

# INFOGRAPHICS: IN SUPPORT OF ONLINE VISUAL LEARNING

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## ABSTRACT

*Many students have an improved ability to learn and remember when offered multi-modal content that includes text and visuals. Can infographics, illustrations that use graphic elements and text to present information, be incorporated into online classrooms to enhance student learning? To examine this question, the researcher created a causal comparative study utilizing infographics as weekly course content summaries. Based on quizzes and a post assessment, the study indicates that students perceived the infographics to be valuable, students utilized the infographics and students had preferences for infographic design. The following paper will present theories about visual learning, a description of this infographics-based learning experience including a review of literature, description of the study, study results, discussion and conclusions.*

**Keywords:** Infographics, Online, Learning, Engagement, Visual.

## INTRODUCTION

A picture paints a thousand words, while this is a common English Language Idiom, the phrase is true, and at least it is true for many people and many learners. As educators and trainers, we strive to create content that is meaningful and supports a variety of learning needs. Copious research supports the idea that visuals are important in the learning process. Some learners experience enriched learning with pictures,

*“We learn and remember best through pictures, not through written or spoken words” (Medina, 2008).*

Other learner’s value pictures in combination with text,

*“People learn and remember more efficiently and effectively through the use of text and visuals than through text alone” (Dunlap & Lowenthal, 2016).*

Infographics are tools that combine pictures and text to succinctly frame information and ideas. But, can infographics be used to support student learning in the online classroom? To examine this question, the researcher created infographics for an online management course. Each weekly infographic depicted major course concepts and was presented to the learners as a weekly content summary. The following paper will outline this infographics-based learning experience in five sections. First, describing relevant research that supports the use of visual communications in the online classroom. Next, a description of infographic design best practices based on a review of literature. Third and overview of the study procedures and methodologies. Fourth, a presentation and discussion of study results and finally, conclusions.

## Visual Communication

In 1983, psychologist Howard Gardner introduced his book, *Frames of Mind*. Dr. Gardner's book presented his theory on multiple intelligences, the theory that people possess multiple types of intelligence and can learn through these various modalities. Among the seven intelligences, Gardner identified visual-spatial intelligence. Gardner describes visual-spatial intelligence as the capacity to use representations to perform valued activities in the world (Gardner, 1983).

*“Gardner’s version of visual-spatial intelligence incorporates the abilities to perceive the visual world accurately, to evaluate and modify those perceptions according to subsequent experience and to recreate components of a perception even without the physical presence of the original stimulus”* (Cary, 2004).

Interesting, Gardner is certainly not the only theorist to recognize that many people have visual learning preferences. In Fleming & Mills (1992), Mills introduced four sensory modalities that are used for learning information, Visual, Aural, Read/Write and Kinesthetic or VARK. The first modality is visual, describing a learner that prefers the depiction of information in maps, diagrams, charts, graphs, flow charts, circles, hierarchies and other devices used to represent and exchange information (VARK, 2019).

Through the years, many researchers have found evidence that visual tools support cognition. In fact, 65% of the population has a preference towards visual learning (Gutierrez, 2014; Wallagher, 2016). Visuals are not only learner preferred, training and educational professionals have identified that visuals support efficient teaching. According to the Visual Systems Division (1997), visual are processed 60,000 times faster in the brain than text and visual aids in the classroom improve learning up to 400 percent. Ideas presented graphically are easier to understand and remember than those presented as words, (Kliegel et al., 1987). Visuals are more easily processed as it takes about ¼ of a second for the human brain to process and attach meaning to a symbol and it takes about 6 seconds to read 20-25 words (Thorpe et al., 1996). As the power of visual learning becomes apparent, visual learning opportunities are increasing in prevalence; in fact, the application of visual learning tools has increased over 9,000 percent since 2009 as people try to manage the information overload available through improved technology (Coulter, 2015).

Infographics are one of the many visual learning tools available to support learning and retention. Infographics are not new; in fact they have been utilized for hundreds of years. Maps from 8000 years ago can be considered a form of infographics as they were visualizations that combined words and pictures to transfer information (Thompson, 2016). Through the century's, notable individuals like economist William Playfair (1759-1823) and Florence Nightingale (1820-1910) used infographics to communicate. Play fair used illustrations and words to communicate large amounts of data in his research and Nightingale used “*rose diagrams*” to communicate death classifications from disease, war, wounds and other (Thompson, 2016). While used for centuries, infographics have experienced an upsurge in popularity over the last few years from industry (Williams, 2019) and academics (Dai et al., 2014). Consider, that more data has been created in the past two years than in the entire previous history of humans (Marr, 2015) and infographics are valuable tools for condensing and managing volumes of complex information (Conner, 2017).

Dunlap & Lowenthal (2016) effectively explain the power of infographics and why they have great potential as learning tools,

*“But the power of infographics is that they are a way of delivering the maximum amount of content in the least amount of space while still being precise and clear; because they are visual presentations as opposed to oral or text presentations, they can quickly tell a story, show relationships, and reveal structure”.*

As infographics can summarize large amounts of information using pictures and text, they may be a valuable tool to include in the online classroom. Not only must online faculty, present large amounts of information to distant learners, online faculty members often have students from all over the world learning together in one course. Online faculty should aim to present course content succinctly and in a variety of modalities to support independent and diverse learning needs.

However, many online courses are heavily based in text only content. When course content is primarily offered through text, students who prefer visual learning methods may experience a less than optimal learning environment. Considering that 65% of learners report they are visual learners, it seems reasonable that text heavy courses may not address the learning and retention needs of many students. Infographics may be one tool that can be included within an online course to support visual learners and diverse learning needs.

## LITERATURE REVIEW

There are many faculty and researchers exploring and studying the value of infographics as learning and communication tools. The following literature review will provide an overview of five research studies that delve into the experience and impact of infographics in the learning process.

Miller & Barnett (2010) conducted a study to specifically examine how audiences respond to environmental health risk information presented in an infographic format. To perform this study, the researchers modified an actual news story from the Pennsylvania environmental cancer scare with the intent of understanding how the graphic representation of risk related data influenced risk perceptions among readers. Three different communication tools were created and presented to 138 undergraduate students. The first infographic included no text and only a map that identified cancer occurrences in an apartment complex and suggested a high rate of cancer incidences for the apartment building. The second infographic included the same map but also added a caption with the map offering a textual explanation of the risk. The third communication tool had no map and only text. After reviewing one of the three communication tools, the participants completed a questionnaire. Based on the student's questionnaire responses, the researchers found that there was a significant difference between the group that read the map alone and those that read the textual explanation of the risk without the map. The researchers found that on their own, text and graphics are both useful yet imperfect methods for communication and that a multimodal communication tool that includes both visual and text information may lead to more effective memory retention. Miller & Barnett (2010) conclude that infographics can synthesize information creating benefits to both educators and students alike. Educators can use infographics to present core ideas of a lesson, and students can create infographics for presentations or to summarize valuable facts.

Noh et al. (2014) conducted the study, *The Use of Infographics as a Tool for Facilitating Learning*. The researchers examined the use of infographics as an instructional tool among graphic design and digital media learners at UiTM Maleaka. Ninety-nine learners completed questionnaires recording their experiences with the infographics. The authors found that the infographic quality and design was a significant factor regarding the tool's effectiveness in

disseminating concise information to an audience. Specifically, the researchers concluded that a good infographic design including attractive colors, concise texts and relevant diagrams could encourage better learning outcomes. Also, the researchers identified weak infographic designs and unstructured images failed to convey ideas and information.

In the 2017 study, *Effects of Infographics on Student Achievement and Students' Perceptions* Alrwele (2017) examined the impact of infographics of student achievement. First examining whether the use of infographics resulted in significant differences in university female students' achievement and second, examining the student's perceptions of their learning experience with infographics. 165 participants were divided into two groups, experimental and control. All the participants completed 9 training sessions each session lasting 2 hours. Data was collected through achievement tests and questionnaires. After the analysis, it was concluded that almost 90% of the participants in the experimental group stated that the infographics had a positive impact on their intellectual and affective development.

Bicen & Beheshti (2017) published the study, *The Psychological Impact of Infographics in Education*. The object of their study was to investigate students' perceptions about using infographics in education. The quantitative study included 163 undergraduate participants and collected data from surveys with 20 close-ended statements. Based on participant response, the researchers found that almost all the students had a positive opinion about infographics and that the students preferred to study with visual materials rather than books or other traditional materials.

Finally, Yilmaz & Bilici (2018) conducted a study called,

*"An Examination of Postgraduate Students' Use of Infographic Design, Metacognitive Strategies and Academic Achievement"*.

The study explored postgraduate students' academic achievement while studying with infographics. 15 postgraduate students from the Computer Education and Instructional Technology Department of a large university in Turkey, participated in the study and based on four different data collection strategies, the results showed that students' metacognitive strategies scores increased over the four-week period in which the study was conducted. Based on this increase, the researchers concluded that an infographic-based training process had a significant effect on academic achievement and metacognition skills, especially on facilitating the management of the learning process.

Based on a brief review of literature, it is clear many researchers are finding that infographics can support students in learning and retaining new information. Not only are they effective, infographics are a preferred learning tools by some students. However, it is important that the instructor or designer of the infographic have not only content knowledge but awareness of effective visual communication techniques.

### **Effective Infographic Designs**

While infographics have great potential, the infographic designer's ability to communicate succinctly and with visuals will contribute greatly to the effectiveness or ineffectiveness of the learning tool (Jordan, 2019). Not all infographics are created equally. There are important techniques that must be applied to communicate through infographics. For example,

*“When infographics are used in conjunction with activities that require reading and critical thinking, students develop important, transferable skills” (Lamb & Johnson, 2014).*

The following Table 1 offers several tips and strategies for effective infographic development.

Author	Effective Infographic Strategies
Harris, 2013	Maintain a simple and focused infographic.
Richard, 2015	Allow time for design and communication.
Khoja, 2017	Select a topic that people care about.
Fain, Laihow & Claveria, 2017	Keep a specific audience in mind.
Martin, 2018	Present information clearly and truthfully.
Toporoff, 2018	Stick to one topic.
Walton, 2018	Include explanatory narrative in support if comprehension.
Compact Creative, 2019	Create a visual style and clear information flow.
Jordan, 2019	Include credible sources.

## **COURSE DESIGN**

Online courses should be created with the learner in mind, a focus on ease of navigation and a support for clarity of content. For this study, a graduate level management course was created using infographics as one tool that could support both ease of navigation and clarity of content. The course was offered in an abbreviated format to fit an intercession schedule, with 43 students. The goal was to include a weekly infographic summary to the course content and measure if the students perceived the infographic to support their learning and to measure if this infographic enhanced section had higher learning outcomes than other sections of the same course, with the same content, same instructor, but without infographic summaries.

Each week contained a course lecture, course discussion, course readings and a written assignment. Course weeks ran from Monday at 12:01 AM to Sunday at 11:59 PM. Each Sunday, the instructor posted an infographic weekly summary with five key points from the weekly content. In addition, to the infographic, the students had an optional True/False quiz to complete regarding the infographic summaries. The infographics and quizzes were posted on the final Sundays of Week 1, Week 2, Week 3 and Week 4 (Figures 1-4, Appendix 1). After the course conclusion, a post assessment survey was offered asking five questions about the student's experiences learning with infographics.

To create the infographic the instructor identified five key or critical concepts each week that the student must understand in order to be successful in the next week's content. The instructor then used Canva to create the course infographics. For each infographic, five key points were communicated with a picture and five or six descriptive words. Blackboard test design was used to create and present the weekly summary quizzes. Each quiz had five True or False questions, one question for each summary idea. Students were not required to complete the quizzes or the post assessment. Both were optional.

## **RESEARCH METHODOLOGY**

The purpose of this causal comparative study is to test whether students, in an online classroom, perceive infographics to contribute value to their learning experience (SP) and to examine if infographic summaries support student learning performance (LP). The research

design was chosen because it attempts to explore possible causative relationships between an independent variable, infographics and a dependent variable, student's perceptions. The controlled variables include the course lectures, discussion questions, assignments, textbooks and instructor.

### Research Questions

**RQ1** Do students perceive enrichment in their learning experiences with the inclusion of weekly infographic content summaries?

**RQ2** Is there a difference between students' learning performance with the inclusion of summary infographics?

*H1* Online students who utilize summary infographics for content enrichment will have a statistically significantly different perception of their learning experience as opposed to students who utilize text only weekly summaries (SP).

*H2* Online students who utilize summary infographics for content enrichment will have a statistically significantly different learning performance than students who utilize text only weekly summaries (LP).

### PROCEDURES

The instructor offered a four and half week abbreviated session of a graduate management course. The abbreviated course has the same syllabi, same text, same instructor, same discussion questions, same assignments and same Blackboard set up as other course sections that run for a full semester or 13 weeks. However, to support students in identifying key concepts in the abbreviate version, the instructor created weekly infographics that summarized critical or key course. Critical concepts were identified as information students would need to internalize to be prepared for the upcoming weekly course content.

The students were informed that infographic weekly summaries would be offered and that an optional weekly quiz over the infographic content would be available each week. As each week ran from Monday at 12:01 AM to Sunday at 11:59 PM, the infographic and weekly quiz were posted Sunday morning and available throughout the remainder of the course. The weekly quiz grades were recorded and tabulated. After the course ended, students were offered a post assessment to discuss their experiences learning with infographics. The post assessment asked the following five questions:

1. Where the infographics helpful for summarizing key concepts?
2. Which infographic was most helpful?
3. Did the infographics help you prepare for the final exam?
4. Did the infographics support your content retention?
5. Will you create infographics in the future?

To consider the student's perceptions (SP) of their learning experiences with infographics, the researcher reviewed the student responses to the five questions and their responses where quantified and categorized. To further consider the student's learning performance (LP) with the infographic summaries, the overall course grades from the infographic enriched course were compared to the overall course grades of the same course offered in a 13-week format with text only weekly summaries (Steward, 2019).

## Data Collection

Three data collection methods were implemented. First, average scores on the weekly summary quizzes. Second, the student's responses to the post assessment questions. Third, final course grades from the infographic enriched course were compared to the final grades of a different section of the same course with text only weekly summaries. As participation in the infographic exercises was optional, not all students completed all quizzes or the post assessment.

### Weekly Summary Quiz Scores

Each week the students were offered an optional summary quiz over the content presented on the weekly infographic. Each quiz had five questions and each question was worth 10 points. One quiz question corresponded with each of the five key course concepts presented on the weekly infographic. The following Table 2 shows the aggregate scores for the student's weekly summary quizzes. As the quizzes were not required, not all students completed every weekly quiz.

Score	50	40	30	20	10	No Participation
Week One	12	18	8			5
Week Two	33	6				4
Week Three	32	5	1			5
Week Four	27	8	1			7

### Post Assessment Survey about Infographic Learning Experience

After the conclusion of the course, students were given the option to complete a post assessment asking five questions about their perceptions of their learning experiences with infographics. Questions 1, 3, 4 and 5 had a Yes or No response option. Question 2 had the question, "*Which infographic was most helpful?*" and the assessment response options were Infographic 1, Infographic 2, Infographic 3 or Infographic 4. All five questions had a space where students could choose to provide an additional qualitative response. While 41 answered the questions with the preselected answer options, many also added comments to their Question Two response about why they selected preferred on infographic over another. These qualitative responses are shown in Table 3 (Appendix 1). Responses to each of the five questions were scored and results were tabulated as shown below.

Research question	Response (%)
1. Where the infographics helpful for summarizing key concepts?	
Yes	39
No	2
2. Which infographic was most helpful?	
Infographic 1	20
Infographic 2	19
Infographic 3	14
Infographic 4	10
3. Did the infographics help you prepare for the final exam?	

Yes	33
No	8
4. Did the infographics support your content retention?	
Yes	39
No	2
5. Will you create infographics in the future?	
Yes	31
No	10

### Final Course Grades

The final course grades from the infographic enriched course were compared to the final course grades from a previous section of the same course with all the same content, same materials and same instructor, but no infographic summaries (Table 4).

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
Infographic Enriched Section	34	8	1	
Section Without Infographics	27	16	2	1

### DISCUSSION

After a review of data, there are some themes that can be identified. First, the students chose to review and study the infographic summaries. Second, the students reported that the infographics were valuable to their learning experience. Third, there were some infographic designs that the students preferred.

#### Students Chose To Review and Study the Infographic Summaries

Nearly all of the students participated in the optional infographic weekly summary quizzes, 84% participating in Week One, 90% participating in Week Two, 88% participating in Week Three and 84% participating in Week Four. While, the students did not directly state why they chose to consistently, participate in the optional quiz, it can be inferred that students would not engage in optional learning activities that did bring value to their learning experience.

#### Students Report That the Infographics Were Valuable to Their Learning Experience

The post assessment was not required and became available after the course ended. For this reason, not all students responded to or answered the post assessment questions. 41 of the 43 students completed this assessment. Interestingly, 39 of the 41 or 95% answered that the infographics were helpful for summarizing key course concept. 33 of 41 or 80% said the infographics helped them study for the final exam. 39 of 41 or 95% stated that the infographics supported their content retention. Based on this information, nearly all the students in the class expressed finding value in the infographics, specifically from their qualitative responses (Table 3 Appendix 1); the infographics offered a summarization of key concepts and supported their course retention. Additionally, the post assessment Question Two asks, “Which infographic was



*most helpful?*” and eight students or 20% did state that they felt all four infographics were equally valuable to their learning (Table 3 Appendix 1).

### **Students Had Infographic Design Preferences**

Infographics 1 and 2 were clearly identified by the students as most helpful, with 48% selecting Infographic 1 and 45% selecting Infographic 2. Some students explained their preference for Infographic 1 and Infographic 2 and their additional comments are listed in Table 3 (Appendix 1). Through an examination of the Question Two qualitative responses it is explained that Infographic 1 is preferred, in part, because it is a *“set up for the rest of the course,”* and the infographic *“summarized major course ideas.”* The students also described that Infographic 2 was helpful as it had meaningful pictures and *“summarized information well.”* Infographics 3 was preferred at 34% and Infographic 4 was preferred at 24%. This indicates that some students felt some of the infographics were more meaningful or more valuable than the other infographics (Fredrick, 2013).

### **Research Questions**

Regarding Research Question 1,

*“Do student perceives enrichment in their learning experiences with the inclusion of weekly infographic content summaries?”*

Overall, through their quantitative and qualitative assessments, the students self-report perceptions that the infographics contributed value to their learning experience.

Regarding Research Question 2,

*“Is there a difference between students’ learning performance with the inclusion of summary infographics?”*

Some information can be examined through a comparison of the final grades from the infographic enriched and the non-infographic sections. It is noticeable that there are more A’s in the infographic enriched section 34 A’s to the 27 A’s in the non-infographic section. But also, noticeable, there are more B’s in the non-infographic section at 16 compared to the infographic-based section with 8. There is not enough data yet to thoroughly address this question, more sections and applications are needed to determine if there are significant learning difference between infographic and non-infographic-based courses.

### **LIMITATIONS**

This study has a few limitations. First, the infographics have been applied and assessed in only one course section. Further application and assessment would be needed to fully understand the value of infographics and the student’s perceptions of their learning. Second, the two sections compared were of different lengths. One section was 13 weeks long and one section was 4 and half weeks. While the content, the textbooks, the assignments and the instructor remained constant across the sections, the variation in length could account at least in part for the variation in student grades. Third, even though the post assessment was offered after the course ended,

students may feel it was difficult to be completely honest about how their learning experiences and perceptions of the course content.

## **RECOMMENDATIONS AND CONCLUSIONS**

From the review of literature, it should be noted that globally, researchers are finding that infographics are preferred learning tools that support students in learning and retaining content. The literature also discussed the need for strategic and thoughtfully infographic design. Not all infographics support student learning. While there is an abundance of literature studying infographics and learning, there are fewer research studies examining infographics as support specifically for online learners (Babak, 2015).

The conclusions from the review of literature are aligned with the conclusions of this study. In this study, students chose to review the infographics and complete voluntary quizzes on the infographic summaries. In their post assessment, students reported that the infographics were valuable to their learning experience. Students also communicated that they preferred some infographic designs over other infographic designs (Grant, 2013).

Based on the student feedback, the researcher offers four tips that can help design quality infographics for the academic online classroom. First, create infographics that support summarization of course concepts. The students overwhelmingly chose to read and complete a quiz on the weekly summary infographics even though this learning step was not rewarded or required. Second, create infographics that support rapid memorization (Pink, 2011). Student's comments on the post-assessment clarified that many valued the infographic because it helped them memorize course content. Third, create infographics that have meaningful pictures. The purpose of the infographic is to use pictures with some words to support the transfer of information. The pictures should be carefully selected to contribute to content comprehension. Fourth, strategically construct infographics to maximize communication transfer and minimize space. In other words, the students want efficient infographics where every word and picture communicates meaning and learning purpose.

In the post assessment, one student stated of their infographic learning experience, I liked the simplicity of the high-level concepts. This student effectively summarized the purpose of infographics in the online classroom. The infographic has the potential to simplify and communicate high level concepts such that independent and diverse learners can improve their understanding of critical course content.

## **APPENDIX 1**

### **QUALITATIVE RESPONSES TO POST ASSESSMENT QUESTION TWO. WHICH INFOGRAPHIC WAS MOST HELPFUL?**

#### **Infographic One**

- Covered concepts well.
- Important course concepts made clear.
- Increased my understanding of course concepts.
- The infographic helped me pull information from the course readings.
- Basic foundation for the course.
- Summarized major course ideas.
- Describes motivation.
- Summarized all the course concepts well.

- Most detailed.
- Most interesting.
- Motivation.
- Set up for the rest of the course.
- Gave me an idea of the key concepts for the course.
- Told me how the course will be run.

### **Infographic Two**

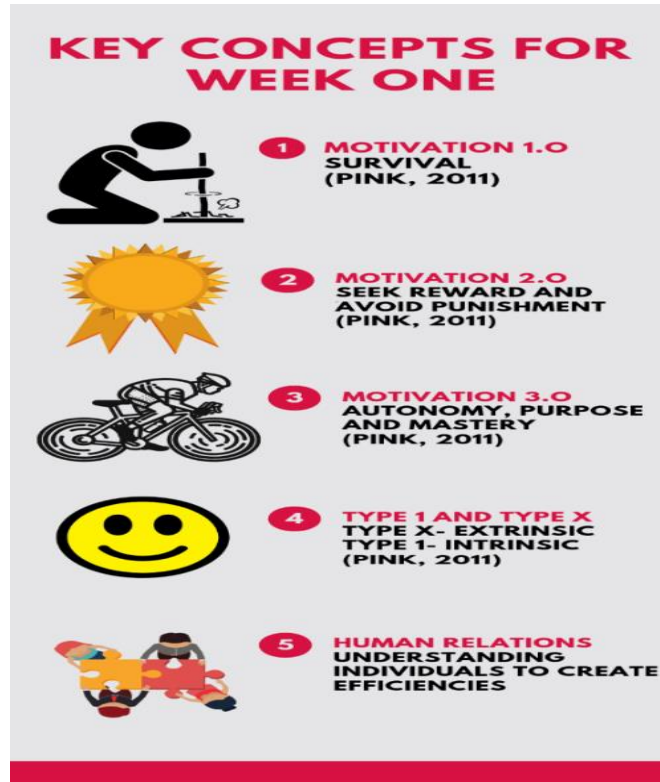
- Supported visual retention.
- Covered concepts well.
- Summarized information well.
- I saved Week Two infographic and referenced for my team.
- Summed up the meaning of mastery.
- Summarized the most chapters.
- Helped me mentally organize the information.
- Broke down chapter content into small sections.
- Helped me understand, why we can't all find a job we love?
- I remember the picture more than any other infographic.
- Most memorable.

### **Infographic Three**

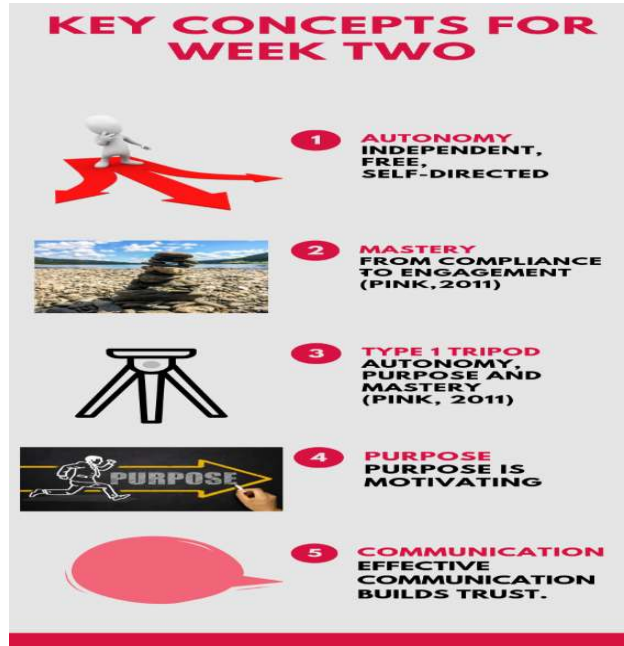
- This week was busy for me so I studied the infographic and could keep up.
- The infographic offered a refresher for CH 5.
- Tuckman's Stages. I memorized from the infographic.
- Brought together ideas from multiple theorists.
- Did not understand the content until I read the infographic.
- Most detailed.
- Most helpful.
- The infographic confirmed my professional experience.

### **Infographic Four**

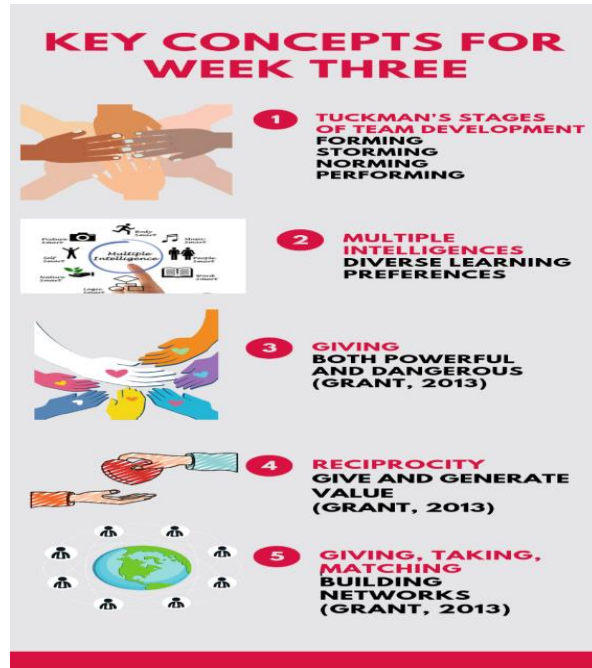
- Enjoyed seeing that volunteering increases happiness.



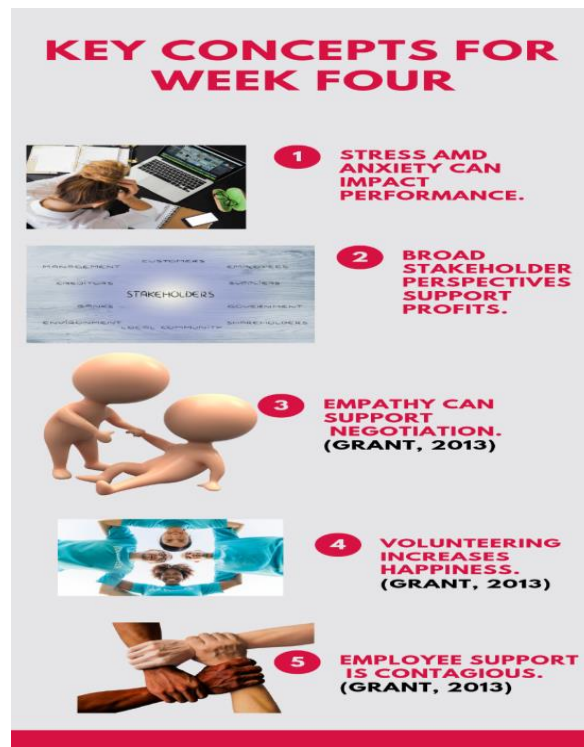
**FIGURE 1**  
**INFOGRAPHICS USED IN WEEK 1 OF THE STUDY**



**FIGURE 2**  
**INFOGRAPHICS USED IN WEEK 2 OF THE STUDY**



**FIGURE 3**  
**INFOGRAPHICS USED IN WEEK 3 OF THE STUDY**



**FIGURE 4**  
**INFOGRAPHICS USED IN WEEK 4 OF THE STUDY**

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