical skills they initially lacked but developed and refined during the process.

Literature Related to Design and Data Visualization Guidance

Literature regarding design and data visualization can be found in scholarly articles, monographs, and open web sources—the last of which are generally created by professionals in the design or data visualization field. This is a large body of literature and we found that the scope varies widely, with some scholarly works taking a conceptual view and others touching on design and data visualization concepts more obliquely. Open web sources appeared pragmatic, focusing less on theory and more on practical application of design and data visualization concepts.

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Literature Related to Design and Data Visualization Guidance: Scholarly Articles and Monographs

The scholarly literature for design and data visualization best practices for student-created infographics yielded little in the way of in-depth, practical guidelines. When these topics are addressed, they are found as a small facet of articles, are broadly presented, and have few to no specifics provided (for example, Anderson *et al.*, 2019; Lamb and Johnson, 2014). Articles include guidance such as, "It's important to remember that all charts and graphs should include a descriptive title, range of data, axis titles, and a legend" (Lamb and Johnson, 2014, p. 58). Others, including articles by Dyjur and Li (2015), Jones *et al.* (2019), and Matrix and Jaigris (2014), however, do not address best practices of infographic creation or assessment at all.

The literature indicated that researchers' approaches vary widely when developing students' understanding of data and design visualization concepts and introducing tools related to implementing these concepts. Researchers Waddell and Clariza (2018) indicate that they provide little to no in-class guidance on data and design visualization; they actively de-emphasize technology and design concepts in order to focus on the narrative and storytelling. Other researchers, such as Dyjur and Li (2015), Jones *et al.* (2019), and Ortiz and Redmon (2020), report providing guidance through objects such as grading rubrics and analyzing existing infographics in class, but not necessarily reviewing design and data visualization principles in depth. In contrast, Kos and Sims (2014) and Mendenhall and Summers (2015) choose to more thoroughly incorporate an introduction to design and data visualization concepts, tools, and technology. Several researchers indicate using multiple methods for seeking a successful approach. Anderson *et al.* (2019) and Kardgar *et al.* (2017) detail pilot projects wherein little in-class time is designated to cover design and data visualization concepts. Both studies detail student output as lacking in effectiveness, demonstrating weak execution, and resulting in overall lower grades. In subsequent courses, researchers scaffolded their approach and provided more in-class time to develop students' understanding, improve their design capabilities, and increase their grasp of data visualization concepts.

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Anderson *et al.* (2019) note improved grades with their new approach, while Kardgar *et al.* (2017) admit better student output requires even greater commitment of in-class time.

For more guidance on best practices, we scouted scholarly and professional literature regarding design and data visualization as standalone topics. However, it became apparent that this literature would not be a fruitful avenue for us to pursue. Most of the literature we encountered is either too vague or broad to be helpful or is at a level conceptually beyond the scope of this project—in other words, covering advanced topics more relevant to those with expertise in the field than to first- and second-year undergraduate students new to infographic creation (for example, Sankaran and Holmes, 2018). One notable exception comes from an Arts and Humanities Research Council grant-funded project exploring the communication of public health data through infographics (Stones and Gent, 2015). Stones and Gent (2015) present clear, evidence-based guidelines for creating effective infographics. Recommendations are organized using the acronym G.R.A.P.H.I.C.: Get to know your audience, Restrict color, Align elements, Prioritize parts, Highlight your heading, Invest in imagery (wisely), and Choose charts carefully (Stones and Gent, 2015, p. 1).

Monographic sources are similar in their drawbacks. Books about creating infographics or data visualizations were either: a) conceptual and discipline-specific, for example Meirelles's (2013) *Design for Information*; b) vague with most advice or recommendations, such as Beegel's (2014) *Infographics for Dummies* and Krum's (2013) *Cool Infographics*; or c) focused more firmly on the marketing aspects of creating infographics, like Lankow and colleagues' (2012) *Infographics: The Power of Visual Storytelling*.

Literature Related to Design and Data Visualization Guidance: Open Web Sources

We next turned to authoritative open web sources for guidance. For design considerations, these sources included infographic creation platforms (Visme, Piktochart, and Venngage), sites with a strong graphic design focus (Print and Smashing Magazine), and sites of content marketing businesses (Column Five and

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Dear Content). Articles on these sites generally present best practices as a list of "dos and don'ts" of infographic design. Some, like French (2020), Mighty (2017), and Velarde (2019), provide examples of ineffective and effective designs to illustrate the recommendations. The scope of these articles varies; some, for example "The Ultimate Infographic Design Guide: 13 Tricks for Better Designs" (Venngage, n.d.), briefly highlight a range of aesthetic considerations, from organization to color palette to font selection. Other articles focus more thoroughly on a specific design element, such as amount of text (Lin, 2019), use of color (Chow, 2019), use of whitespace (Sanchez, 2015), or use of icons (West, n.d.). Whether presented as a brief entry in a longer list, or discussed in depth as a standalone topic, similar recommendations appear across lists (such as, "Use a minimal color palette." "Avoid adding too much text.").

Reviewing open web sources was also useful for determining and compiling preliminary best practices for student infographic data visualizations. These resources included tech sector websites, graphics and visualization design websites, and marketing websites from companies such as Venngage, Visme, and Column Five. Articles from these websites generally fall within one of two categories: a) common mistakes, their importance, and how to avoid them, as in articles by Chibana (n.d.), McReady (2020), and Sharma (2015), or b) how to choose the right visualization for your data, explored in articles such as Nediger (2019), Oetting (2020), Ribecca (n.d.).

Articles from the first category—common mistakes—focus on misrepresenting data. In the book *Cool Infographics*, Krum (2013, p. 272) sums up why mistakes matter by stating, "Getting the data visualization wrong can kill your credibility… and demonstrate your lack of expertise in your subject area. Your audience will assume that because you got one data visualization wrong, the rest of your message is also of questionable accuracy. One bad chart draws so much attention from the audience that it won't matter that the rest of the information is correct." Errors or mistakes most often noted by authors such as Chibana (n.d.), McReady (2020), and Sharma (2015) are details such as omitting or skewing axes, using inaccurate scales, applying inappropriate labeling, and selecting the wrong visualization for the data

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type. French (2017) also notes that mistakes with color, style, and form on graphs or charts contribute to confusion and misunderstanding of the data.

Articles from the second category—choosing the right visualization—provide a wide overview of different types of visualizations. Articles like those by Nediger (2019), Oetting (2020), and Ribecca (n.d.) often include a brief explanation, the function or usefulness of that particular visualization (for example, a line chart is useful for showing changes over time), what types of data are best represented by a particular visualization, and recommendations when using a particular visualization type.

Planning

Initial Steps

Our first step in planning our infographic data and design checklists (henceforth referred to as "combined checklist") was identifying our target audience. We chose first- and second-year undergraduate students as our primary focus; they are the largest population at the institution and, in our experience, are more likely to need this type of support and direction. For many, this may be their first time encountering an alternative assignment with requisite challenges. We hoped to create something useful to students in any discipline rather than focus on a single discipline or subject. We wanted students in general, non-major classes to use this tool as easily as more advanced students taking courses within their majors.

We next identified five guiding principles to use when creating the combined checklist and infographic examples. These principles are:

- Include basic information and avoid anything that requires advanced understanding
- Focus on specific, actionable items
- Avoid conflicting suggestions
- Stick to guidance students are most likely to need
- Address content students are most likely to find and include

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These steps were crucial to the combined checklist's development and helped us identify and exclude anything outside the parameters, creating guidance that was useful but not overwhelming.

Finally, we determined how we would balance guidance related to data with guidance related to design. Both data and design are critical to an effective infographic. However, for a research infographic in the classroom, without correct data design, the visual design becomes irrelevant. Therefore, we elected to place a slightly stronger emphasis on data points over design.

Researching Best Practices and Guidelines for Data and Design

This project required us to research guidelines and best practices for both data and design. As indicated in the literature review, we began by reviewing the list of resources gathered in our initial literature search and broadened our scope to include general web resources. Many of the best practices for creating an infographic come from these web sources. However, these sources can be problematic due to issues with authority, difficulty determining expertise of authors, and the ephemeral nature of content on the web (in other words, stability). To address concerns over content stability and provide students with authoritative information, we stuck to well-known and respected professional sites with wide readership. These sites generally identify authors, indicate authors' credentials, and retain and archive their information. For selecting advice or direction from these sources, we adhered to a keep-it-simple model and our original principles of focusing on basic guidance, highlighting accessible information resources, and meeting students' most frequent information needs.

We identified recurring themes and balanced those with our guiding principles. Identified themes include:

- Select audience and information sources
- Select and organize data and corresponding visualizations
- Ensure accurate representation of data via visualizations
- Incorporate appropriate textual elements within data visualizations

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To make sure that students could get to additional detail for included points, we linked checklist resources to originating information (Figure 1).

<<Insert Figure 1>>

We followed this same strategy for our design considerations: balancing germane themes with our main principles. Though design recommendations are geared primarily to marketing and public relations purposes, guidelines and best practices related to basic aesthetics from these sources are generally applicable to student projects. Using repetition of guidance from site to site as evidence of accepted standards and practices, we built a streamlined list of design best practices for students new to infographic creation. Our main themes revolved around flow and spacing, color selection and contrast, and visual consistency (for example, design elements matching data, font selection and use, and so forth). One note: though recommended, we decided against advising severe restriction of the amount of explanatory text on an infographic. Based on our experience, an instructor may expect far more explanatory text on an infographic than what is recommended in the sources to properly assess the student's command of the subject matter. Therefore, we advise students avoid adding too much text rather than limiting explanatory text as much as possible. As with the data elements, we provided additional detail for each included point on the design checklist from our original sources (Figure 2). The data and design checklists can be found here: https://researchguides.wcu.edu/infographics.

<<Insert Figure 2>>

Researching Technology to Create the Combined Checklist and Example Infographics

Part of our creation process included determining what technology to use and how. This need was predicated on our desire to have a combined checklist that would be easy to use electronically and in print, as well as our desire to use interactive examples to illustrate our main points. We decided our combined checklist would be visually plain and that the infographic examples would be eye-catching enough to be interesting, though not so arresting as to distract from the instructional aspects of the examples. In the example infographics, we also wanted to be able to highlight best practices and not-so-

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best practices in an interactive way. Our final requirement was that the technology work well with our current research guides platform, Springshare's LibGuides, since that is where much of our department's instructional content lives.

Selecting the technology to create the combined checklist was easy. We used the table function in LibGuides to create two checklists, one for information/data and the other for design/visuals, with each table having two simple columns. The right column hosts the advice or guidance (such as, "I have identified my target audience," "I have minimized visual clutter," and the like.) while the left column contains a simple checkbox that students can use to track their work.

To generate the infographics, we chose Canva, a graphics creation program. Two main considerations drove our selection. First, Canva was a platform with which both authors were already familiar and had used for infographic creation previously. This eliminated any learning curve. Second, Canva allowed us to share editing privileges during creation of the infographics. We considered shared editing privileges a must-have function for this type of collaboration, and all technologies we ultimately used had this feature. In Canva, we created three separate infographics: an appropriate and effective design/data visualization infographic, an inappropriate/incorrect data visualization infographic, and an ineffective design infographic.

The initial idea to make Canva-generated infographics interactive involved using popup or hover-over boxes for each infographic. The boxes would contain explanatory material (such as, why a pie chart is the right choice for parts-of-a-whole data presentation, why adequate white space is needed, and so forth) relevant to the infographic's focus. However, initial investigations in the LibGuides platform indicated employing such functions would be problematic, requiring coding capacities surpassing our own. We also were not convinced our idea would work as envisioned in LibGuides. We desired a simple, end-user-friendly solution that was basically WYSIWYG ("what you see is what you get") design that could be embedded in LibGuides. After some research, we found a collaboration platform, H5P, that was exactly

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what we wanted. We trialed the platform and it worked very well; we were able to create popups that worked well embedded in LibGuides. H5P also made editing interactive infographics simple, another important consideration. This platform allowed us to go from vision to product in very few steps.

Having a working prototype was extremely useful. We could see how our instructional content looked and functioned. The prototype enabled us to relay our ideas meaningfully. Our technology problems were not solved, however. The H5P platform we trialed was subscription-based; the cost was high and, even in a non-pandemic year (much of the work took place in 2020), funding would be difficult to obtain.

Using screenshots and demonstrating the prototype while still live, we worked with our Web Services unit to create four functioning interactive infographics within LibGuides. We created image hotspots using Adobe Fireworks, and our Web Services unit created corresponding code that enabled popup windows for each hotspotted image (Figure 3).

<<Insert Figure 3>>

Creating

Choosing a Topic

In choosing the topic for our infographic, we started with something lighthearted and fictitious (cryptid space travel) as a placeholder with the idea that we would later select a real-world topic for our final product. However, as we got farther along, we decided to keep the fictitious topic for several reasons. First, it was fun for us, and as we were working on this at the start of the COVID-19 pandemic, fun was sorely needed. Second, using a fictitious topic was a more efficient use of our time. Librarians often want to work with existing data and ideas, but we knew that would needlessly consume a huge amount of time. We wanted the focus of our examples to be on the instructional content presented in popup windows (e.g., why a specific chart or graph used in the infographic is the appropriate or inappropriate choice, how the selected color palette contributes to or detracts from the aesthetic presentation, etc.) rather than on the infographics themselves. Third, we wanted students to focus on learning to create an infographic and not

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critiquing the example infographics' content; knowing that the data are obviously not based in reality keeps the focus on the process rather than on the product. Finally, and most importantly, we thought the topic would draw in students. Selecting a fact-based topic would have reduced the infographics' relevance for more than one discipline. Since our target audience was undergraduate students broadly, we did not want to give the appearance that the combined checklist and example infographics pertained only to a single discipline and risk alienating students outside that discipline. By using the fictitious topic, we kept our infographic examples discipline neutral.

Creating the Infographics

After finalizing our topic, we created the infographics. To keep it easy for students to follow, we developed three example infographics: appropriate and effective data and design, inappropriate/incorrect data visualization, and ineffective design. For our appropriate and effective example, we focused on simplicity to showcase best practices without overpowering the instructional content (Figure 4).

<<Insert Figure 4>>

For our incorrect and ineffective examples, on the other hand, we went fairly over the top to highlight clearly how choices can affect a viewer's interpretation of the infographic (Figure 5).

<<Insert Figure 5>>

We designed the infographics to incorporate all items on the combined checklist so students could see best as well as poor practices in use. We used data visualizations undergraduate students would find familiar and be likely to use: pie charts, line graphs, and bar charts. For each visual and data element, we provided explanation in the instructional popup windows regarding why an element worked or was ineffective, misleading, or incorrect. To keep students' focus on visual and data design elements instead of the story being told, we kept the narrative text identical between effective and ineffective infographics.

We wanted the process of creating our example infographics to mirror as closely as possible what we would ask of and expect from students. Therefore, when selecting our tools, we also considered ease of

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use for students. We used Canva's stock icons and themes, figuring that students are more likely to use a single tool rather than, for example, sourcing icons from one resource and background images from another. We made exceptions: our charts and graphs. Due to its superior data visualization capabilities, we created our charts and graphs in Microsoft Excel and uploaded those to Canva as images—a process we would recommend to students as well. To make the integration between Canva and Excel seamless, we used a shared color palette selected from COLOURLovers. To meet our library's web accessibility guidelines, we modified that palette to meet color contrast requirements.

Another benefit of selecting Canva and Excel is their friendliness to our student population: accounts are either freely available (Canva) or available through an institutional license (Excel). Additionally, Canva is easier to use than more sophisticated visualization tools such as Tableau. Students are also likely to have experience with Excel as it is an institutionally-supported application.

Accessibility

Our concerns about the accessibility of our object were not limited to color palette. Most guide content could be captured by a screen reader or other assistive technologies, but the infographics presented some difficulty. The accessibility issues inherent in infographics and amplified by our two-layer design left us wondering how we could create accessible versions of our infographics that were clear, understandable, and that emphasized the appropriate content. While guidance exists for creating an accessible infographic—view the exceedingly helpful page on accessible infographics by the Universal Design Center at California State University, Northridge [II]—our needs were different. Because our infographics serve as illustrative examples for our instructional popup windows, we sought advice on the best way to create an accessible version of the two-layer object. However, we were unable to find recommendations that met our needs. Additionally, our library does not have a person on staff who specializes in accessibility who could provide guidance or suggestions. Using the guidelines available for creating text-based transcripts and a little bit of guesswork on our part, we created transcripts we hope adequately

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describe the example infographics while placing emphasis on the instructional content found in the popup windows.

Revising

Iterations and Caveats

The process of revising the infographic object, particularly the example infographics, was the most time intensive portion of the project. We tweaked each piece countless times: editing content and visual presentation, as well as calibrating work between collaborators for uniformity, including font size and image dimensions. A single change could result in updates in four or more places, requiring us to change explanations, infographics, and hotspots.

This iterative process resulted in a stronger, more useable product, but it also laid bare two main caveats related to the use of web-based tools and content. First, trials are problematic. To take advantage of Canva's more robust features, we signed up for a free one-month trial of Canva Pro. Because the revision process took a significant amount of time, we exceeded the trial period and ended up paying for the Canva Pro subscription for two months.

The second caveat relates to web content stability. Considering the transitory nature of web content, we were concerned about directing students to online content. During the process of creating our infographics and combined checklist, one resource changed its URL, necessitating another round of item updates. While guidance provided in our combined checklist will likely remain stable, sources of that information may not; we recognize the necessity of checking and updating links regularly.

Peer Review

An important aspect of creating a learning object such as the combined checklist and attendant examples is sufficient peer review. Not only was it important to have the review for improvement purposes, but as faculty librarians with tenure status, objects like this can be considered part of our scholarly work. Our institution employs the Boyer model, which embraces non-traditional scholarship; learning objects such

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as this infographic can be treated as scholarly products after undergoing external peer review and dissemination.

Before external peer review, we sought feedback from departmental colleagues. Not only did this feedback identify errors such as non-working links and other technical issues, but it also highlighted areas of confusion and bias. For example, an extremely valuable piece of feedback pertained to terminology we used to describe and differentiate our infographics. We originally used "good" and "bad" to describe the different infographics we created (that is to say, "good data and design infographic," "bad data infographic," "bad design infographic"). In their feedback, a colleague shared their concern that good/bad is judgment-based terminology that may alienate students who interpret the terms as a reflection on the creator rather than the content. This feedback not only flagged our use of non-inclusive language but also indicated our terminology did not precisely describe the infographics and their purpose. In using "good," we meant the infographic was effective in its visual design or used appropriate/correct data visualizations. With "bad," we meant to convey that the infographic was ineffective regarding visual design or utilized inappropriate/incorrect data visualizations. To address this issue, we changed our terminology to "appropriate," "effective," "inappropriate," "incorrect," and "ineffective."

Our combined checklist and infographics next underwent external peer review. This project was the authors' second non-traditional scholarly product and we had already worked through many details of this type of peer review process. We created an abstract to accompany the combined checklist and infographics. The abstract includes details regarding the intended audience, the impetus for creation, and the resource's intended use (for example, by students, reference librarians, and so on). Our department head developed evaluative criteria, identified potential peer reviewers with specialization in the subject area, and served as our liaison with reviewers, blinding creators' identities and reviewers' feedback. Other than the blinding, we received the full text of the reviewers' feedback, questions, and issues.

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Unlike an article that requires final edits before publication, we made the combined checklist and example infographics publicly accessible after internal review but before external review. This action was primarily to ensure guidance was available to students at the start of the semester. Though our object was available, we committed to addressing reviewer feedback as soon as we received it. We incorporated feedback and noted any feedback we did not or could not implement; such feedback was not implemented due to exceeding the project's scope or due to technological limitations. Incorporated feedback mostly centered on organization and content length. We addressed these issues by creating another page on our LibGuide which allowed us to separate recommended resources from our combined checklist, thus decreasing the density of text on the guide's homepage. We also divided the resource list and indicated through both a text heading and a graphical icon whether resources addressed data and information aspects, visual and design aspects, or both. This peer review process can be valuable even for those whose institutions do not honor alternative scholarship, giving an important external perspective on what works, what needs more attention, and whether a project might be an appropriate topic for an article.

Recommendations

For librarians wanting to create support resources for alternative assignments, we offer the following lessons learned.

1. Start early

   Depending on the type of product students must create (infographic, graphical abstract, podcast, etc.), there may be little literature on, and few examples of, application of that product in an academic setting. This predicament may necessitate the creation not only of guidelines but also examples of those products as they might look when created for an undergraduate research assignment. Our infographics project manifested slowly, in part due to COVID-19 disruptions, but also due to the lack of strong, clear guidance specific to undergraduate-created research infographics. We made many decisions based on best guesses and limited extant guidance, an

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uncomfortable proposition at times. We recognized that the same lack of resources presenting complications to our work would also challenge students.

2. Choose your topic wisely

It may be tempting to choose a substantial, real-world topic for example products. However, use caution when selecting topics as they can require huge commitments of time and effort. If your goal is making an example of interest to a general audience, discipline-specific or single-subject topics may prevent students from engaging fully with the example. The topic we developed prevented us from spending an inordinate amount of time finding data, making sure it would fit all that we wished to accomplish with this example, limiting it, and then creating an effective infographic. And, as noted earlier, it was fun! Because a broad range of undergraduate students comprised our target audience, we did not want to give the appearance that the infographic object pertained only to a single discipline.

3. Be prepared to revise

As various forms of data representation and visualization are adapted for use in classroom assignments, it is reasonable to expect assignments and guidelines will undergo revisions to better meet student and instructor needs and learning outcomes. We expect our guide to be a living object and anticipate future iterations as we learn more about the use of infographics, student experiences with the guide, and as new tools and resources become available. For librarians relying on free product trials to create support resources, consider in advance the availability of funding to support future revisions.

4. Recognize accessibility issues

Understand that there may be accessibility issues inherent to some alternative research products. Technology to mitigate those accessibility issues may not be available at your institution. This challenge may require constructing an accessible alternative if no technology or established

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guidance is available. We realized students should also be prepared to recognize these accessibility challenges. The desire to create an aesthetically appealing object and the responsibility to have it meet accessibility guidelines can be especially challenging for students who may be required to adhere to university visual branding guidelines, which themselves may not meet accessibility standards.

5. Advocate for guidelines in addition to rubrics

When collaborating with teaching faculty on an alternative assignment, be prepared to talk about why rubrics should not be offered in lieu of instructions or guidelines. Rubrics are important for students to understand how their work will be assessed but are not sufficient for helping students understand how to create the product. A rubric may indicate that students will be assessed on an effective use of color, but what does that mean in practice? One color? Three colors? Complementary colors? Contrasting colors? Additionally, because technological skillsets vary widely among students, instructors need to be aware that students are likely to benefit from step-by-step guidance on how to create these projects effectively. Librarians can partner with instructors to provide this guidance, whether through in-person, in-class instruction or through tutorials and other supporting resources. This guidance can help ensure students have a base-level understanding and reduce disparities among students' technological skillsets.

6. Be cognizant of the lack of exemplars

Until these assignments become more common, making more examples of student-created alternative research products available, students may have to rely on examples created for non-academic purposes. An infographic created for marketing purposes will likely look different from an infographic created for a research assignment, but students may not realize that without adequate examples for comparison.

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Final Thoughts

We expect use of alternative assignments to grow, whether in introductory undergraduate courses or upper-level capstone courses. As librarians, we must think about our role in providing guidance on these assignments to students and faculty. These opportunities provide a valuable avenue for engaging students with concepts and skills related to information literacy, visual literacy, and data literacy. We expect that, in a few years, librarians will have a better understanding of best practices for academic, student-created infographics and where those infographics intersect with and diverge from marketing and public relations-focused infographics. In the meantime, librarians must figure out a starting point for developing our own best practices.

Librarians supporting alternative assignments should understand how long their creation takes, both for ourselves and, more importantly, for students who may be unfamiliar with the concepts and tools required to successfully complete such assignments. Collaborating with instructors to plan for early interventions and scaffolded approaches is critical. We look forward to the growth of alternative assignments and the many exciting opportunities they provide for librarians to expand our work with students.

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Reference Services Review

References

Anderson, E.K., Bishop, R., and Cross, N. (2019), "Dealing with data: instructing with infographics in an undergraduate sociology course", *College Teaching*, Vol. 67 No. 1, pp. 36–49, available at: https://doi.org/10.1080/87567555.2018.1518890.

Beegel, J. (2014), *Infographics for Dummies*, Wiley, Somerset, NJ.

Bradshaw, M.J., and Porter, S. (2017), "Infographics: a new tool for the nursing classroom", *Nurse Educator*, Vol. 42 No. 2, pp. 57–59, available at: https://www.nursingcenter.com/journalarticle?Article_ID=4008529&Journal_ID=54026&Issue_ID=4008524.

Carter, D. (2015), "Connected to my world: seeing to understand", *Access* Vol. 29 No. 1, pp. 22–29.

Chibana, N. (n.d), "Bad infographics: 11 mistakes you never want to make", available at: https://visme.co/blog/bad-infographics/ (accessed 6 April 2020).

Chow, S. (2019), "4 steps to choosing good color combinations for your infographic", available at: https://piktochart.com/blog/pick-great-color-schemes-your-infographics/ (accessed 3 August 2020).

Dyjur, P. and Li, L. (2015), "Learning 21st century skills by engaging in an infographics assignment", in Preciado Babb, P., Takuchi, M., and Lock, J. (Eds.), *Proceedings of the IDEAS: Designing Responsive Pedagogy Conference, Calgary, April 30-May 1, 2015*, Werklund School of Education, University of Calgary, Calgary, AB, pp. 62-71, available at: http://dx.doi.org/10.11575/PRISM/5313.

French, K. (2020), "25 tips to instantly improve your data visualization design", available at: https://www.columnfivemedia.com/25-tips-to-upgrade-your-data-visualization-design (accessed 7 April 2020).

French, K. (2017), "How to fix the 15 most common infographic design mistakes", available at: https://www.columnfivemedia.com/how-to-fix-the-15-common-infographic-design-mistakes (accessed 7 April 2020).

Reference Services Review

Gallagher, S.E., O'Dulain, M., O'Mahony, N., Kehoe, C., McCarthy, F., and Morgan, G. (2017), "Instructor-provided summary infographics to support online learning", *Educational Media International*, Vol. 54 No. 2, pp. 129–47, available at: https://doi.org/10.1080/09523987.2017.1362795.

Jones, N.P., Sage, M., and Hitchcock, L. (2019), "Infographics as an assignment to build digital skills in the social work", *Journal of Technology in Human Services*, Vol. 37 Nos. 2/3, pp. 203–25, available at: https://doi.org/10.1080/15228835.2018.1552904.

Kardgar, A., Mentzer, N., Laux, D., Chesley, A., and Whittinghill, D.M. (2017), "Developing strategies for instruction and assessment of infographics for first-year technology students", paper presented at the 2017 ASEE Annual Conference and Exposition, 24 June-28 June, Columbus, OH, available at: https://peer.asee.org/28150.

Kos, B.A. and Sims, E. (2014), "Infographics: the new 5-paragraph essay", paper presented at Rocky Mountain Celebration of Women in Computing, 23 October-24 October, Laramie, WY, available at: https://scholar.colorado.edu/concern/conference_proceedings/pr76f406g.

Krum, R. (2013), *Cool Infographics: Effective Communication with Data Visualization and Design*, Wiley, Indianapolis, IN.

Lamb, A. and Johnson, L. (2014), "Infographics part 1: invitations to inquiry", *Teacher Librarian*, Vol. 41 No. 4, pp. 54–58.

Lankow, J., Ritchie, J., and Crooks, R. (2012), *Infographics: The Power of Visual Storytelling*, Wiley, Hoboken, NJ.

Lin (2019), "Minimal yet powerful: improving the text on your infographics", available at: https://dearcontent.com/minimal-yet-powerful-improving-the-text-on-your-infographics/ (accessed 3 August 2020).

Matrix, S. and Jaigris, H. (2014), "Teaching with infographics: practicing new digital competencies and visual literacies", *Journal of Pedagogic Development*, Vol. 4 No. 2, pp. 17–27, available at: https://www.beds.ac.uk/jpd/volume-4-issue-2/teaching-with-infographics.

http://mc.manuscriptcentral.com/rsr

Reference Services Review

McReady, R. (2020), "5 ways writers use misleading graphs to manipulate you", available at: https://venngage.com/blog/misleading-graphs/ (accessed 30 July 2020).

Meirelles, I. (2013), *Design for Information : An Introduction to the Histories, Theories, and Best Practices Behind Effective Information Visualizations*, Rockport, Beverly, MA.

Mendenhall, A.S. and Summers, S. (2015), "Designing research: using infographics to teach design thinking in composition", *Journal of Global Literacies, Technologies, and Emerging Pedagogies*, Vol. 3 No. 1, pp. 359–371, available at: http://jogltep.com/wp-content/uploads/2020/03/JOGLTEP41.pdf.

Mighty, K.T. (2017), "The do's and don'ts of infographic typography", available at: https://blog.hubspot.com/marketing/infographic-design (accessed 3 August 2020).

Nediger, M. (2019), "How to choose the right charts for your infographic", available at: https://venngage.com/blog/how-to-choose-the-best-charts-for-your-infographic/ (accessed 8 April 2020).

Oetting, J. (2020), "Data visualization 101: how to choose the right chart or graph for your data", available at: https://blog.hubspot.com/marketing/types-of-graphs-for-data-visualization (accessed 8 April 2020).

Ortiz, M. and Redmon, A. (2020), "Creating a culture of diversity, equity & inclusion through active learning using student-created infographics", *AURCO Journal*, Vol. 26, pp. 117–27, available at: https://www.aurco.org/Journals/AURCO_Journal_2020/Ortiz_Creating_Culture_Diversity_2020.pdf .

Ribecca, S. (n.d.), *The Data Visualisation Catalogue*, available at: https://datavizcatalogue.com/index.html (accessed 13 July 2020).

Sanchez, G. (2015), "Using whitespace for clean and uncluttered infographic design", available at: https://piktochart.com/blog/the-key-to-clean-and-uncluttered-infographic-design-managing-whitespace/ (accessed 3 August 2020).

Reference Services Review

Sankaran, K. and Holmes, S. (2018), "Interactive Visualization of Hierarchically Structured Data", *Journal of Computational &Graphical Statistics* Vol. 27 No. 3, pp. 553-563, available at https://doi.org/10.1080/10618600.2017.1392866.

Sharma, N. (2015), "7 most common data visualization mistakes," available at: https://thenextweb.com/dd/2015/05/15/7-most-common-data-visualization-mistakes/ (accessed 8 April 2020).

Stones, C. and Gent, M. (2015), "The 7 G.R.A.P.H.I.C. principles of public health infographic design", available at: https://visualisinghealth.com/design-guidelines/ (accessed 15 April 2021).

Velarde, O. (2019), "Follow these 10 basic elements of design for infographic mastery", available at: https://visme.co/blog/design-for-infographics/ (accessed 18 May 2021).

Venngage (n.d.), "The ultimate infographic design guide: 13 tricks for better designs", available at: https://venngage.com/blog/infographic-design/ (accessed 26 March 2020).

Waddell, M. and Clariza, E. (2018), "Critical digital pedagogy and cultural sensitivity in the library classroom: infographics and digital storytelling", *College & Research Libraries News* Vol. 79 No. 5, pp. 228–32, available at: https://doi.org/10.5860/crln.79.5.228.

Waskie-Laura, N. and LeBlanc, S. (2015), "Images for inquiry: using visually based texts to scaffold complexity", *School Library Connection*, November, pp. 6-9.

West, C. (n.d.), "Infographic icons 101: how to use icons in your infographics", available at: https://visme.co/blog/how-to-use-icons-in-infographics/ (accessed 1 October 2020).

Western Carolina University Office of Institutional Planning and Effectiveness (2021), "Quick Facts", available at: https://public.tableau.com/app/profile/wcu.ir/viz/QuickFacts_15683111433170/QuickFacts (accessed 18 October 2021).

Yarbrough, J.R. (2019), "Infographics: in support of online visual learning", *Academy of Educational Leadership Journal*, Vol. 23 No. 2, available at: https://www.abacademies.org/abstract/infographics-in-support-of-online-visual-learning-8368.html.

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Further Reading

[I] https://affiliate.wcu.edu/comm/about/land-acknowledgment/

[II] https://www.csun.edu/universal-design-center/accessible-infographics.

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Infographics Checklist

Data & Information Considerations

☐	I have identified my target audience (peers, professors, researchers, laypeople, etc.).
☐	I have identified the main, significant data or information I want to use or represent.[19]
☐	I have made sure that alike or related data is together.[2]
☐	I have selected the appropriate chart, graph, or other visualization type that best represents the data I am using.[5 6 7]
☐	For charts, graphs, etc., I have reviewed recommendations for use of color in those elements.[2]
☐	My data is arranged intuitively (for example, from largest to smallest).[1 5]
☐	I have made sure my data is scaled accurately on any chart, graph, etc., that I have used.[1]
☐	For data given as percentages, I have made sure that any related percentages add up to 100%.[6]
☐	I have made sure that charts, graphs, etc., have the appropriate labels, titles, annotations, and so forth.[2]
☐	I have made sure to include a legend when appropriate (such as with line charts). It is placed near the item it explains.[5]
☐	Numerical chart axes start at zero and have tick marks or grid lines in consistent and logical intervals.[5]
☐	I have not incorrectly resized or distorted data representations to emphasize/de-emphasize a relationship or point of view.[4]
☐	I have fully cited the sources from which I obtained my information or data, or both.[19]

The superscript numbers in both checklists correspond to the numbered resources found on the "Information Sources" page of this guide. Clicking on the superscript number will take you directly to the source.

Figure 1: Data and information considerations checklist

177x181mm (120 x 120 DPI)

Infographics Checklist

Visual & Design Considerations

☐	I have selected a theme and graphics that match my subject.[20]
☐	I have organized my infographic in a logical way.[9]
☐	I have minimized visual clutter and used plenty of white space.[14]
☐	I have avoided creating an infographic that is excessively long.[16]
☐	I have used 2-3 complementary fonts.[13]
☐	I have used a curated color palette with 1-3 dominant colors and limited accent colors.[10]
☐	I have used colors that have enough contrast to be easily read by the widest possible audience.[15]
☐	I have avoided adding too much text.[12]
☐	I have used graphics that match (for example, not mixing 2D and 3D elements).[17]
☐	I have aligned my content consistently and spaced it evenly.[11]

Figure 2: Visual and design considerations checklist

177x127mm (120 x 120 DPI)

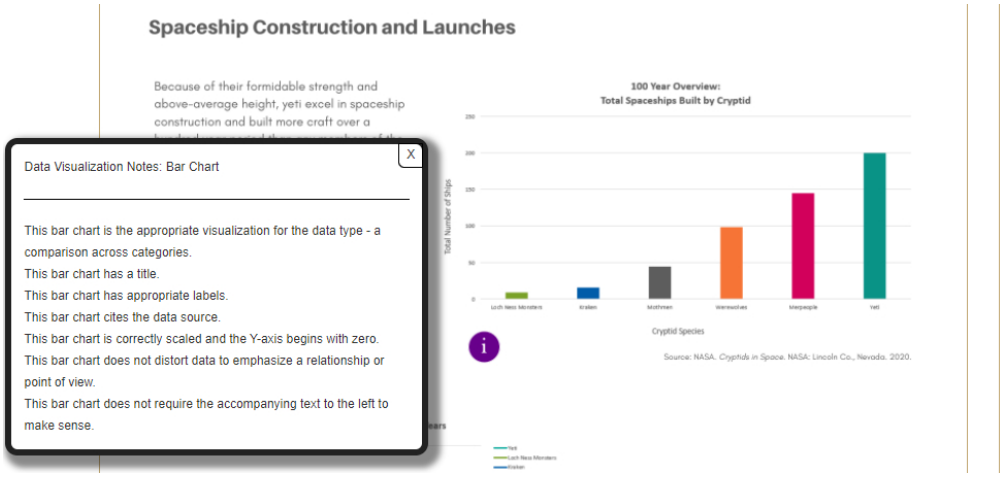

Figure 3: Popup window

523x245mm (47 x 47 DPI)

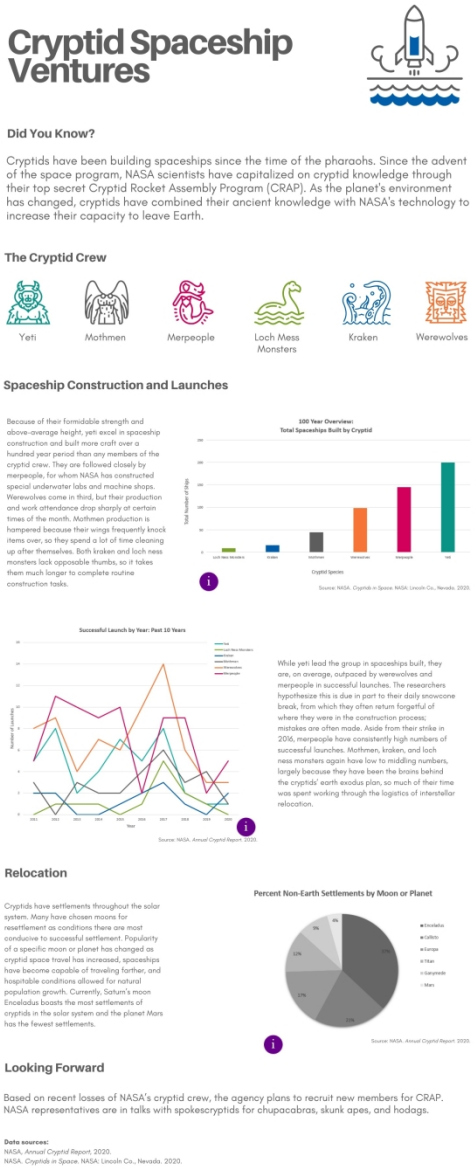

Figure 4: Appropriate data visualization and effective design infographic

338x783mm (120 x 120 DPI)

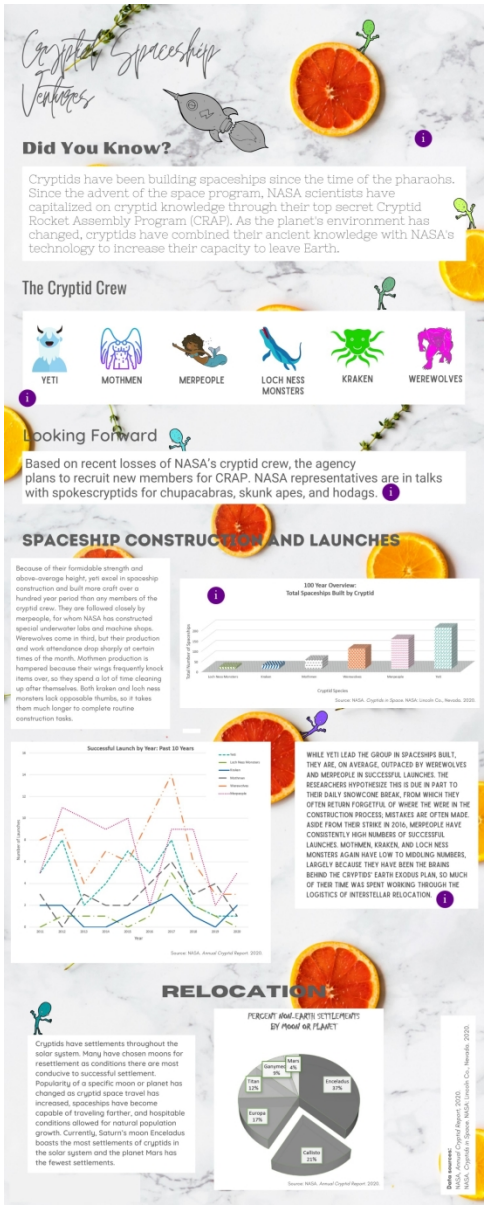

Figure 5: Appropriate data visualization and ineffective design infographic

111x279mm (330 x 330 DPI)