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## Proposal for a Learning Process Using Cognitive Tools in an Infographic Design Approach to Improve Visual Literacy of Undergraduate Art Education Students(การนำเสนอกระบวนการเรียนรู้โดยใช้เครื่องมือทางปัญญาด้วยวิธีออกแบบอินโฟกราฟิกเพื่อพัฒนาการรู้ทางทัศนศาสตร์สำหรับนักศึกษาศิลปศึกษา)

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การนำเสนอกระบวนการเรียนรู้โดยใช้เครื่องมือทางปัญญาด้วยวิธีออกแบบอินโฟกราฟฟิก  
เพื่อพัฒนาการรู้ทางทัศนศาสตร์สำหรับนักศึกษาศิลปศึกษา

Proposal for a Learning Process Using Cognitive Tools in an Infographic Design  
Approach to Improve Visual Literacy of Undergraduate Art Education Students

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บทคัดย่อ

การวิจัยนี้มีวัตถุประสงค์เพื่อนำเสนอกระบวนการเรียนรู้โดยใช้เครื่องมือทางปัญญาด้วยวิธีออกแบบอินโฟกราฟฟิกเพื่อพัฒนาการรู้ทางทัศนศาสตร์สำหรับนักศึกษาศิลปศึกษา เป็นการวิจัยแบบผสมผสานโดยมีการดำเนินงาน 3 ขั้นตอน ได้แก่ 1) สอบถามความคิดเห็นของอาจารย์ผู้สอนสาขาวิชาศิลปศึกษา จำนวน 26 คน โดยวิธีการเลือกแบบเจาะจง 2) สอบถามความคิดเห็นของนักศึกษาสาขาวิชาศิลปศึกษา ชั้นปีที่ 4 จำนวน 172 คน โดยวิธีการสุ่มตัวอย่างแบบหลายชั้น และ 3) ศึกษาเอกสารและงานวิจัยที่เกี่ยวข้องและสัมภาษณ์นักออกแบบอินโฟกราฟฟิกอาชีพที่มีประสบการณ์สอนในระดับอุดมศึกษา จำนวน 5 คน โดยวิธีการเลือกแบบเจาะจง เครื่องมือที่ใช้ คือ แบบสอบถามและแบบสัมภาษณ์ ผลการวิจัย พบว่า อาจารย์ผู้สอนและนักศึกษาส่วนใหญ่เห็นว่า อินโฟกราฟฟิกสามารถใช้พัฒนาการรู้ทางทัศนศาสตร์ของผู้เรียน นอกจากนี้ ผลการศึกษาเอกสารและงานวิจัยที่เกี่ยวข้อง พบว่า การใช้อินโฟกราฟฟิกเพื่อการเรียนการสอนสามารถพัฒนาการรู้ทางทัศนศาสตร์ให้กับผู้เรียนได้ และแนวทางที่เหมาะสมสำหรับการสอนออกแบบอินโฟกราฟฟิกเพื่อพัฒนาการรู้ทางทัศนศาสตร์นั้นประกอบด้วย 2 ขั้นตอน ได้แก่ ขั้นตอนที่ 1 การเตรียมความพร้อมก่อนการออกแบบ ประกอบด้วยกิจกรรม (1) การศึกษาทฤษฎีการสื่อสารทางทัศนศาสตร์ (2) การฝึกวิเคราะห์และตีความภาพ (3) การฝึกประเมินผลงานอินโฟกราฟฟิก และขั้นตอนที่ 2 การสร้างผลงาน ประกอบด้วยกิจกรรม (1) การศึกษาค้นคว้าและระดมสมอง (2) การออกแบบ (3) การตรวจสอบและปรับปรุงแก้ไข (4) การเผยแพร่ผลงาน

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### Abstract

This mixed method research aims to propose a learning process using cognitive tools in an infographic design approach to improve visual literacy of undergraduate Art Education students. The study was divided into three phases: 1) surveying opinions of 26 Art Education instructors who were selected by a purposive sampling method, 2) surveying opinions of 172 Art Education students who were selected by a multi-stage sampling method, and 3) studying the infographic design approach from related documents and interviewing five experienced infographic designers who have taught in higher education. These infographic designers were selected by a purposive sampling method. The research instruments were a questionnaire and semi-structured interview form. The results revealed that most instructors and students thought Infographics could be used to improve visual literacy. However, more than half of them had no experience with infographics. Based on the result of literature review, the process of teaching infographic design consists of two steps: learner preparation before design, and creating the infographic. Three activities for learner preparation before the design step are 1) review the Visual Communication theory, 2) practice analysis and interpretation of images or visual media, and 3) compare and evaluate infographic works. The four activities comprising the other step are 1) researching and brainstorming, 2) design, 3) review and revision, and 4) publishing.

*Keywords:* cognitive tools, infographic design approach, visual literacy, art education students

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### Introduction

Visual literacy skills were essential for the 21st century learners and have an influence on students' perception, interpretation, and creation of visual materials. At the present time, higher education students are being asked to produce projects and intellectual work using visual media, and they must develop the needed skills - finding, interpreting, evaluating, using, and producing visual materials. Recent studies of student use of visual materials in higher education have provided important information about student image-related skills and behaviors. The result not only revealed students' need to develop their visual literacy, but also to find ways for enhancing visual literacy. Yeh and Cheng (2010) studied the instruction of visual design principles that had an influence

on pre-service teachers' perception and interpretation of visual materials. The result implied that the instruction of visual design principles could improve pre-service teachers' visual literacy. Moreover, Islamoglu et al. (2015) studied the opportunities for infographics to provide education and suggested ways to integrate infographic knowledge and skill development in teacher education. The result showed that visual design principles and infographics can be used to improve visual literacy. Although researchers have identified the benefits of using visual design principles and infographics, there is a lack of research investigating specifically how to use visual design principles with infographics to improve the visual literacy of art education students. For this reason, the researchers needed to propose a learning process using cognitive tools in infographic design process to enhance the visual literacy of undergraduate art education students.

### 1. Cognitive Tools

Cognitive tools are general computer tools that are intended to engage and facilitate cognitive processing. Cognitive tools engage learners in the creation of knowledge that reflects their comprehension and information processing. Moreover, cognitive tools can be used for collaborative communities which are essentially different from tools for individuals such as interaction among people, group cognition, and social practice. Liyoshi et al. (2005) identified cognitive tools according to the characteristic of information processing into five categories: 1) information seeking tools, 2) information presentation tools, 3) knowledge organization tools, 4) knowledge integration tools and 5) knowledge generation tools. In addition, recent research has suggested that cognitive tools can scaffold student centered learning and support collaborative learning.

### 2) Infographics Design Approach

Infographics are defined as the visualization of data or ideas that attempts to convey complex information to an audience in a manner that can

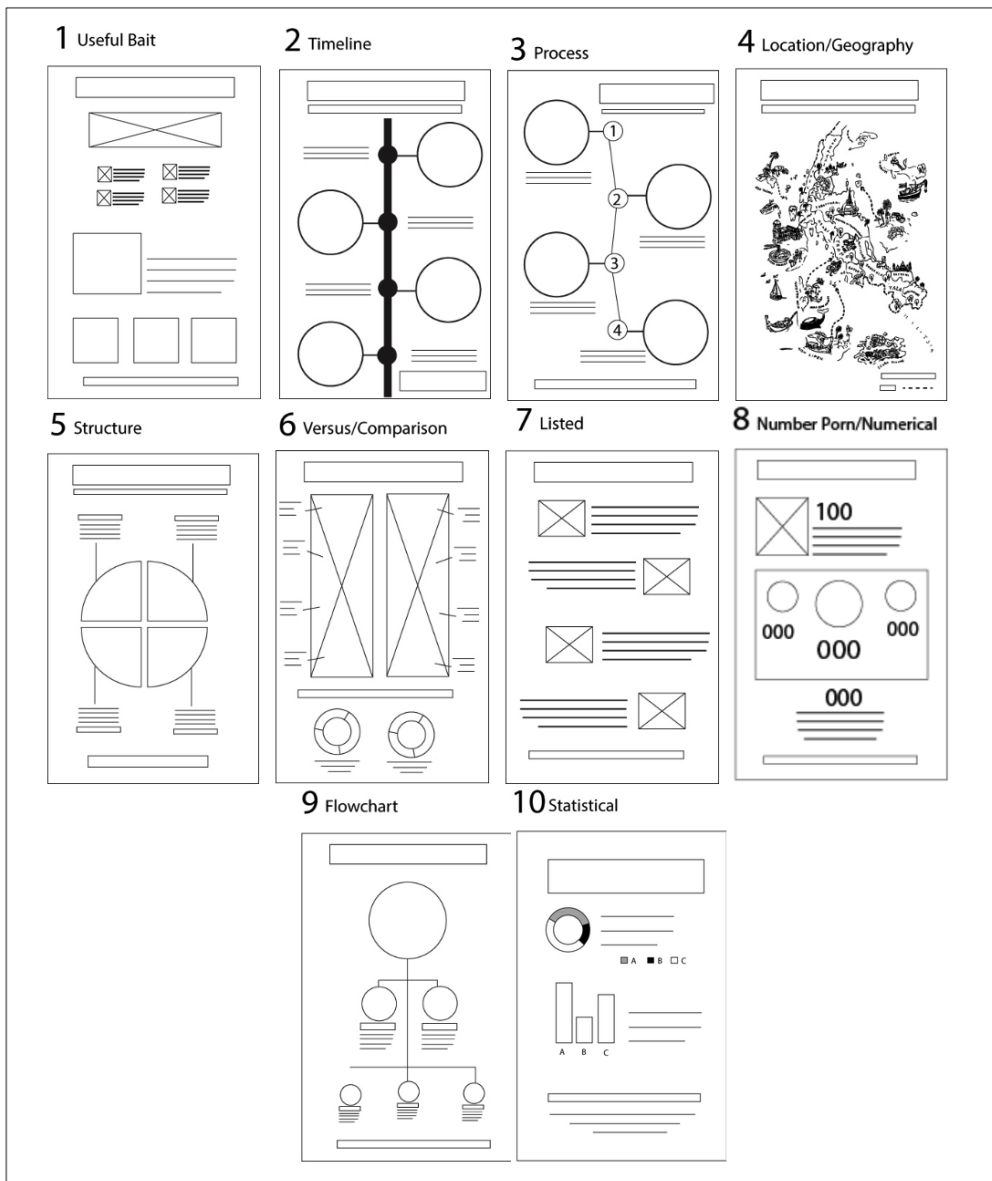
be quickly consumed and easily understood (Smiciklas, 2012). Highly visual impact graphics such as multiple charts, tables, data maps, photos, pictograms, diagrams, and conceptual illustrations are all considered in infographics (Wong, 2013).

Edward R. Tufte, one of the most renowned experts working the area of information design and data visualization, argued that any graphic elements of a design which did not communicate (by giving some specific information) should be omitted. (Krum, 2014; Lankow et al., 2014). There are three main formats of infographics: 1) static infographics, 2) motion infographics, and 3) interactive infographics (Lankow et al., 2014). The most common types of infographics can be classified into ten categories which are normally used to present information namely 1) useful bait, 2) timeline, 3) process, 4) location or geography, 5) structure, 6) versus and comparison, 7) listed, 8) number porn or numerals, 9) flowchart, and 10) statistics (Bladon, 2015; Chow, 2015; Lester, 2014) (Figure 1).

The process of designing infographics consists of: 1) preparing information (e.g. purpose, goals, and audiences' needs), 2) processing ideas through exploration, recording, synthesizing, and using the 5W1H questions technique, 3) designing infographics by using design tools, design components, and inspiration resources, and 4) publishing infographics by using a variety of channels such as print media, blogs, and social networking sites (Smiciklas, 2012). Moreover, Lankow et al. (2014) refined five processes to design infographics: 1) brainstorm an Idea, 2) research related information, 3) create content, 4) sequence a story, and then 5) design.

Figure 1

*The ten categories of infographic formats*



### 3) Visual Literacy

According to the Association of College and Research Libraries (ACRL), visual literacy is a set of abilities to effectively find, interpret, evaluate, use, and create images and visual media. Visual literacy skills equip a learner to

understand and analyze the contextual, cultural, ethical, aesthetic, intellectual, and technical components involved in production and use of visual media (Hattwig et al., 2013). Stafford (2011) explained that visual literacy is a process of reading, interpreting, and understanding visual media. Visual literacy development requires students to practice decoding or interpreting and analyzing images and visual media. Matrix and Hodson conducted a study in 2014 titled “Teaching with Infographics: Practicing New Digital Competencies and Visual Literacies”. Participants included 500 students from Queen’s University and 120 students from Ryerson University in Canada. This study aimed to demonstrate how incorporating a research-based graphic design assignment into coursework challenges and encourages students’ visual digital literacies. The study suggested that the use of graphic representations and the creative design assignment in a blended learning environment could enable students to communicate a message and can encourage students’ visual digital literacies.

### **Research objectives**

The main objective was to propose a learning process using cognitive tools in infographic design approach for improving visual literacy of undergraduate Art Education students. The three minor objectives were considered for the study were; 1) to investigate the current situations with the use of cognitive tools and infographics for improving the visual literacy of undergraduate Art Education students; 2) to study the use of cognitive tools in infographic design approach from related research and documents; and 3) to gather the opinions of infographic designers on the key factors for supporting the use of infographics in the design approach.

## Research methodology

This study was a mixed-method research and was divided into two parts. Part 1 focused on a quantitative research which investigated the current use of cognitive tools and infographics for improving the visual literacy of undergraduate Art Education students in Rajabhat University in Thailand. Each branch of Rajabhat must offer an Art Education program for least four years. These included 1) Phetchaburi Rajabhat University, 2) Muban Chombueng Rajabhat University, 3) Nakhonratchasima Rajabhat University, 4) Buriram Rajabhat University, and 5) Suratthani Rajabhat University. Part 2 was a qualitative research to study related documents and research and gather the opinions of infographic designers on guidelines concerning the use of infographic design process and the activities that support the design process for Art Education students. The details are illustrated below. The sample groups were composed of: 1) 26 instructors who were chosen by purposive sampling, 2) 172 fourth year students from Art Education program who were chosen by stratified sampling, and 3) five infographic designers who were chosen by purposive sampling with the criteria of having an expertise in infographic design and teaching in field of infographic design for undergraduates at least three years.

### 1) Instrument

The tools used to collect data were: 1) a questionnaire titled “the current situations of the use of cognitive tools and infographics for improving visual literacy of Undergraduate Art Education students”, and 2) semi-structured interviews.

### 2) Data analysis

This study is a documentary research that analyzed data by applying theories and relevant research about the current situations with the use of cognitive tools and infographics for undergraduate Art Education students and



how to use infographic design approach as a tool to enhance visual literacy from questionnaires and interviews. Content analysis was used, and quantitative data was analyzed by using frequency, percentage, arithmetic mean and standard deviation.

## **Results**

The results from the survey of instructors and students from the Art Education program in Rajabhat University in Thailand about the current use of cognitive tools and infographics for improving visual literacy of undergraduate Art Education students from 5 Rajabhat Universities: Phetchaburi Rajabhat University, Muban Chombueng Rajabhat University, Nakhonratchasima Rajabhat University, Buriram Rajabhat University, and Surathani Rajabhat University consisted of the following

### 1) Background information of the respondents

1.1) The background information of Art Education instructors who responded to the survey indicated that there were 26 respondents included in this section of the study, including 19 females (73.08%), and 7 males (26.92%). Their academic positions were comprised of three assistant professors (11.54%) and 23 not holding any academic positions (88.46%). For the level of education, one held a doctoral degree (3.85%) and 25 held a Master's degree (96.15%). In term of teaching experience in higher education, eight instructors had taught less than 5 years (30.77%), 11 had taught for 5-10 years (42.31), three had taught for 11-15 years (11.54%) and four had taught for more than 16 years (15.38%).

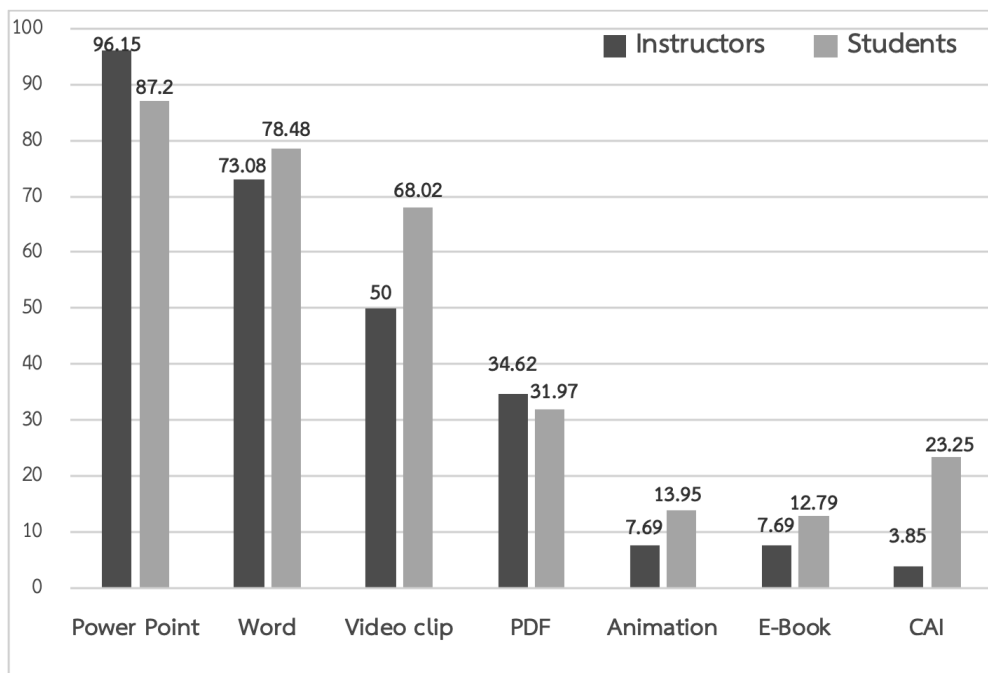
1.2) The background information of Art Education students responded to the survey. There were 172 Art Education students from the fourth year at various Rajabhat University branches in Thailand during academic year 2016 who responded to survey.

1.3) The background information of the infographic designers, five had teaching experience in higher education on the key factors of infographic design process to improve visual literacy.

2) The top three media formats that instructors and students used in teaching and learning activities were 1) Power Point presentation (96.15%, 87.20%), 2) Word document (73.08%, 78.48%), and 3) video clips (50%, 68.02%) (Figure 2).

**Figure 2**

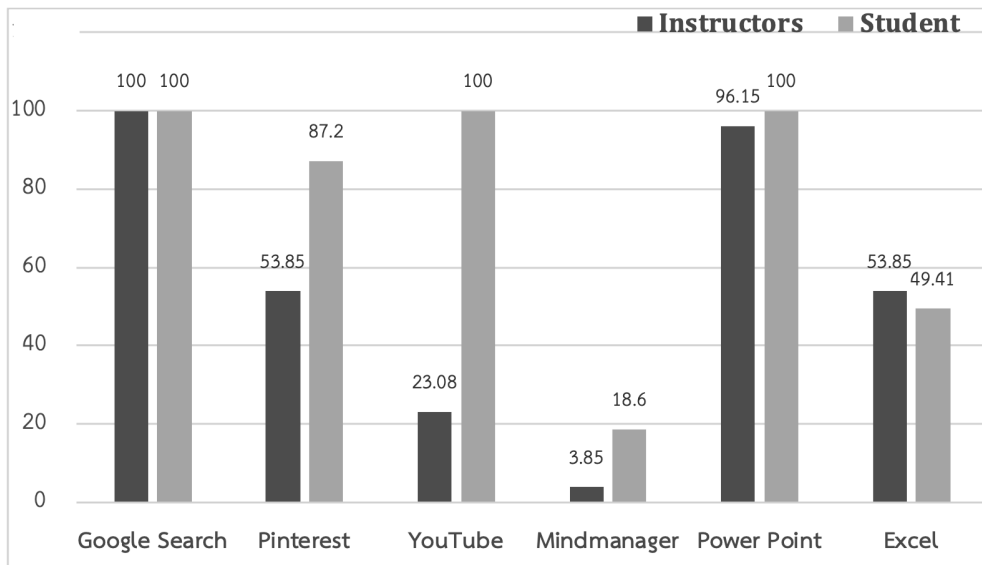
*The use of media in teaching and learning activities*



3) The survey results reflecting cognitive tools in the classroom found that the top three types of cognitive tools that most instructors and students used in the classroom were 1) information seeking tools such as Google search (100%, 100%), 2) information presentation tools such as Pinterest (53.85%, 87.20%), and 3) generation tools such as Power Point (96.15%, 100%) (Figure 3).

Figure 3

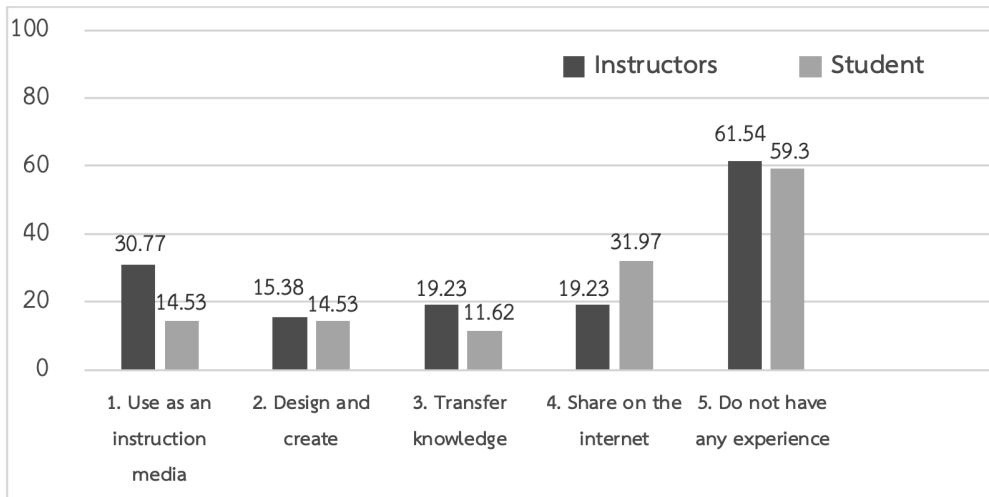
*The use of cognitive tools in the classroom*



4) The survey of current situations on the use of infographics in classroom found that more than half of the instructors and students (61.54%, 59.3%) remarked that they did not have any experience with infographics. Apart from the previous group, other instructors and students indicated their experience with infographics in various methods such as using them as instructional media (30.77%, 14.53%), sharing them on the Internet (19.23%, 31.97%), using them as tools for knowledge transformation (19.23%, 11.62%), and designing and creating infographics (15.38%, 14.53%) (Figure 4).

Figure 4

*The current use of infographics in classroom*



According to the instructors, the top three knowledge or skills that infographics could be used to enhance were 1) creativity ( $M = 4.62, SD = 0.57$ ), 2) numerical analytical thinking ( $M = 4.46, SD = 0.58$ ), and 3) visual communication ( $M = 4.46, SD = 0.71$ ). Meanwhile, the knowledge or skills that students thought infographics could be used to enhance were 1) graphic design ( $M = 4.40, SD = 0.75$ ), 2) numerical analytical thinking ( $M = 4.39, SD = 0.71$ ), and 3) visual communication ( $M = 4.36, SD = 0.80$ ).

5) The results from the survey showed that the top three learning activities for the purpose of enhancing the visual literacy of instructors and students were (1) to interpret the images. (2) to evaluate the image (100%, 98.83%), and 3) to use images for communication (96.15%, 100%).

6) The results of the document review about how to teach with infographics and design process found that the infographic design approach consists of two main steps as follows: (Figure 5)

Figure 5

*Infographic design approach*

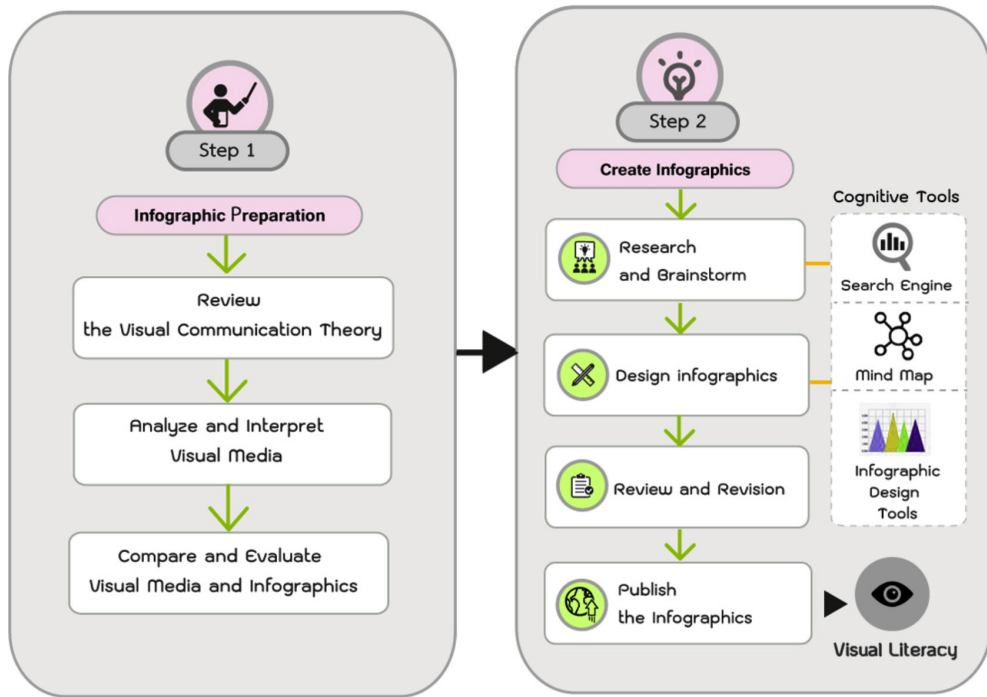


Figure 5 illustrates the two main steps of the infographic design approach namely, Infographic Preparation and Creating Infographics.

*Step 1 Infographic Preparation*, students are engaged to learn about visual communication, analyze, and interpret images or visual media.

(1) Review the Visual Communication theories: 1) the Semiotics Theory, comprising the science of signs and symbol; 2) the Gestalt Theory, which states the whole is greater than its parts, and 3) the Cognitive Theory, which adhere to the concept that mental processes emphasize comparing what one has seen with a catalog of memories.

(2) Practice Analysis and Interpretation of images or visual media such as symbols, charts, diagrams, infographics and etc.: This is an activity that will prepare students with knowledge of infographic design before starting to create infographics.

(3) Compare and Evaluate Visual Media and Infographics. In this activity, students think about bad/good characteristics of infographic design.

### *Step 2 Create Infographics*

(1) Research and Brainstorm: In this step, students have to research and consider the infographics' topic and content.

(2) Design Infographic: students are expected to briefly design, sketch and lay out the graphics with consideration of key factors. They must set an infographic objective by answering the two questions: Who are the target group of this infographics? And, what message do infographics need to communicate? Moreover, designers should analyze their audience's information needs and apply the principles of infographic design.

(3) Review and Revision: For both the content and design, check the accuracy of data and data visualization format. Choosing the proper format will increase viewers' accessibility and understanding.

(4) Publish the Infographics either online or via offline channels. Some examples of online publishing channels are blogs, Facebook, and Pinterest. Students can print them via offline publishing channels such as brochures, prints, posters, etc. Properly citing all resources used in the infographics is essential.

7) The interview of five infographic designers with teaching experience in higher education on the key factors of infographic design approach to improve visual literacy showed that all designers agreed with the infographic design approach above and suggested some guidelines, activities, tools, and rubrics for evaluating effective infographics. The results of the interview can be summarized as follows:

7.1) Brainstorm technique: This can be done by using mind maps, post-it notes, and bullet points. Nevertheless, the infographics' topic and content should be interesting, up-to-date, awe-inspiring or something that

people are not familiar with, and have a large number from various sources as data for developing content

7.2) Structuring the information by finding keywords: This can be done by choosing related data, and creating a hierarchy of data. These depend on the infographic elements—with title or topic, secondary topic, content and detail, ending topic, and adding citations.

7.3) Writing headline: This can be done by using these techniques: 1) Deliver value by being helpful; 2) Evoke emotions by appealing; 3) Ask the question in an effective manner; 4) Offer “do” and “don’t” lessons that the audiences find valuable, compare and contrast the content; 5) Create lists that are great for article teasers, blog post titles, and other types of headlines; 6) Inspire readers about their desires; 7) Nightmare - speak to the problems of the readers; 8) Demonstrate empathy to understand and care about the readers; and 9) Deliver the content in a successful way.

7.4) Tools and resources that support infographic design include: 1) offline tools such as Photoshop and Illustrator, and 2) online tools such as Visage.co, Piktochart, Visual.ly, Columnfivemedia.com, and Behance. Moreover, there are also helpful resources for designing in flaticon.com, vecteezy.com, freepik.com, and etc.

7.5) Search for inspiration from sites such as these: coolinfographics.com, flickr.com, visual.ly, pinterest.com, informationisbeautiful.net, and dailyinfographic.com. When students need guidance or want to jump in a conversation, they can ask the design expert from chat room, and learn more about information design from these sites. Students can find the inspiration from many textbooks such as Infographics: the power of visual storytelling, by Jason Lankow, Josh Ritchie, and Ross Crooks, Cool Infographic, by Randy Krum, and Infographic Design in Media, by Wang Kai.

7.6) Infographic Evaluation: when students are finished creating their infographics, they can evaluate themselves, their friends, and instructor(s). The rubric for evaluating students' infographics should be divided into four areas as follows: 1) usefulness - infographic should have a clear purpose to present, data should come from reliable sources, displays of data should be proportional to the values and graphics should relate to the audience; 2) legibility - a legible graphic should have general aspects such as labels, axes, font, and contrast; 3) good design - an effective infographic must use most of the available space, and utilize color where needed; and 4) aesthetics - an infographic should be aesthetically appealing by utilizing organized data and avoiding an overload of information.

## **Conclusion and discussion**

Results of the research on the current situations on the use of cognitive tools for improving visual literacy of undergraduate Art Education students and survey opinions of infographic designers on the key factors supporting the use of infographic design approach were able to discuss in following topic:

1) Regarding the use of infographics, the results showed that more than half of the instructors and students (61.54%, 59.3%) remarked that they did not have any experience with infographics. In addition, there were only a few instructors and students who had experience with infographics for the purposes of (1) using them as an instructional media, (2) designing and creating, and (3) transferring knowledge to others by, sharing them on the internet. Furthermore, the four skills that the instructors and students thought that infographics could be used to enhance were creativity, numerical analytical thinking, visual communication, and graphic design. Moreover, many studies have shown that the use of infographics through various activities (such as



interpretation and analysis, evaluation design and creation) could improve learners' visual literacy and skills (Islamoglu et al., 2015; Kaya, 2012; Matrix & Hodson, 2014; McTigue & Flowers, 2011; Yeh & Lohr, 2010). For this reason, infographics are a new alternative tool for use as media to enhance knowledge and various skills of students especially in higher education.

2) According to the current use of cognitive tools to support student-centered learning, the cognitive tools that instructors and students always use in the classroom were not varied. The top three types of cognitive tools were Google search (100%, 100%), 2) Pinterest (53.85%, 87.20%), and 3) PowerPoint (96.15%, 100%). In addition, the study of related documents and research has shown many kinds of cognitive tools which can be used to enhance visual literacy both online and offline tools such as 1) knowledge generation tools including Prezi, Glogster EDU, Piktochart, Infogr.am, Pixlr, Adobe Illustration, Adobe Photoshop, Adobe Indesign, and PowerPoint; 2) supportive cognitive and metacognitive processes with map Tools; and 3) information seeking tools such as Flickr and YouTube (Islamoglu et al., 2015; Matrix & Hodson, 2014; Piksööt et al., 2012; Yang, 2013; Yeh & Lohr, 2010).

3) In terms of improving visual literacy, the results showed the top three learning activities that the instructors and students use for the purpose of enhancing visual literacy were (1) interpreting images (100%, 98.83%), (2) evaluating images (100%, 98.83%), and (3) using images to communicate (96.15%, 100%). The results of the present study confirmed that using these activities can enhance visual literacy (Islamoglu et al., 2015; Kaya, 2012; Matrix & Hodson, 2014; McTigue & Flowers, 2011; Piksööt et al., 2012; Yang, 2013; Yeh & Lohr, 2010).

4) Moreover, the results from the literature review showed that the process of teaching infographic design consisted of two Steps. Step 1 was infographic preparation that engages students to 1) review the Visual

Communication theory, 2) analyze and interpret image or visual media, and 3) compares and evaluates the infographics. Step 2 was comprised of creating infographics that consists of 1) research and brainstorming, 2) design, 3) review and revision, and 4) publishing. In addition, the interviews with infographic designers showed that they agreed with these steps and insisted on not helping students to design infographics. This point is also consistent with the way to improve visual literacy. They advised the instructors to be good consultants, introduce clear guidelines for infographic designs, and inform students about the scoring rubric for evaluation.

### Further research

The majority of previous research has emphasized on the current use of blended learning, infographics, and cognitive tools for improving visual literacy of undergraduate Art Education students. From the results, further research should be conducted to promote the use of infographics as a tool for improving visual literacy and other skills through various activities such as interpretation, analysis, evaluation, design and images creation.

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