Implementation of Formative Assessment in Teaching Infographics

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ABSTRACT

Designing learning instruction or pedagogical activities is one of the elements in constructive alignment. Constructive alignment is needed to assess students' learning on the concept of infographics. In teaching the concept of infographics with good storytelling, students need to understand the principles and categories of visualization. This concept is quite challenging for students to understand and implement in real situations. Based on the given data, most of the students have used the wrong visualization technique. Therefore, this article provides the explanation on how a formative assessment can be conducted via online. In doing this, the researcher involved a group of postgraduate students in a case study. Findings show these students can improve their design via group work activities. Hopefully, this article contributes to provide innovative ideas on online learning and teaching andragogy and thus, makes it more meaningful and engaging to both students and teachers.

Introduction

While and post COVID-19 periods have witnessed that online teaching and learning is becoming more customary. Although it is becoming more common than before, it also faces challenges (Lepp, L., Aaviku, T., Leijen, Ä., Pedaste, M., & Saks, K.; 2021). Among the challenges are students and teachers' technological and pedagogical readiness regarding online learning and teaching must be in sync with the current situations or changes that are taking place. Another challenge is students' learning style. Online learning is one of the 21'st century learning styles which are student-centered. This kind of learning style requires students to establish knowledge and have right attitudes and behaviors in the learning process (Santosa, M. H.; 2022).

In the 21st century, data and information keeps on increasing, and focusing on relevant information is getting more challenging. Simultaneously, social media is becoming more significant in learning and teaching because it can transfer information faster and in agreement with learning in groups and educational establishments (Evans, D., Bratton, S., & McKee, J.; 2021). With these developments, teaching and learning must also embrace the rise of big data. In big data, visualization such as pattern recognition is crucial to areas such as teaching and learning because information can be organized better and thus, it would be easier to be remembered. According to Randy Krum (2014) the rising of big data enables us to transform abundant information that we have into more organised, compact, and appealing forms of

non-linear text which is an infographic. Infographics is crucial for a person to gain better insights into a topic, and it is useful in making decisions in which it enables a person to digest important facts and make assessments faster. In the light of this, infographics is one of the visualizations that is popular nowadays. This agrees with previous studies that mention people remember pictures better than words (Li, Y., & Xie, Y.; 2020). Hence, skills in visualization are crucial in the design principles and development stages of an infographic. This is especially true with the rapid advancement of the world in which technology is constructed as an important resource (Fadzil, H. M.; 2018).

Ru and Ming (2014) state that infographics usually contain three items or components: (a) The Visual (colours coding, graphics, and reference icons), (b) The Content (statistics, time frames, and references), and (c) The Knowledge (the facts and conclusions to convey the overall message of a story). An infographic may also include a key, scale, and label to better explain the representations of a document. Besides, it should also contain a three-part story format: introduction, key message, and conclusion (Naparin, H., & Saad, A. B. 2017). In addition, to items and parts, data visualization also may make up the entire infographic. The primary five types of visualization categories like time series, statistical, map, hierarchies or tree, and networking need to be understood by students.

The constructivism approach is a learning method that involves students learning activities and students need to construct or create their own knowledge based on past experiences. Some instructional methods that reflect constructivist principles are class discussion, peer tutoring, cooperative learning, reciprocal teaching, and reflective teaching (Schunk, D. H., 2012). This instructional method challenges students' thinking so that they can construct new knowledge. Consequently, this concept which involves the physical and social contexts, highlights the relations between person and situations (Sunzuma, G., Zezekwa, N., & Munakandafa, W., 2022). Therefore, lecturers or instructors must structure or plan the learning instruction to make the process of learning and teaching becomes more meaningful and students find the assessments given more appealing and meaning to them, and this is known as constructive alignment.
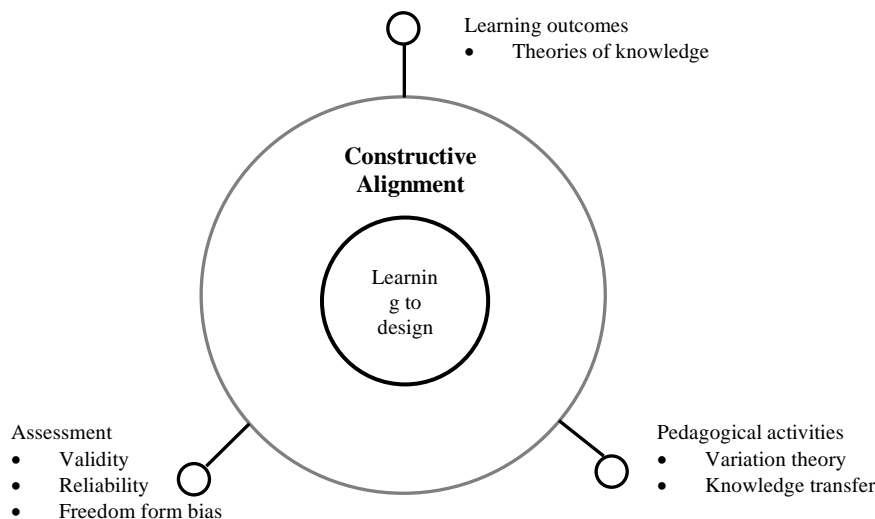
Figure 1. Alignment of learning outcomes to learning instruction and assessment (Buckley, J., Seery et al., 2021; Brookhart, S. M., 2004)

Constructive alignment needs learning outcomes, teaching and learning activities or instruction, and assessment to be affiliated. This term is illustrated in Figure 1. Learning outcomes must be aligned with assessment tasks and teaching and learning activities based on the constructivist approach (Buckley, J., Seery, N., Gumaelius, L., Canty, D., Doyle, A., & Pears, A., 2021). This kind of learning environment gives students the opportunity to construct knowledge or skills specified in the desired outcomes. Besides, assessment can serve several purposes in instruction. Previous research works mention that constructive alignment is the most useful way to distinguish between assessment used as formative assessment and/or summative assessment (Scriven, M., Tyler, R., & Gagne, R.,1967; Lewkowicz, J., & Leung, C., 2021). Formative assessment is an assessment designed to inform lecturers and students about students'

learning and thus, this would help in improving the instruction while summative assessment summarizes students' achievement (O'Donnell, A. M., Reeve, J., & Smith, J. K. ,2011). According to Figure 1, assessment must be valid and reliable. In addition, it must also be free from any bias (Brookhart, S. M., 2004; O'Donnell, A. M., Reeve, J., & Smith, J. K. ,2011). To achieve reliability, validity and reduce biasness in students' scoring, an assessment must have a rubric.

Implementing active learning activities and lessons that focus on students' independent learning is different from traditional face-to face classes (Yajima, K., Takeichi, Y., Sato, J., Ichimura, R., & Kishimoto, S., 2022). In understanding the concept of digital visual representation students must understand the concept of visualization principles such as Gestalt design principles and other graphic design principles. Besides visualization principles, students must also identify the correct type of visualization categories in designing infographics. These make it difficult for students to select appropriate storytelling according to the data given by the lecturer. Organizing classes in a virtual environment that encourage group work actively to construct their own knowledge and at the same time must follow the constructive alignment is a challenging task. Therefore, the objective of this article is to provide the explanation on how to design the learning instruction and activity for students in developing digital visual representations or infographics according to a given dataset.

Methodology

This article presents a case study that employed a qualitative method approach. An open-ended questionnaire was constructed to gain appropriate data. The data was obtained in Semester 1 of 2021/2022 session during the online classes conducted due to the COVID-19 pandemic.

The selected course involved both formative and summative assessments. Table 1 shows how the lecturer conducted the assessments involved. However, this article only focuses on the formative assessment which carried 60%. The formative assessment was conducted through group work while the summative assessment was conducted individually. The lecturer chose formative assessment to be conducted because it would help students in term of being able to discuss and get feedbacks on their designs and eventually, improve their grades. This agrees with the social constructivist theory in which learners can construct knowledge through interaction with peers (Schreiber, L. M., & Valle, B. E., 2013; Omodan, B. I.; 2022).

Table 1. Types of evaluation in the course

Evaluation	Conducted	Assessment Method	Percentage
Formative	Groupwork	Digital Visual Representation Report	60%
Summative	Individual	Digital Visualization Brochure	20%
Summative	Individual	Presentation	10%
Summative	Individual	Final Exam	10%
Total Marks			100%

The formative assessment was based on a course learning outcome that required students to design a visual representation according to the principle of information graphics and digital visualization in a group. In doing this, students had to produce digital visual reports. The descriptions of items of the assessment are depicted in Table 2. This formative assessment was designed because it would provide students with a similar assignment in the summative evaluation that is 30% of the total marks.

Table 2. Percentage of Digital Visual representation report

Instrument	Assessment method	Marks
Question/Instruction for students	Planning Sheet rubric (10%) Process for infographic rubric (10%)	20%
Information graphics report	Information graphics or storyboard rubric	30%
Peer Assessment Report	Peer assessment rubric	10%
Formative Assessment		60%

Participants

The participants were five postgraduate students (3 male and 2 female) who enrolled in the Visual Informatics & Technology Assisted Learning (MANQ2223) course. This course is an elective course in fulfilling the requirement to pass the Master of Science (Informatics) program. This course is module-based, and it has six classes throughout the semester, that make up 120 hours per semester. It introduces students to the fundamental concept the presentation and communication design through the principle of information graphics and digital visualization.

Research Instrument

An instrument is employed, and it was in the form of a task or instruction for students. The instrument was adopted from Infographic Project (A middle school Survival Guide, 2022). An example of a task is shown in Figure 2.

Figure 2. Questions for students

To fulfill the task, students must first design a planning sheet before they start developing the infographic. This planning sheet must be presented in class for the lecturer to validate whether students were on the right track or otherwise. An example of a planning sheet can be seen in Figure 3. This planning sheet was adapted from Infographic Project (A middle school Survival Guide, 2022).

Figure 3. Planning sheet given to students

Research Procedure

The lecturer first explained on the method of designing the learning instruction and activity to the students. They needed this information so that they would understand the concepts in developing digital visual representation or infographic. The theme of the group assignment was Bestsellers Books with Categories. The details of the research procedure and the learning instruction given to students are:

  i. The lecturer explained the instructions and rubric for assessment to students (infographic rubric and peer evaluation rubric).
 ii. Three items were given to students:
      a. A dataset was given via e-learning to students according to the theme. The data set was taken from the website: www.kaggel.com (Amazon Top 50 Bestselling Books 2009 – 2019).
      b. A list of image collection was also given, and this is shown in Figure 4.
      c. A list of chart generators was given, and this is shown in Figure 5.

Figure 4. Image collections for students to avoid copyright issue

Figure 5. Chart generators for the student in designing the charts

 iii. Students must prepare and present two documents; (a) Planning sheets (b) PowerPoint slides that had visuals on the steps involved in developing the infographic, including the data cleaning according to the data set given. In addition, students also must justify what kind of graph was used and explain why they chose the graph.
  iv. Presentation 1: The lecturer provided students with feedbacks on the content and the two documents in their presentation so that they could improve their quality of design.
   v. Students were given time to design version one of the infographics and present it.
  vi. Presentation 2: Students present version one of the infographics. Students get feedbacks from their groupmates and the lecturer during the presentation. The example of online class activity can be seen in Figure 6.
 vii. Students updated the infographic design according to feedbacks.
viii. Students submitted the first version and the final design of infographics via e-learning.
  ix. Lecturer provided students with peer evaluation form to give peer assessment marks.
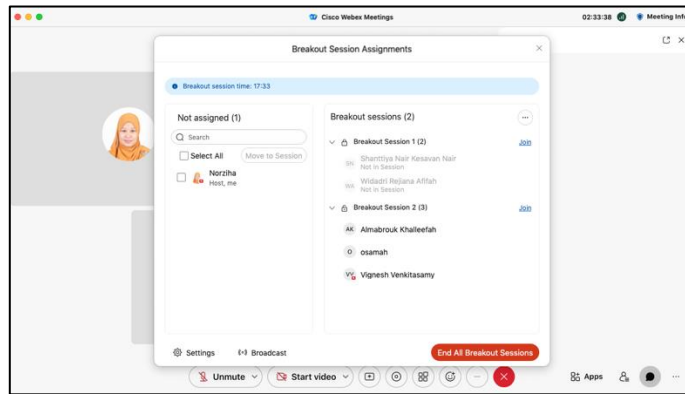
Figure 6. In class teams cooperative learning activity was used during the breakout session

Result and Discussion

To access the pre-attentive visual attributes, students needed to analyze the data provided and then need to do storytelling for a simpler and more comprehensible presentation based on the data given. For the class activity, students must present the planning sheet. Figure 7 exhibits the examples from two groups of students for the planning sheet according to the data set given. In the planning sheet student identified: (a) the visual or theme, (b) content (relevant facts to support the communication of topic) and (c) knowledge (data to the communication of topic the representation in chart or graph).

Group 1

Group 2

Figure 7. Example of planning sheet during the first presentation

According to the planning sheet in Figure 7, students develop an infographic. During the assignment development, students choose suitable applications that is suitable for data presentation like PowerPoint, Canva, Visme.co, Venngage, Visual.ly, Picktochart and others. There are the digital skills that students should acquire in this course. After developing the infographic, students must present it. This encourages communication skills which are important in computing curricula education (Computing Curricula, 2020). Another study states that creating infographics for assessment allows students to improve their visual communication, information organization and collaboration (Kaya-Hamza, A. T. O. S., & Beheshti-Fezile, F. S. M., 2017). According to social constructivist, this activity also makes students socialize with their peers and provides them with ideas on how to produce better infographic (Schreiber, L. M., & Valle, B. E.,2013). Besides, active learning including group work using breakouts sessions increases students' motivation (Yajima, K., Takeichi, Y., Sato, J., Ichimura, R., & Kishimoto, S.,2022). Table 3 provides the comments during the presentation. From these comments, students can improve the design and must present again online. Meanwhile, Figure 8 shows the example of an infographic development before and after comments from peers and lectures.

Table 3. Comments or suggestion to improve the design

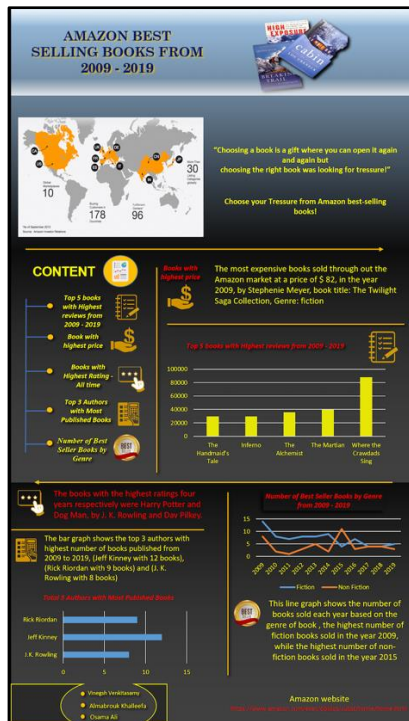| Group	Items need to revise
1	• Title: reduce to text, highlight the word Amazon because to tell reader where data are coming from. • Replace pie graph to line graph for tell reader about the tabulation by years. • Use the same color for icon and graph • Change text color for more readable and contrast from bar chart
2	• Change to A4 size (according to the instruction) • Revisit the title (Use to use standard icon for Amazon) • Color needs to revise to make more attractive • Reduce text • Change suitable graph • Add group name

Group 1 - Before feedback (Presentation 1)

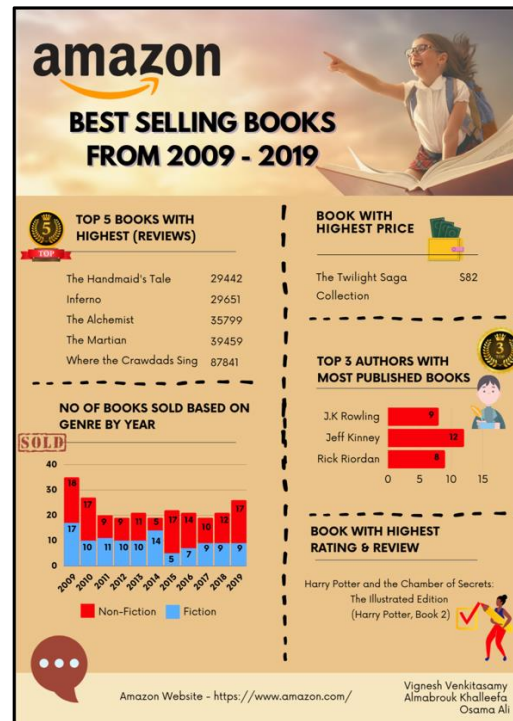**Group 1 - After feedback (Presentation 2)**

Group 2 - Before feedback (Presentation 1)   **Group 2 - After feedback (Presentation 2)**

Figure 8. Before and after comments for groups one and two

According to a previous study, the process of developing an infographic assists students to explain information visually. Besides, it also provides students with an extensive and brother form of learning and comprehension in instruction (Kaya-Hamza, A. T. O. S., & Beheshti-Fezile, F. S. M. ,2017). This learning instruction activity encourages students to think in high level by having to think about what the presentation or narration of data from the data is provided (Alsaadoun, A., 2021). Besides learning instruction, learning and assessment methods need to be streamlined. The concept of constructive alignment has been implemented to align between learning instructional and assessment methods (Akbay, A. P. D. S., 2022). Hence, the assessments conducted must be based on the rubrics that have been shared with students. Once the explanation about the rubrics is done, students would know the assessed items. To produce a fair evaluation among students, students should also evaluate their peers based on group work activities. Once the learning is completed in groups, a summative assignment is given individually. This will ensure that students can implement what they understand individually.

Conclusion

This article has provided the explanations on the learning instruction and activity conducted among students in developing digital visual representations or infographics according to a given dataset. Based on studies conducted, based on the visualization principles, infographics make students deliver complex information more effectively. It is hoped that this article provides insights among lecturers or teachers on conducting activities that enable students to engage more actively and meaningfully in classes that are conducted online. This research can also be the catalyst for more studies to be conducted on developing infographics. It has also widened the perspectives of teachers in using various platforms to teach infographics and students also, have gained more meaningful learning experiences in using technology as well as exploring more learning styles. All these create more opportunities for students, teachers, and researchers to go hand in hand in meeting the challenges of the rapidly changing education landscape.

Acknowledgement

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