

Is a Picture Truly Worth a Thousand Words? Infographics for Undergraduate Teaching

Riana Steyn*, Adriana Botha, and Nita Mennega

Department of Informatics, University of Pretoria, Pretoria, South Africa

*Riana.steyn@up.ac.za

Abstract.

Infographics, have emerged as an appealing academic tool. Supplementing traditional learning material such as textbooks, or PowerPoint slides, infographics allow for summarised versions of the same material.

Millennials want access to relevant information literally at the click of a button. As educators, we have to find a way of engaging these students with new teaching practices and new learning styles. The researchers commenced on a quest to see how they could engage these students, not only by teaching them the relevant knowledge, but also by allowing these students to use a simple infographic, which covers an entire study theme, and testing the students' perception of the use of infographics as a substitute for or even to replace "traditional" PowerPoint slides. The infographic was guided based on the 5 principles of the Gestalt theory.

The study was conducted on 210 student participants, with limited prior experience of infographics.

The infographic was perceived as a great tool and of good quality, which they would prefer to use as a study method over PowerPoint slides.

As educators, we need to find ways in which to incorporate infographics as a learning approach, to enhance the learning experience of students.

It is recommended that educators explore visual tools to enhance the learning experience and to retain the knowledge to which our students have been exposed. It is further recommended that infographics should be evaluated based on the five principles of Gestalt to not only improve designs, but also student experience.

Keywords: Infographic, Visual communication tool, Learning tool, Hybrid learning, Traditional learning approaches

1 Introduction

Teaching has long surpassed the handing out of a textbook, which includes all the content required for the term, semester or even year, or giving students a set of PowerPoint slides that they are expected to use, and add additional notes or summaries. Students are engaged with technology everywhere one looks. As educators, we need to find the means to embrace these technologies to engage more effectively with the students. As Puttnam [1] rightfully states: "If we want to win back the trust of young people, we need to engage far more effectively with their world – learn to view technology, and the way in which they relate to it – through their eyes." The reality of

the students with whom we work is “always on/never off”, as coined by Ashraf [2] and Pullan [3]. Turpie [4] said that “new technology and digital media engage young people from the day they enter the world”. The students referred to here are millennials, who are “the first generation growing up with the internet” or even further Generation Z [5], which are students born after 1995. Kalantzis [6] says that, with this ever-changing world, perhaps we – as educators – should lead the change. Bradshaw and Porter [7] note that most people are visual learners. Therefore, using visual aids as a teaching mechanism is inevitable.

Many universities are forced to engage in a blended learning environment where technology-mediated learning and face-to-face sessions have to merge [8]. Kirkwood and Prince [9] also noted that technology is no longer a field only for enthusiasts or novel users. All lecturers should engage with technology [10, 11]. This new context of technology needs to be understood [10], and as educators, we should find the means to embed our understanding of technology within the existing classroom. Davidson, Major and Michaelson [12] talk of the notion of getting students to become “*active participants in the learning process*”, and not just having them sit in a classroom, listening to a lecturer and then repeating the theory back to the lecturer.

Vanichvasin [13] confirms three aspects of infographics in the learning process: appeal (as a communication tool to engage students), comprehension (to connect subject matter and conceptualise it) and retention (to make knowledge more memorable).

This paper explores this notion by allowing students to give their viewpoint on the use of an infographic as an additional learning tool to assist them by supporting the traditional PowerPoint slides that educators love to use.

2 Literature Review

Yildirim [14] notes that many teaching approaches have adopted a hybrid approach. Bonk and Graham [15] define blended learning as the combination of “face-to-face instructions with computer-mediated instruction”. Bender [16] talks about hybrid learning, where a course that has face-to-face classes on campus has an additional web component that is linked to the course. Woods, Baker and Hopper [17] confirm this when they talk about the web-based augmentation of the traditional classroom setting. Bender [16], Rosenberg [18] and Wilson [19] talk of the best of both worlds: this phenomenon of combining physical classroom interactions with some sort of web component.

Yildirim [14] states that one of the most crucial forms of presenting information is through the use of visual aids. Visuals evoke emotions and create experiences [7], which is one of the reasons for the effective use of visual aids in a classroom environment. However, Yildirim [14] also says that no matter what visual aid, tool or technology one uses, each aid has its own properties of information, intended use and learner preferences.

Yildirim [14] continues to note that graphics allow for the visual presentation of information and that, in today’s teaching environment, infographics are seen as a new type of material that provides information to fit within a certain scope or flow. “Too

much information can be presented with very little explanation,” [14]. He further defines an infographic as “presenting information within a certain flow with the help of various visuals and texts in a visual form,” [14] which is similarly defined by Sudakov et al. [20], who use words such as “images combined with knowledge”. It is important to note that the information should be presented in a logical sequence, this is where the Gestalt theory plays a crucial role. Gestalt says that one should not only focus on the individual parts, but that the whole effect of the picture should also create a “whole effect” [21] or “gestalt” and that one experience perceptual wholes, and not necessarily isolated parts. Wertheimer and Riezler [22] defines gestalt as “what happens to a part of the whole is, in clear-cut cases, determined by the laws of the inner structure of its whole”, thus the individual pieces are driven or determined by the structure of the entire whole, also mentioned as the context.

Infographics stimulate a human’s visual system in order to recognise certain patterns and trends [20], and effective infographics present the data in pleasing and simplistic ways. Williams [23] defines infographics as “the statistics, patterns and trends in information; the characteristics of the information landscape” However the “trick” is to see how the whole picture says something relevant and once one starts looking at the individual parts, these also convey their own message [21]. Wang [24] confirms the use of Gestalt as “there are many ways Gestalt principles can help us organize and present visual information better in an infographic, especially if you are dealing with complex information” and this paper uses complex information in an academic setting.

Infographics are increasing in popularity in the education environment [7, 14, 20, 25]. Yildirim [14] notes that the strongest aspects of infographics are their flexible structure, the fact that they allow information to be visual, and that they can be prepared in alternative forms, which means that each infographic can look different.

For the purpose of this research, an infographic was designed based on the first study unit of a first-year undergraduate course in business analysis and design. The infographic is a one-page view (see Annexure A), which is broken down into the four study units, from a broader viewpoint, but once you start reading the context, you will note each section relates to a theme within the broader study unit, thus gestalt.

2.1 Quality of Infographics

Gestalt theory has five principles which should be followed during design. These principles [24, 26] will now briefly be discussed.

- Similarity: Relationships are created by sharing visual characteristics. Colour was used extensively in the infographic to create relationships amongst objects, as well as borders around the various sub-themes within the study unit. See Annexure A, Section A for an example.
- Continuation: an object will allow the eye to follow in a specific direction once the eye is fixed on the object, until another object interrupts the flow. An example of how it is applied can be seen in Annexure A, Section B. The bold green lines show that three topics exist, but the bold green arrow indicates the flow and thus ensures continuation is achieved.

- Closure: this principle is applied which allows the eye to close the loop, or the gap, it is also mostly recommended in art work, mosaics or sculptures. This infographic did not include this principle due to the nature of the work. As this infographic already summarises almost 69 academic slides and content in total, we did not want to create confusion amongst the students to allow them to try and close the loop or fill the gaps.
- Proximity: Placing objects together makes them seem like a group, this can be applied in various ways. This was applied by breaking down the infographic into the various study themes within the entire study unit and placing borders around these themes.
- Figure/ground: This is the relationship between objects and its surroundings. The layout was based around a clock, where one moves clockwise around the various study units.

In addition to Gestalt’s theory which purely focuses on design, various other authors have also listed certain points or aspects which they consider to be relevant for creating infographics specifically. The infographic used for this study was designed to ensure a positive learning experience for the students. To determine if the infographic designed for this paper was considered good, the researchers addressed the characteristics of a good infographic according to various authors as follows (Table 1):

Table 1 Infographic characteristics

| Characteristics | Applied for this study |
|--|---|
| Purpose of the infographic [14] | The infographic was designed to determine if one can replace the traditional PowerPoint slides with one view. Thus, 90 slides were consolidated into one view |
| Quality of the visuals and design [7, 14, 21, 22, 24, 25] Level of visualising the information [14, 25] Information and visualisation of the information should be top quality (no errors, no unnecessary information should be displayed) [14]. Every element should do something [25]. | The students were asked to evaluate the infographic, in two ways. First, they had to answer a question in an Answer Garden: “Type one word that you think describes the infographic.” Secondly, they had to complete a questionnaire based on the quality by answering the following question: “Rate the quality of the infographic based on the following”: Content/Layout/Visuals/Consistency between information and visuals/No errors/No unnecessary information/Colour appropriate/Preferred layout |

2.2 Further Background to the Study

This infographic was designed by the researchers with the help of an instructional designer, as Yildirim [14] highlighted that instructional design is a crucial element to creating infographics.

The content of the specific study unit, Systems Theory, was analysed to determine the most important concept of the study unit. Thus, the main information required on the infographic was determined and extracted from the PowerPoint slides as a consolidation of the main concepts, normally presented in 90 slides, into one view. This information was handed to the graphic designer with a brief plan or layout of what the researchers had in mind. The infographic evolved through various iterations. The final version can be viewed in Annexure A.

3 Method

As part of a first-year course called Systems Analysis and Design, which was presented at an urban university, the students had to grasp key concepts of the Systems Theory study unit. This research was conducted on completion of the first study unit, four weeks into the students' first semester of studies. Although it was assumed that the students had little experience of infographics as a learning tool, this was one of the questions asked during the data gathering. The classes were split up into three groups, with their first contact session of the week either a Monday or a Tuesday. This is relevant since the infographic was distributed in colour, printed in an A4 format, to all the students who attended the classes during their first contact session of the week, thus either on a Monday or a Tuesday.

The teaching of this study unit was traditionally through additional reading material in a portable document format (PDF) and PowerPoint slides that were created and made available to students through the learning management system (LMS) Blackboard. In total, there were 91 slides for the entire Study Unit 1, of which 22 were seen as being "empty" thus no new content. They were the introduction slides, the exercise slides or a few recap slides. Thus, 69 slides contained the content for Study Unit 1.

At the end of each study unit, the students have to write a quiz based on all the work covered in the slides. The quiz is online and they write it in their own time, this was written on the Friday before the infographic was distributed in class. They could use their learning material if they wanted to. During the following class (the Monday or Tuesday class), the students all received a hard copy of the infographic in colour, which was the first time they had seen the infographic. They also had to complete an Answer Garden stating what they love or hate about the infographic in one word. Of the 352 students enrolled for this subject, 209 completed the questionnaire, implying a 59.4% response rate. The Answer Garden received 290 responses. The assumption the researchers made due to the difference in responses was that a student could have provided more than one word in the Answer Garden. They were given 10 min to read it, and were then given a quiz consisting of 10 questions, randomly selected from the same question bank as their first quiz on the Friday. They then had to complete the quiz using the infographic to answer the questions. After the quiz, they were asked to navigate to the Answer Garden and type one word they thought best described the infographic. The students then had to complete an online questionnaire on Google Forms, consisting of 16 questions, on their experience and perception of the infographic, as well as the quality of the infographic. The feedback from the questionnaire was then analysed.

4 Findings

An Answer Garden is a free tool available on <https://answergarden.ch/> [27] that allows one to generate responses based on a specific question. As the respondents give their answers, a word cloud instantly grows, with repeating words growing bigger. The responses from the students can be seen in Fig. 1.



Fig. 1. Answer Garden word cloud

It is evident from the word cloud that the word “helpful” was the most repetitive word, by accumulating 51 responses. This was followed by: Informative – 21 responses; Useful – 19 responses; Convenient – 18 responses.

Thus, overall, there was a positive response from the students’ side towards the infographic. The students were asked to be brutally honest and, if they hated it, they could also state that. There were a few negative responses, such as “useless” (1 response), “boring” (1 response) and “busy” (2 responses). This was expected as people do not agree on everything. However, the low negative response showed that, overall, the majority of the students could see the value of infographics.

The students then had to complete the questionnaire on Google Forms. This was completed during class time. Of the 209 respondents, the majority were male students (69.4%), followed by female students (58.7%) and those who preferred not to say (1.9%). Looking at their ages, 97.1% of the students belonged to Generation Z, thus were born after 1995.

Asking them if they had ever used or seen an infographic as a study tool before, 56.5% said “No”. The rest said “Yes”.

Printed textbooks, infographics and PowerPoint slides were the most preferred study methods. Interestingly, videos were only selected by 42% of the respondents, which is in contrast with the findings of Steyn et al. [11] and Yildirim [14]. By Selecting other one respondent said: “By making personal notes from information collected during class and out of a textbook”.

The next section of questionnaire related to the actual focus of this paper, which was the link back to a good-quality infographic. These questions were asked in the form of a Likert scale, with 1 being poor and 5 being excellent.

The main question asked was: “Rate the quality of the infographic based on the following”: (1.) Content; (2.) Layout; (3.) Visuals; (4.) Consistency between

information and visuals; (5.) No errors; (6.) No unnecessary information; (7.) Colour appropriate; (8.) Preferred layout. It is evident from Fig. 2 that most of the students thought the infographic was excellent to above average for all the categories. Thus, did the infographic meet the characteristics as set out by the literature? The answer is: “Yes, most definitely”.

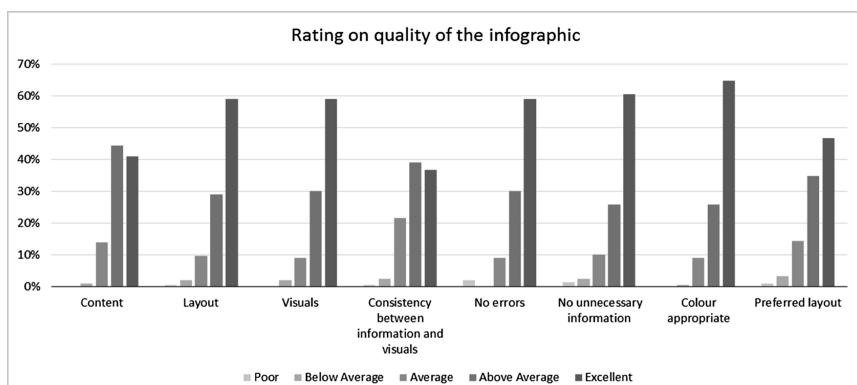


Fig. 2. Quality rating

Their opinion on whether they thought the infographic was an effective tool from which to study for Study Unit 1. Some 94% of the students said “Yes”.

Students were asked their perception or opinion on the successful use of Infographic in the following contexts: (1.) In Presenting lectures; (2.) In explaining study material; (3.) Used in learning activities; (4.) Showing examples; (5.) In summarizing content. Figure 3 clearly show various areas where student felt infographics could successfully be applied during their studies.

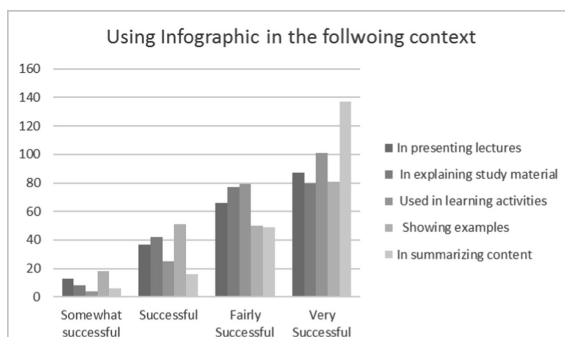


Fig. 3. Using infographic in the following context

Additional comments about the infographic were: “Brilliant thank you!”; “It is a really good tool and I’m glad you did it for us.”; “It is a good summarisation of the work but it is a bit too clustered.”; “Loved it.”; “Really enjoyed it. Glad it was made.”; “Supercalifragilisticexpialidocious.”; “This infographic is extremely helpful. I hope this form of study is implemented in all modules.”; “Why have we not done this before? This is a great way of learning...”

Some of the more constructive comments were: “Examples and short definitions, would not recommend for studying but as a nice summary of the content I would recommend every student to have an infographic.”; “The infographic is an excellent assisting tool. However, it does not contain all the required detail for someone who knows nothing about the content of the work. Brilliant for someone who has been through the work before.”

5 Discussion

As educators, we have to engage students in “their” world, and one of the ways this paper focused on was designing an infographic to assist the students in grasping large amounts of information at a glance.

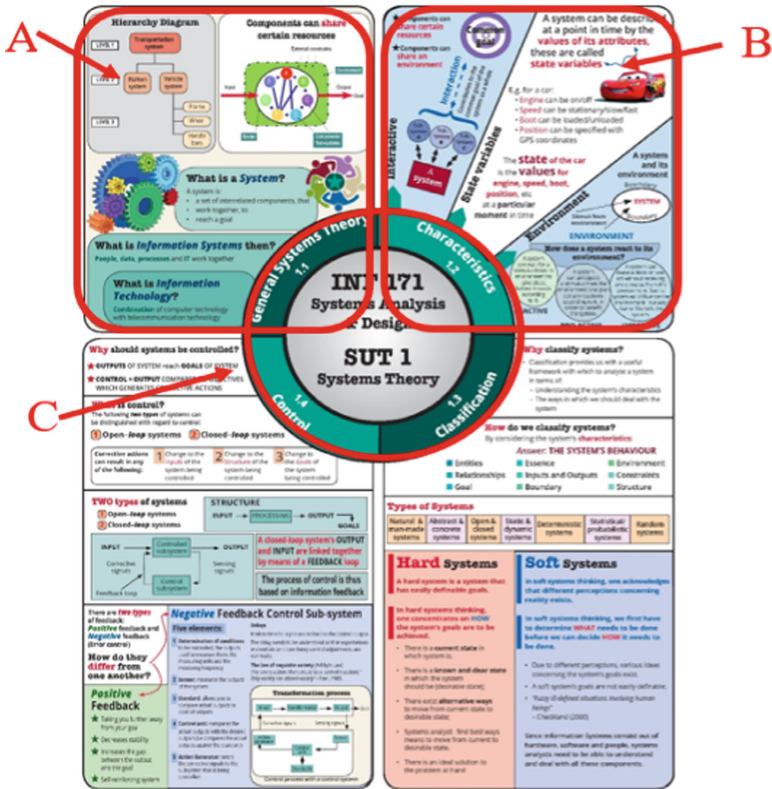
The infographic that was produced clearly ticked all the boxes when it came to the design and characteristics of a good infographic as a teaching tool as identified [7, 14, 22]. It also followed the Gestalt theory’s principles for design [22, 24] to ensure that it is not just pictures and words placed onto a page to try something, but with careful planning and design, the end result can ensure that knowledge is not only transferred, but also laid down in the foundation of the students.

The next part of this research will focus on the true impact of the infographic on the knowledge retention of students.

6 Conclusion

This paper set out to determine whether an infographic can be used to enhance students’ learning abilities and, in the end, replace the “traditional” PowerPoint slides that educators love to hand out. By careful planning and designing these types of interventions, one can get to a place where knowledge is embedded in these student’s minds which they can use in their further studies and in the end apply when they enter their work environment. The results showed that the students felt that the quality of the infographics was good and acceptable for them to use in Study Unit 1 and they were excited that lecturers are exploring different teaching methods to truly engage with them.

Annexure A



References

1. Puttnam, L.: Creative learning through technology. In: Wright, S., Kieffer, J., Holden, J., Newbiggin, J. (Eds.) CreativityMoneyLove: Learning for the 21st Century (2012)
2. Ashraf, B.: Teaching the Google-eyed YouTube generation. Educ. Train. **51**(5/6), 343–352 (2009)
3. Pullan, M.C.: Student support services for millennial undergraduates. J. Educ. Technol. Syst. **38**(2), 235–253 (2009)
4. Turpie, J.: Creative engineers. In: Wright, S., Kieffer, J., Holden, J., Newbiggin, J. (Eds.) CreativityMoneyLove: Learning for the 21st Century (2012)
5. Wikipedia: Generation Z (2017). https://en.m.wikipedia.org/wiki/generation_Z. Accessed 9 Feb 2017
6. Kalantzis, M.: Changing subjectivities, new learning. Pedagog. Int. J. **1**(1), 7–12 (2006)

7. Bradshaw, M.J., Porter, S.: Infographics: a new tool for the nursing classroom. *Nurse Educ.: Technol. Corner* **42**(2), 57–59 (2017)
8. Kirkwood, A., Price, L.: Learners and learning in the twenty-first century: what do we know about students' attitudes towards and experiences of information and communication technologies that will help us design courses? *Stud. High. Educ.* **30**(3), 257–274 (2005)
9. Kirkwood, A., Prince, L.: Technology-enhanced learning and teaching in higher education: what is 'enhanced' and how do we know? A critical literature review. *Learn., Media Technol.* **39**(2), 6–36 (2014)
10. Laurillard, D.: The pedagogical challenges to collaborative technologies. *Comput.-Support. Collab. Learn.* **4**, 5–20 (2009)
11. Steyn, R., Millard, S., Jordaan, J.: The use of a learning management system to facilitate student-driven content design: an experiment. In: Huang, T.-C., Lau, R., Huang, Y.-M., Spaniol, M., Yuen, C.-H. (eds.) *SETE 2017. LNCS*, vol. 10676, pp. 75–94. Springer, Cham (2017). https://doi.org/10.1007/978-3-319-71084-6_10
12. Davidson, N., Major, C.H., Michaelsen, L.K.: Small-group learning in higher education - cooperative, collaborative, problem-based and team-based learning: an introduction by guest editors. *J. Excell. Coll. Teach.* **25**(3&4), 1–6 (2014)
13. Vanichvasin, P.: Enhancing the quality of learning through the use of infographics as visual communication tool and learning tool. In: *ICQA 2013 International Conference on QA Culture: Cooperation or Competition*, Bangkok (2013)
14. Yildirim, S.: Infographics for educational purposes: their structure, properties and reader approaches. *Turk. Online J. Educ. Technol.* **15**(3), 98–110 (2016)
15. Bonk, C.J., Graham, C.R.: *The Handbook of Blended Learning: Global Perspectives, Local Designs*. Pfeiffer, San Francisco (2006)
16. Bender, T.: *Discussion-Based Online Teaching to Enhance Student Learning: Theory, Practice, and Assessment*, 2nd edn, p. 256. Stylus Publishing, LLC, Virginia (2012)
17. Woods, R., Baker, J.D., Hopper, D.: Hybrid structures: faculty use and perception of web-based courseware as a supplement to face-to-face instruction. *Internet High. Educ.* **7**, 281–297 (2004)
18. Rosenberg, M.J.: Knowledge management and learning: perfect together. In: Reiser, R.A., Dempsey, J.V. (eds.) *Trends and Issues in Instructional Design and Technology*. Pearson, Boston (2012)
19. Wilson, R.W.: In-class-online hybrid methods of teaching planning theory: assessing impacts on discussion and learning. *J. Plan. Educ. Res.* **28**, 237–246 (2008)
20. Sudakov, I., Bellsky, T., Usenyuk, S., Polyakova, V.V.: Infographics and mathematics: a mechanism for effective learning in the classroom. *Probl., Resour., Issues Math. Undergrad. Stud.* **26**(2), 158–167 (2016)
21. Behrens, R.R.: Art, design and gestalt theory. *Leonardo* **31**(4), 299–303 (1998)
22. Wertheimer, M., Riezler, K.: Gestalt theory. *Soc. Res.* **11**(1), 78–99 (1944)
23. Williams, F.M.: Diversity, thinking styles, and infographics. In: *12th International Conference of Women Engineers and Scientists* (2002)
24. Wang, L.: Gestalt principles for information design. In: *HOW Magazine* (2017)
25. Saunders, D.H., Horrel, A., Murray, A.: Infographics for students assessment: more than meets the eye. *BJSM* (2017)
26. Staff: Gestalt theory in typography & design principles. In: *HOW Magazine* (2015)
27. AnswerGarden: Answer Garden (2018). <https://answergarden.ch/>. Accessed 20 Feb 2018