

Infographics, assessment and digital literacy: innovating learning and teaching through developing ethically responsible digital competencies in public health

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Infographics are eye-catching one-page documents that provide a concise overview of a topic through visually representing information or data using graphics, icons and/or images, with minimal words. They are an emerging key form of communication in society, government, research, education and industry, and can be found widely in social media, advertising, teaching, policy documents and scientific journal publications, for example. Due to their user-friendly, quick-read format, infographics are highly influential in shaping the opinions of their audience. An emerging issue with infographics, however, is the capacity to mislead or misrepresent information or data. In the contemporary higher education environment, providing students with digital literacy skills, including the capacity to critically evaluate digital media forms such as infographics, is vital. This paper will provide a review of the use of infographics in learning and teaching in the literature, including as assessment, examining the benefits as well as the potential issues, and how some of these challenges might be met.

Keywords: infographics, assessment, digital literacy, public health



Figure 1: Infographic on the benefits and risks of using infographics in higher education.

Introduction

Infographics are eye-catching one-page documents that provide a concise overview of a topic through visually representing information or data using graphics, icons and/or images, with minimal words. Infographics are intended to visually engage their audience using colour and imagery, presenting complex information in an accessible, easy-to-understand visual form. In simple terms, they are a combination of data and design, where data means both numbers and facts, designed to be communicated transparently (Vital 2018). Infographics are extremely useful for conveying complex information quickly and easily.

Infographics are a highly transferrable media form and are currently being used across the entire spectrum of society, government, research, education and industry; in social media, advertising, teaching, policy documents, and scientific journal publications, for example. They are widely used because of their capacity to convey otherwise complex information quickly and easily, in an eye-catching form, within any area or discipline. Few other media forms are capable of this level of accessibility and transferability, and is one of the reasons that they have been so widely embraced, particularly by the commercial sector. As McCrorie, Donnelly and McGlade (2016, p. 72) write, the “commercial sector has enthusiastically taken up infographic design within the last decade or so as a means of communicating large quantities of otherwise difficult to assimilate information in a single easily understood and visually attractive product”. In the healthcare sector, for example, infographics have been used for mass public consumption for a large-scale public health campaigns, as well as for communicating with the public on a smaller scale, such as posters within a general practice.

As Toth (2013) has argued, given the rise of infographics in the business world, students need exposure to them, as they will be probably asked to interpret and/or create them in the workplace. If used well, infographics can be very useful in learning and teaching, including assessment. In teaching, long explanations in lectures can be replaced with infographics (Anghel & Dahaila, 2019). Infographics increase student participation because they are visually engaging: they draw the attention of the students when used appropriately and meaningfully, and collaboration on infographics, such as creating team infographic assessment, enhances collaboration and communication skills (Rhodes, Johanesen & Abud, 2019). Infographics can enhance peer learning: students are much more likely to engage with another student’s infographic than they are with their essays. They can be posted to a discussion forum, where students are required to comment on each other’s infographics. They can also be presented to both peers and teachers in a presentation format.

There are, however, several potential issues in with the use of infographics, particularly in learning and teaching. Although graphic design skills are not necessary to create them, there is still a somewhat steep learning curve to create a meaningful, well-designed infographic. Due to their user-friendly, quick-read format, infographics are highly influential in shaping the opinions of their audience. This capacity, however, means that they are also open to misuse, either intentionally or unintentionally. The capacity to be able to objectively analyse infographics for the quality of the information they present can be challenging, particularly for students.

In 2019, in the Master of Public Health course at Monash University, we began incorporating infographics into learning and teaching in the areas of health and law; occupational health and safety; aviation medicine; and health management, with the aim of enhancing authentic learning for our students. Authentic learning experiences are those that connect students with real-world problems and work situations, through immersing learners in environments where they can gain highly practical, lifelong learning skills (Adams Becker, Brown, Dahlstrom, Davis, DePaul, Diaz & Pomerantz, 2018). Our challenge in incorporating infographics was to support teachers and students to understand, interpret, and create them, given the steep learning curve, and the potential for them to be misused. This paper discusses the use of infographics in learning and teaching, examining the benefits and the potential issues, and how we might meet some of these challenges. It will discuss how infographics ‘work’ as a media form, the use of infographics in public health, and an analysis of the benefits versus the risks of using infographics in learning and teaching, in the context of digital literacy.

How do infographics ‘work’?

Infographics can be described as a “multimodal” media format, integrating multiple modes of meaning making brought together into a single media text (West, 2019, p. 151). Although the use of infographic-type formats can be found throughout human history, the term infographic first appeared in the 1960’s (Vital, 2018), and they were popularised in 1980’s and 90’s in American newspapers such as *USA Today* and the *New York Times* (Otten, Cheng & Drewnowski, 2015). Research on the use of the infographic as a distinct media form dates to at least the early 90’s (see Utt and Pasternack, 1993, for example). There are many different types of infographics, and wide interpretation and variation on these types, from basic annotated image infographics, to much more complex data

and statistical infographics. The rise of the popularity of infographics is equivalent to the rise in the era of ‘information overload’: infographics have emerged as a tool that can whittle down the complexity and abundance of information into a user-friendly format.

There is significant evidence that infographics reduce barriers to understanding (Otten, Cheng & Drewnowski, 2015). Visual processing in the human brain is very rapid: it takes an individual less than one-tenth of a second to get the sense of a visual scene, and viewers can quickly find patterns and make comparisons in well-designed infographics (Otten, Cheng & Drewnowski, 2015). Visual information has been shown to have a higher emotional impact and is remembered longer than text (Toth, 2013). Studies show that pictorial elements significantly increase memorability (Byrne, Angus, & Wiles, 2016), and the inclusion of recognisable imagery attracts attention, and aids in understanding and retention of the represented information (Byrne, Angus, & Wiles, 2016). By making information that is both compelling and more easily digestible, infographics enhance decision-making (Otten, Cheng & Drewnowski, 2015). Colours alter mood and energy levels and are used in infographics to attract attention (McCrorie, Donnelly & McGlade, 2016), thereby increasing influence over audience response to the messages being conveyed within an infographic. As Otten, Cheng and Drewnowski (2015, p. 1901) have written, “[t]he most effective infographics help viewers think critically about a particular subject or data set in terms of individual measurements and broader patterns”.

As Lee and Kim have suggested, (2016) infographics convey content using varying methods of presentation that appeal to different human perceptual systems: text, images, audio, and video, for example. Their research has shown that multimodal formats such as infographics, so long as they do not simultaneously compete with one another, enhance learning as compared to single channel communication. That is, spoken and written words presented simultaneously – such as in a spoken lecture that is simultaneously presenting lengthy written text on a PowerPoint slide – has the effect of reducing comprehension, whereas written text and visual images presented in a complementary manner – such as in an infographic – has been shown to enhance comprehension and learning. In short, infographics, when done well, improve information acquisition. Statistical information and procedural tasks, for example, have been shown to be recalled better when presented together in text and graphic formats, than in either mode alone.

Infographics in public health

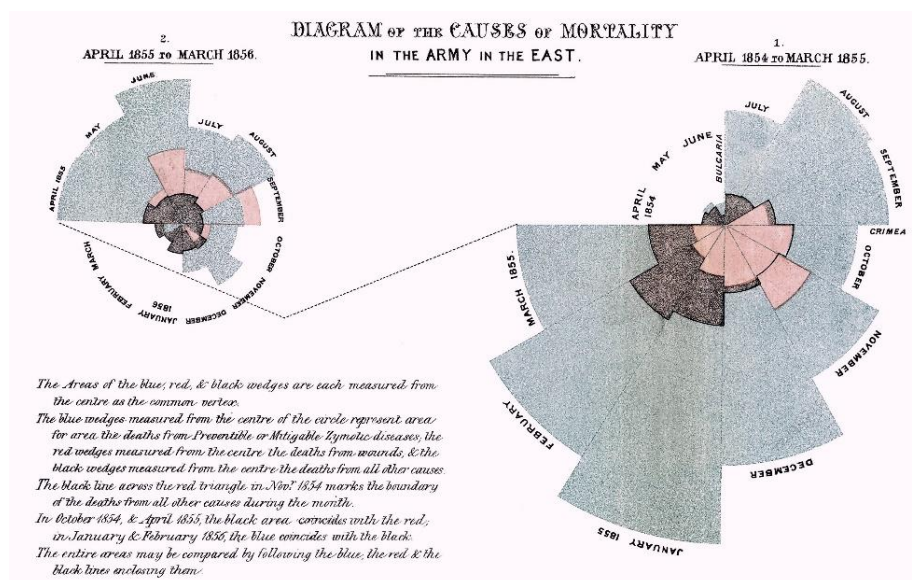


Figure 2: Florence Nightingale's 19th century “Rose diagram” on mortality in the army during the Crimean War. (Image in public domain.)

Infographic-type formats have a long history, including in medicine and health. Ancient cave paintings, depicting the location and availability of resources can be described as infographics; the Ancient Greeks used graphic information formats, and many historical maps and navigational drawings were what we would now call infographics. Infographics have long been historically important in public health. McCrorie et al (2016) suggest that in the nineteenth century, part of Florence Nightingale's success in communicating public health issues was due to the graphical representations she used to show causes of mortality amongst British forces during the

Crimean war. Using what we would now call a “polar area diagram” (or “coxcomb graph”), Nightingale illustrated that death from preventable disease outnumbered other causes including battle wounds. She was incredibly successful at reaching her target audience, they argue, whilst simultaneously triggering attitudinal change. These aims are the key to contemporary infographic design.

The user-friendly aspect of infographics makes them ideal for contemporary medicine and public health settings, where they have been widely used. Evidence shows that infographic-type formats enhances understanding and the ability for patients and the general public to make decisions about their health, and there is increasing demand for patient and public access to quality healthcare information, in a manner that is easily understood, so that patients can make better decisions about their care (McCrorie, Donnelly & McGlade, 2016). Through integrating quantitative charts with explanatory text and illustrative diagrams, researchers can create infographics that convey key issues around otherwise complicated public and policy interests (Otten, Cheng & Drewnowski, 2015).

There is substantial use of infographics within the healthcare sector, communicating medical information to patients in an accessible manner, thereby enhancing patient’s decision-making capacities regarding their health. They are also widely used at the population level for public health messages (McCrorie, Donnelly & McGlade, 2016). As Otten, Cheng and Drewnowski (2015, p. 1903) write “[i]nformatics provide an effective means to communicate health and nutrition data to decision makers, who need high-quality information but in bite-size and readily accessible forms”. In mass media campaigns they are intended to present positive change and/or prevent negative changes in health-related behaviours across large populations (Wakefield, Liken & Hornick, 2010, in Hamilton, Peden, Keech, and Hagger, 2018).

Infographics can be used in a manner that functions on an affective level of the human body, primarily through the use of colour, influencing mood and emotional engagement. In a healthcare context, using a traffic light system of red, amber and green, for example, the use of red in an infographic visually links that information to “danger” or the need to “stop”, information that needs consideration in amber, and positive information in green (McCrorie, Donnelly & McGlade, 2016). At the cafeteria within the Alfred hospital in Melbourne, for example, an infographic about food choices represents unhealthy, high-fat, sugary food in red; moderately healthy food in amber, and healthier choices in green.

Infographics can also be used to overcome language barriers, through communicating with patients who may not speak the same language as their practitioners (McCrorie, Donnelly & McGlade, 2016). There is also a higher risk, however, of some patients misunderstanding infographic symbolism and representation, and interpreting it too literally. McCrorie, Donnelly and McGlade (2016) give the example of an infographic that shows the number of fruit that should be eaten daily as part of a healthy diet, which is represented by an image of 5 apples. This may be interpreted by some, however, to mean that people should eat 5 apples per day, and/or that apples are the only fruit that should be eaten.

Infographics – like any media form – are not always effective in changing behaviours or attitudes in public health, and this should be considered when assessing their use. Hamilton, Peden, Keech and Hagger (2018), undertook a study of the use of a video infographic that highlighted the dangers of driving through floodwaters in Australia, including providing safety tips to reduce the risk. Their study evaluated its effectiveness in changing the beliefs and intentions of Australian adults toward this risky driving behaviour. Their study predicted that the infographic would lead to factors such as lower reported intentions, less favourable attitudes, and reduced social pressure to drive through floodwaters, due to the growing evidence that infographics have strong effects on behaviour: “we expected the infographic to deliver longer-term changes in beliefs and intentions” (Hamilton, Peden, Keech & Hagger, 2018, p. 52). Their study found that whilst factors including gender, attitude, intention, emotion and aptitude for understanding the background information all play a role in how information is understood and acted upon, their overall research concluded that intentions to drive through floodwaters were not affected by exposure to the infographic, and that the infographic was ultimately “not ... effective in changing behaviour” (Hamilton, Peden, Keech & Hagger, 2018, p. 57).

Infographics in learning and teaching

Infographics are narrative devices: they tell a story. Part of their popularity and utility, particularly in education and research, is their capacity to present quantitative information to audiences who may otherwise have little understanding of the creation and use of scientific data. Infographics enable this data to be presented in a narrative format. As Otten, Cheng and Drewnowski (2015, p. 1902) write, through “integrating quantitative charts with explanatory text and illustrative diagrams, for example, researchers can communicate their findings as engaging, persuasive, or memorable narratives of discovery”. As such, they can be very useful for STEM (science,

technology, engineering, mathematics and medicine) disciplines, which may not traditionally use narratives very well. The narratives of infographics could be explanatory (aiming to educate or inform), editorial (making value judgements), persuasive (seeking to influence), or exploratory (testing a hypothesis), for example (ibid).

Infographics function as a stand-alone form of communication, where the “audience should comprehend the information by simply looking at it without seeking additional resources to understand it” (Toth, 2013, p. 448). In a long text, major figures and other numerical data may go unnoticed (Aydin, Aksut, & Demir, 2019), however an infographic can graphically quantify the magnitude of an issue, giving the audience an immediate sense of its significance. Large datasets can be made more coherent, facilitating comprehension. Infographics can be either static (printed as a poster or as a static screen image), animated (an animated screen image), or interactive (displayed on a screen with clickable links and other interactive elements). They can be hand-drawn or electronically created, and many electronically created infographics insert hand-drawn elements.

Whilst visual language is highly flexible, and there are multiple ways in which something might be represented, as (Byrne, Angus, & Wiles, 2016) argue, effective designs make use of conventional graphic and figurative representations and elements for ease of user understanding and remembering, as understanding can happen faster and with less effort, due to the easy recognition of the graphics presented. Sometimes impact is also created through breaking convention, however, which challenges the audience to reconceptualise the information they are presented with in a novel manner.

In many ways infographics have evolved from PowerPoint slides: many infographics are three to four graphically focused, well-designed, minimal text PowerPoint slides combined into one document. Reflecting upon infographics and how they work allows us to think about how we could present information in teaching and research much more effectively, to move away from the infamous ‘death by PowerPoint’, and towards creating attention grabbing, focused, user-friendly presentations.

It is important to note that the design of infographics should always be informed by the communication setting in which they are to be presented (Otten, Cheng & Drewnowski, 2015). An infographic that is to be developed as part of an oral presentation should be succinct and have a high visual impact, because it is accompanied by a spoken word element. An infographic that is to be used as a stand-alone poster requires more detail and needs additional annotation (Otten, Cheng & Drewnowski, 2015). Infographics also don’t necessarily need to be used to present information to others: they can be created for personal use. In teaching and learning students can improve their understanding of technical information, for example, by being taught to create basic infographic “sketchnotes” (Fernandes-Fontecha, O’Halloran, Tan, & Wignell. 2018, p. 8) to review and revise the learning content in preparation for an exam.

Infographics can enhance professional skills in communication. Employers constantly cite communication skills in graduate students as a much higher priority than just having the disciplinary knowledge. They want students to be able to innovate and apply their knowledge, and to have interdisciplinary skills. It’s not that their degree isn’t important of course, but it is very limited if students do not have communication skills to use that knowledge meaningfully (Choate & Chan, 2016). Infographics can enhance creativity, innovation and interdisciplinarity: teaching students to push their boundaries and to creatively innovate and apply knowledge in a highly communicable form.

Zuk (2011) argues that in order to create a successful infographic, students need a basic understanding of the power of marketing, so that their infographics are focused, and compelling. More than just a tool for public relations, students need to learn to market their learning and their skills, in quick, easily understandable terms. Often referred to as the “elevator conversation” scenario, this skill is about students being able to give a snapshot of their skills and knowledge in a minute to someone of influence, where the question is often framed: “If you ran into your boss in the elevator, what do you say about the value of the work you are doing?” The capacity for students to be able to ‘market’ themselves meaningfully is a vital professional skill. Infographic resumes have also become popular: they are attention-grabbing, attempting to gain an edge in the competitive job market. Learning to create infographics gives students the skills to be better placed for employment.

Incorporating infographics into learning and teaching in public health is part of Monash University’s vision of higher education to expand and enrich staff and student capabilities in digital education; incorporate capabilities of the future into education, including the skills to lead and transform communities; to be proficient in digital literacy, and; to foster development opportunities in digital learning for both staff and students (Monash University, 2019). As Leu argues, “[n]ew forms of strategic knowledge are required with new literacies” (cited in

West, 2019, p. 171), and advances in technology requires new approaches in education for both teachers and students (Aydin, Aksut, & Demir, 2019).

By embedding infographics into learning and teaching – including as assessment items – we can drive digital competencies for educators, researchers and students, developing critical enterprise skills in digital literacy. In order to understand how to create infographics, however, students need to be taught how infographics work to communicate information, how to critically analyse them, and how to create responsible infographics.

The benefits and the risks of using infographics in learning and teaching

Whilst there are many benefits of using infographics in educational teaching and research, there are also a number of risks. Developing responsible data-sourced infographics takes time and commitment (Otten, Cheng & Drewnowski, 2015). This is to say that there can be a steep learning curve involved in creating infographics: they can be laborious and time consuming to create. Due to their visual nature, infographics can appear simple and effortless (Toth, 2013), but appearances can be deceptive, both in terms of the amount of work and thought that is actually required to create them, as well as in terms of the quality – or otherwise – of the information they are presenting. Aydin, Aksut, and Demir (2019) noted that students are often negative when they realise the steep learning curve, but much more positive once they have completed the task.

There must be structured support for creating infographics, not only the practical skills to create them, but also how to create and interpret graphs and data. Whilst effective infographics that communicate meaningfully look great and can be highly beneficial in teaching and research, ineffective infographics tend to be visually overwhelming; use excessive or extraneous data; present information in a way that is confusing; and/or over- or under-value certain information (Otten, Cheng & Drewnowski, 2015).

Due to their steep learning curve, infographics as assessments need to be scaffolded appropriately. Toth (2013) discusses the ways in which an individual assessment can be set up with three parts: an initial rough sketch research proposal, which includes the data students intend to present; the infographic (which is shared with the whole class), and a reflective, evaluative piece on what their intentions were, what they learned, and how they would do things differently in future. Formative assessment could include online infographic drawing module embedded within the Learning Management System that teachers can use either in a face-to-face lesson, or as an online module. The module should be specifically aimed at the level and discipline of the students, and assume no specialised knowledge of drawing, industrial design, or computer graphics.

Students must have clear instructions for expectations, including exemplars that are of the standard that they are expected to produce. Previous work student exemplars are critically important, as students will often look to professionally produced infographics for inspiration, however not having the professional design skills may tempt students to plagiarise online infographics, rather than create one that they think is very poor quality in comparison to the professionally created one. By providing them with multiple examples of previous student work, students gain realistic expectations of the quality of the work they are required to produce. It is important to reiterate with student infographic assessments that professional design skills are not required and are not assessed; what is important is the quality of information being presented and the organisation of the infographic in terms of how it is presented. Clarity and quality of information are the key criteria in student work on infographics.

Toth (2013) notes that in their assessments, the quality of the infographics that the students produced varied widely. Some were very high quality, some very low. The most common trouble areas Toth noted were organisation, clarity, text and consistency: poor organisational structure; information that was unclear; too much text; and inconsistency with the use of visuals and text. It was also noted that students commented positively on the infographic assignment, including that it helped them tie together concepts from earlier in the semester; they enjoyed the freedom of creating an infographic; and they found it “fun”. Students also noted that they were surprised at how much work and thought was involved. From a marking perspective, it was noted that infographics are less time consuming to mark than longer papers.

Designing an infographic in terms of the use of colour and graphics is only one part of the process of creating an effective product: it is also critical that infographics are created ethically and responsibly. Creating a compelling infographic from primary research can be challenging: there is the chance of oversimplification, and to inadvertently (or otherwise) distort data (Otten, Cheng & Drewnowski, 2015). As Molek-Kozakowska (2019) notes, one of the challenges of the popularisation of science, including the creation of media forms which include visual enhancements that are understandable to a lay audience, is to ensure that they continue to frame scientific work legitimately, without distorting, aggrandising, or sensationalising it.

This raises issues in relation to the information that is provided to students. What data or questions do educators use to shape the complexity of the infographic students are expected to produce? How do educators frame expectations without being too limiting? How can educators teach students about ensuring that infographics are scientifically responsible?

One risk is misinterpretation of what is represented, which can be due to a number of factors. Successful creation and interpretation of infographics is dependent upon accurately decoding the visual information into a message about the underlying data (Byrne, Angus, & Wiles, 2016). Motivation and prior knowledge have also been shown to be key factors in information retention. That is, if a student lacks either the motivation or the ability to process the message (including through lack of prior knowledge of a topic), they are more likely to show low levels of understanding (Lee & Kim, 2016). In regards to infographics, care must be taken with students who have poor language skills in the language infographics are presented in, as it has been shown that foreign language students learning can be negatively impacted due to interpretation of visual, textual and cultural language conventions, resulting in an inability to distinguish relevant and irrelevant information, and instead focus on the more superficial, rather than substantive aspects of the infographic (Lee & Kim, 2016).

The convincing nature of infographics can be somewhat of a double-edged sword. Whilst numerical data and statistical information are more convincing and concrete because of the use of graphics (Aydin, Aksut & Demir 2019), however this is also potentially an issue if that data or information is used irresponsibly. As Toth (2013, p. 449) writes, infographics that use statistical information in some way present an illusion of trustworthiness due to their visual nature, and viewers “are more likely to believe information presented on infographics”. Therefore, educators need to assist students to make ethical and responsible choices when creating them. Otten, Cheng and Drewnowski (2015) argue that collaborative, team-based activities are a way to potentially alleviate potential issues around the misuse of data in the creation of infographics in learning and teaching, as active input from multiple team members reduces the possibility that data will be ambiguous or inaccurately represented.

Infographics, digital literacy, and future focused education

Teaching students digital literacy is a key employability and life skill, and accordingly is also a key priority of higher education institutions, in order to enhance student employability. In the online, information overload environment, students are required to make informed judgements about information, and particularly online information: to navigate, critically evaluate and responsibly use information (Feerrar, 2019). That is, students need to be able to not only use and create digital tools, but also think critically in the way they consume them (Feerrar, 2019). When it is now so easy to consume and disseminate information digitally, it is the responsibility of educators to ensure that students understand the implications of creating socially, politically, ethically and scientifically responsible information. This includes determining appropriate media, making effective design choices and reflecting on the ethics and impact of their work. Creating visual media such as infographics, videos, and animations are vital to digital literacy (Hobbs, in Feerrar, 2019).

Students need to be taught how to judge infographics in order to create their own effectively. Toth (2013) recommends a critical analysis that incorporates an understanding of infographics as a media genre, a comprehension of the informative and persuasive techniques that are used to successfully communicate their message, an application of the traits of effective document design, and an understanding of the topic or disciplinary context in which they are to be used.

Educators need to prepare students for the future. Price (2017) argues that there is currently a mismatch between both current and future employment needs and contemporary higher education models, and that the critical gap is in interpersonal and professional skills. Graduates are critically underemployed: not working as many hours as they want to, and not doing the level of job that their degree prepared them for. There has been much discussion around changing the higher education system for a long time, Price argues, but we’re still not delivering on what needs to change. Students need high-level critical knowledge skills: less knowledge for its own sake and much more of how to responsibly apply, analyse, evaluate and create it.

Teaching, in any discipline, should always include a critical understanding of the importance of ethical issues in relation to the presentation of data, to use information responsibly, and that information cannot be divorced from its social, political and cultural contexts. Educators have a responsibility to teach students digital literacy, to ensure that they are critically evaluating information, including questioning the credibility of data sources, examining structural manipulation, and are aware of the ways in which statistics can be used to mislead (Otten, Cheng & Drewnowski, 2015). The use of infographics in higher education must include teaching students the

capacity to read and interpret digital content in a critical manner, so that they understand that the presentation of information is always socially, politically, commercially and culturally contextualised.

Conclusion

This paper has discussed the use of infographics in a higher education context, including the benefits and risks in their use in learning and teaching. It has argued that the use of infographics in higher education requires the inclusion of digital literacy, which is not simply the capacity to skilfully use digital tools, but also the capacity to critically engage with digital content. Information is always presented in ways that are designed to influence understanding. To be digitally literate is to have the knowledge and skills to use and create digital media responsibly and ethically. Digital literacy and infographics are as much about understanding the use of ideas as they are about the use of technology. This paper has also argued that although there are potentials risks with the use of infographics – particularly in a scientific context – the risk of the misuse of data and information through the use of the incredibly popular infographic type formats only adds weight to the argument that, from a digital literacy perspective, they should be incorporated into learning and teaching in a structured, scaffolded manner, so that students learn to critically engage with information, to provide them with essential lifelong learning skills and take them forward into the future.

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Please cite as: Darcy, R. (2019). Infographics, assessment and digital literacy: innovating learning and teaching through developing ethically responsible digital competencies in public health. In Y. W. Chew, K. M. Chan, and A. Alphonso (Eds.), *Personalised Learning. Diverse Goals. One Heart. ASCILITE 2019 Singapore* (pp. 112-120).