(RESEARCH ARTICLE)

Check for updates

The impact of visual graphic design module utilization on the national certification performance of senior high school students

Christian Bernardo Santos [1, *], Emmanuel Sta. Maria Enriquez [2] and Shiela Marie Flores Castillo [3]

[1] Master Teacher I, San Miguel National High School, San Miguel South District, SDO Bulacan 3011, Philippines.
[2] Teacher II, Carlos F. Gonzales High School, San Rafael West District, SDO Bulacan 3008, Philippines.
[3] Education Program Specialist II, SDO Bulacan, City of Malolos, Bulacan 3000, Philippines.

Abstract

This study investigates the impact of implementing a visual graphic design module on the national certification performance of senior high school students, utilizing a descriptive correlational method with standard questionnaires and documentary analysis as primary data collection tools. The participants encompass TVL-ICT class students and ICT teachers with Visual Graphic Designer NC III certification, evaluating student performance. Employing two instruments—the Utilization of the Visual Graphic Design Module questionnaire and the Performance of Visual Graphic Design NC III of Senior High School Students rating sheet—the research explores how the module enhances creative and innovative design development. Integral to its efficacy, the orientation and training offered to students acquaint them with module benefits, particularly concerning national certification. Engagement with the module facilitates refinement of graphic design skills spanning various media, fostering confidence during certification assessments. In essence, this study underscores how the visual graphic design module positively influences senior high school students' national certification performance, substantiated by questionnaire responses and performance evaluations.

Keywords: Visual Graphic Design; National Certification; TESDA; Module; Skills Performance

1. Introduction

Since 2010, the graphic design industry has exhibited growth spurred by the business sectors and their demand for graphic design in order to streamline their digital and print brand presence (IDISWorld, 2015). In 2014, the United States Department of Labor reported that 261,600 graphic design jobs were present in the United States and projected that number would rise only seven percent over the next 10 years.

According to the United States Department of Labor, the projection rate from 2012 to 2022 and the foreseen change in employment opportunities for graphic designers will vary by industry. Employment of graphic designers in the print industries such as newspaper, periodical, book, and directory publishers are projected to decline 16% from 2012 to 2022, whereas employment of graphic designers in the computer systems design industries such as web development, app development, electronic publishing, social media and video entertainment media are projected to grow 35% over the same period (United States Department of Labor, 2012).

Design departments at colleges, universities, and art schools are as diverse and individualistic as the students they teach. On some campuses, graphic design students have ink under their fingernails and carry art supplies in their backpacks. On others, students lug titanium laptops and take classes with names like Virtual Time and Space. On still others, students sit alongside M.B.A. candidates and hear lectures on the uses of design for business. Some departments are

research-oriented; others focus on "making." At some, design is taught as a form of self-expression using words and images; others prepare students for a client-centered practice (Shapiro E, 2004). One thing they have in common: They are all dealing with rapid change. Changes in the profession, and changes in the way design is viewed by society. "Today, the biggest challenge in graphic design education is getting a grasp on where the profession is going based on technological, cultural, social, and economic changes, determining how we want to respond to the changes, and then having the fluidity in the program to make those changes," says Louise Sandhaus, co-director of the graphic design program at California Institute of the Arts in Valencia (Lambert, N.M., 2012).

Inspiration is the primary element of good design. Designers, however, also risk not being able to find inspiration. Novice designers commonly find themselves to be depressed during the conceptual design phase when they fail to find inspiration and the information to be creative. Accordingly, under the graphic design parameter, researchers have developed the 'Analytic Composition Method (ACM)' to guide novice designers in gradually breaking through their usual modes of thinking to construct their own methods of composition (Labuz, R.M.,2014). This method provides a variety of creative modes for the design field. A design method is first constructed based on the results of a pretest and the existing composition methods of graphical design. Researchers then apply the design method to three iterations of graphic design instruction. Lastly, researchers conduct an expert interview to evaluate the usefulness of this method (Scott R. et. al., 2019).

The growing capabilities of computers and multimedia technology provide an exciting opportunity for boosting technology-based education in schools, universities, and corporate training. Multimedia modules provide the advantage of visualization of highly mathematical subjects and abstract concepts, intuitive learning and conceptual understanding, and the ability to participate in "what-if" scenarios. Graphics, animation, video clips, virtual labs, and guided use of simulation software introduce students to a challenging new world with all the advantages of learn-by-doing possibilities (Susan Giloi, Lynn Quinn, 2019).

Senior high school students find it hard to learn different areas needed for national certification of visual graphic design. Because of the rotating complexity of graphic design's identity and the increase in the number of graphic design degree programs, design education is faced with insecurities about the content and structure of courses, assessment criteria, and relations between practice, research and theory along with teaching methods. Heller (2005) recognized the difficulty it would be for design educators to formulate a solid core curriculum and standards for how graphic design should be taught given the various degrees and identities. The general objective of this study is to explore the opportunity of utilizing the module on Visual Graphic Design (VGD) for the national certification performance of senior high school students. This goal is possible through investigation of the possible advantages of utilizing the module. Moreover, the study aims to have a great output by having the students qualified the assessment for visual graphics design through the use of module.

1.1. Statement of the Problem

The major problem of the study was to assess the impact of Visual Graphic Design module utilization on the performance of the students on TESDA National Certification.

Specifically, this study sought to answer the following questions:

What is the extent of utilization of Visual Graphic Design Module in terms of the following course content:

- o Print Media;
- o Electronic Media;
- o Product Packaging; and
- o Booth and Product/ Window Display?
- o What is the level of performance of students in TESDA National Certification?
- o Does the utilization of VGD module exert significant impact on the performance of students in TESDA National Certification?
- o What implication may be drawn from the findings of the study?

1.2. Hypotheses

The following hypotheses were tested in the study:

The visual graphic design module utilization does not significantly influence the national certification performance of senior school students

1.3. Conceptual Framework

This study postulates that utilization of visual graphic design module can influence the national certification performance of senior high school students. Visual graphic design module contains different lessons and activities for print media design, electronic media design, product packaging design, and design for booth and product/ window display. A Research about the effectiveness of using teaching module based on radical constructivism toward students learning process which were published by Matanlukab, Mohammadb, NorizahAg. Kifleeb, Molod Imbuga (2013) indicates that the use of teaching module can improve student's thinking skills.

The idea of using module for learning and organizing schools as learning organizations where the practices allow for continuous learning is rapidly and steadily considered as the mediator for achieving school improvement (Silins and Mulford, 2012). The school is gradually transformed into a learning organization which needs to refresh the processes involving its current and future needs (Huber, 2014).

Using a teaching module to teach as compared to the traditional method of using a textbook is meant to increase active learning and improve critical thinking, as well as problem solving skills (Cheng and Bakar, 2014).

Utilization of Module on Visual Graphic Design contained different lessons and activities about: Print Media which is a form of graphic design which involves the creation of flyers, brochures, book covers, t-shirt prints, business cards, and more. Basically, anything that has any kind of graphics or visual pattern is a print media design (SAG IPL, 2011); Electronic Media which encompasses all content presented in electronic format such as web sites, electronic documents, and graphics published in virtual domain (Galvin, 2015); Product Packaging design which refers to the creation of the exterior of a product.

That includes choices in material and form as well as graphics, colors and fonts that are used on wrapping, a box, a can, a bottle or any kind of container (Morr, 2016); and Booth and Product/ Window Display design to meet the display purpose of a particular brand shop window (including the requirements of the brand for its environmental role, the requirements for the use of functions, and the requirements for its visual experience), which enables specific materials forming the objects that can be aesthetic or symbolic under the conditions feasible in terms of technology, economy, etc. (Hwang, 2018).

Finally, the national certification performance of students was evaluated in terms of competencies and skills set by the TESDA in the light of print media, electronic media, product packaging, and booth and product/window display.
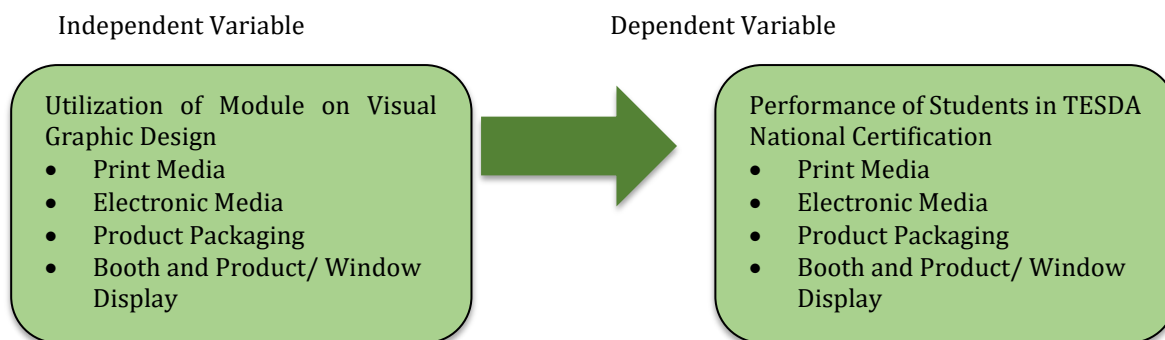
Independent Variable   Dependent Variable

Figure 1 Paradigm of the Study

Figure 1 depicts the conceptual model that was used in determining the impact of utilization of visual graphic design module to the national certification performance of students.

1.4. Significance of the Study

The study provides information towards the impact of the usage of visual graphics design module to the national certification of senior high school students. Furthermore, the data gathered may be usable in improving learning programs for senior high school.

This paper further suggests the module's potential to help the students qualify to the assessment for the visual graphics design national certification. The study involved the utilization of instructional material for students under Visual Graphic Design course for them to be qualified for National Certification III of VGD. The study is helpful to the following entities:

- Students. The instructional module facilitated their learning and develop their skills in Visual Graphic Design even in the absence of the teacher. It can provide a better understanding of the course about the new trends and techniques in the field of Visual Graphic Design since instructions are now individualize rather than group activity.
- Teachers. The teacher can really act as a facilitator of the learning, for they can have more time to supervise their students individually specially those who handle big classes. This can be of help in developing more interactive learning material that suits the level of the students.
- Administrators. This can help to lessen the financial difficulties in providing teaching and instructional materials. Also, it can be a basis for instruction or the subject matter in the absence of competent instructor.
- Industry. The school then will be capable of providing efficient and skilled individuals because the instructional module can prepare and equip students with skills needed for the target job, thus enabling students to contribute in the improvement and development of the economy of the state.

1.5. Scope and Limitation of the Study

This research focused only on the impact of implementing a visual graphic design module on the national certification performance of senior high school students.

The population for the utilization of instructional module are the eighty (80) TVL-ICT class under the TVL track of the Senior High School where the researcher is presently employed. Also, there are at least three (3) ICT teachers who are also Visual Graphic Designer Level III holder who evaluated the result of the performance of the students. The researcher used the universal sampling design of all the TVL ICT class of the senior high school.

1.6. Location of the Study

This study was conducted in Carlos F. Gonzales High School located at Maguinao San Rafael, Bulacan 3008, Philippines.

Source: https://mapcarta.com/W159929089
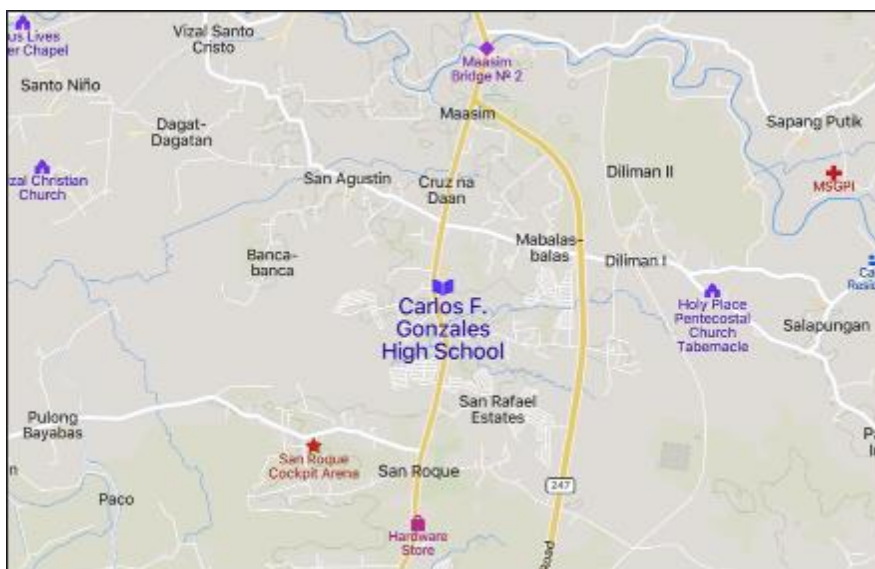
Figure 2 Map going to Carlos F. Gonzales High school

1.7. Definition of Terms

- o The following terms were defined operationally for common understanding
- o Visual Graphic Design National Certification III. This qualification consists of competencies that a person must achieve to design and develop visual graphic designs for (i) print media; (ii) electronic media; (iii) product packaging; and (iv) booth and product/window display.
- o Visual Graphic Design Module. Learning material that contains the lessons for the competencies needed to pass the National Certification for Visual Graphic Design. As used in the study, utilization of visual graphic design module refers to the extent of teachers' usage of print media, electronic media, product packaging and booth and product window/ display.

2. Material and methods

The information about the research and sampling procedures that were utilized by the researcher are provided in this chapter. The research design that was employed, as well as the data gathering techniques, and data analysis scheme are also discussed in this chapter.

2.1. Research Design

The descriptive correlational design of research was employed in the research. The aim of a descriptive correlational design is to describe the relationship among the variables.

This design is useful in describing how one phenomenon is related to another in situations where researcher has no control over the independent variables, the variables that are believed to cause or influence the dependent or outcome variable. The advantage of this design is that it is straightforward, it can be done quickly and usually inexpensive. Often, it can serve as preliminary research for further studies that can be done to determine cause and effect relationship between variables.

2.2. Data Gathering Techniques

The questionnaire method was the mode of data gathering. Each of the respondents was given a structured set of questions. In gathering the data, the researcher carried out the following procedure:

- o The researcher asked the approval of researchers' adviser before the distribution of questionnaire.
- o A permission letter was given to the school heads /principal of basic education department in La Consolacion University Philippines.
- o Distributed the questionnaires to grade 12 computer programming teachers with the permission of school heads/principal.
- o The questionnaires were presented and answered individually by the respondents.
- o The researcher collected the questionnaires personally from the respondents and checked if all the items were answered.
- o When the questionnaires were retrieved already, the researchers tallied, analyzed and interpreted the data.

2.3. Sampling Procedures

The population for the utilization of instructional module are the eighty (80) TVL-ICT class under the TVL track of the Senior High School where the researcher is presently employed. Also, there are at least three (3) ICT teachers who are also Visual Graphic Designer Level III holder who evaluated the result of the performance of the students. The researcher used the universal sampling design of all the TVL ICT class of the senior high school.

Table 1 Respondents of the Study

Respondents	F	%
Senior High School TVL ICT Students	80	96.39
Teachers	3	3.61
Total	**83**	**100**

2.4. Data Analysis Scheme

The researchers used the following statistical treatment tool in the analysis and interpretation of the data. The mean and weighted mean was used to determine the level of agreement of the utilization of VGD module which was based from the questionnaire answered by the senior high school students. For the evaluation rating of the utilization of VGD module, below is a 5 – point Likert scale that was used:

Table 2 Likert scale for the evaluation rating of the utilization of VGD module

Rating	Range	Descriptive Evaluation
5	4.5 – 5.0	Very Great Extent
4	3.5 – 4.49	Great Extent
3	2.5 – 3.49	Moderate Extent
2	1.5 – 2.49	Least Extent
1	1.0 – 1.49	Not at All

The data from the rating sheet for the performance of VGD NCIII of the senior high school students was gathered, tallied, and tabulated.

The mean and weighted mean was used to determine the level of success of the rate for every Competency.

Below is the rating scale set by the TESDA that was used by the researcher based from the evaluation tool:

Table 3 Rating scale set by TESDA from the evaluation tool.

Rating	Descriptive Evaluation
Satisfactory	Passed, Certified Skilled
Not Satisfactory	Not Yet Competent

3. Results and discussion

This chapter presents, analyses, and interprets the data collected in the study. For clarity of presentation and consistency in the discussion, the data are presented following the order and sequence of the questions raised in Chapter 1, to wit: (1) extent of utilization of Visual Graphic Design module in terms of Print Media, Electronic Media, Product Packaging, Booth and Product/ window display, (2) level of performance of students in TESDA National Certification in terms of Print Media, Electronic Media, Product Packaging, Booth and Product/ window display, (3) impact of utilization of VGD module to the performance of students TESDA National Certification, and (4) implications from the findings of the study.

3.1. Extent of Utilization of Visual Graphic Design Module

Visual Graphic Design module aims to teach students conceptualization skills, design techniques and professionalism needed to succeed in today's fast-paced and lucrative creative industry. Students utilizing this module explore various design projects that stretch their creativity, thus, developing their skills in graphic design, Hence, this study assessed the extent of utilization of Visual Graphic Design module in terms of Print Media, Electronic Media, Product Packaging, Booth and Product/ window display and was found to be a "Very Great Extent" in terms of print Media (4.81).

3.1.1. Print Media

This competency is one of the four (4) certificate of competencies needed to qualify the Visual Graphic Design NC III. Print media designs involves the creation of flyers, brochures, posters and others which are formed to be printed. It includes physical artifacts or items you can hold in your hand such as business cards, banners and the like.

It may be gleaned from the data in Table 2 that students utilized print media to a "Very Great Extent" as shown by an average of 4.81. This was manifested when students personally use the module for the development of graphic designs for print media of VGD modules (4.74), after the utilization of VGD module, students are comfortable in developing graphic designs for print media (4.80), after the utilization of VGD module, students have created their own personal print media designs (4.80), after the utilization of VGD module, students use the module for the development of graphic designs for print media more often (4.85), If there would be a training available for Visual Graphic Design, students will use the VGD module for print media to help themselves (4.84).

Table 4 Utilization of Visual Graphic Design Module in terms of Print Media

Indicators	Mean	Interpretation
I personally use the module for the development of graphic designs for print media of VGD Modules.	4.74	Very Great Extent
After the utilization of VGD Module, I am comfortable in developing graphic designs for print media.	4.80	Very Great Extent
After the utilization of VGD module, I have created my own personal print media designs.	4.80	Very Great Extent
After completing the learning modules, I use the module for the development of graphic designs for print media more often.	4.85	Very Great Extent
If there would be training available for Visual Graphic Design, I will use the VGD module for print media to help myself.	4.84	Very Great Extent
It is important to me that the Visual Graphic Design module for print media is always available.	4.83	Very Great Extent
VGD modules helped me become more adept in creating designs for print media?	4.84	Very Great Extent
Average	4.81	Very Great Extent

3.1.2. Electronic Media

This certificate of competency refers to the RGB mode designs, the creation of content and graphic design solution for Internet-based and print presentation. The content develop is designed to be delivered via the Internet and accessed with PCs, laptops and mobile devices it also recognizes offline media. It encompasses all content presented in electronic format, such as web sites, electronic documents, graphics published in the virtual domain.

Table 5 Utilization of Visual Graphic Design Module in terms of Electronic Media

Indicators	Mean	Interpretation
I personally use the module for the development of graphic designs for electronic media of VGD Modules.	4.83	Very Great Extent
After the utilization of VGD Module, I am comfortable in developing graphic designs for electronic media.	4.76	Very Great Extent
After the utilization of VGD module, I have created my own personal electronic media designs.	4.84	Very Great Extent
After completing the learning modules, I use the module for the development of graphic designs for electronic media more often.	4.86	Very Great Extent
If there would be training available for Visual Graphic Design, I will use the VGD module for electronic media to help myself.	4.88	Very Great Extent
It is important to me that the Visual Graphic Design module for electronic media is always available.	4.83	Very Great Extent

VGD modules helped me become more adept in creating designs for electronic media?	4.83	Very Great Extent
Average	4.83	Very Great Extent

It may be noted in Table 3 that students utilized the module for electronic media and was found to be a "Very Great Extent" as shown by an average of 4.83. This was manifested when students personally use the module for the development of graphic designs for electronic media (4.83), after the utilization of VGD Module, students are comfortable in developing graphic designs for electronic media (4.76), after the utilization of VGD module, students have created my own personal electronic media designs (4.84), after completing the learning modules, students use the module for the development of graphic designs for electronic media more often. If there would be training available for Visual Graphic Design, students will use the VGD module for electronic media to help themselves (4.88), It is important for the students that the Visual Graphic Design module for electronic media is always available (4.83), and VGD modules helped the students to become more adept in creating designs for electronic media (4.83).

3.2. Product Packaging

Refers to the process of designing the packages such as containers, wrappers and the like. Packaging design means the visual identity of a certain brand, it is responsible for attracting the attention of customer, to provide product information, and to strengthen the business branding.

It may be noted in Table 4 that students utilized the module for product packaging and was found to be a "Very Great Extent" as shown by an average of 4.83. This was manifested when students personally use the module for the development of graphic designs for product packaging (4.75), after the utilization of VGD Module, students are comfortable in developing graphic designs for product packaging (4.84), after the utilization of VGD module, students have created my own personal product packging designs (4.76), after completing the learning modules, students use the module for the development of graphic designs for product packaging more often. If there would be training available for Visual Graphic Design, students will use the VGD module for product packaging to help themselves (4.86), it is important for the students that the Visual Graphic Design module for product packaging is always available (4.80), and VGD modules helped the students to become more adept in creating designs for product packaging (4.93).

Table 6 Utilization of Visual Graphic Design Module in terms of Product Packaging

Indicators	Mean	Interpretation
I personally use the module for the development of graphic designs for product packaging of VGD Modules.	4.75	Very Great Extent
After the utilization of VGD Module, I am comfortable in developing graphic designs for product packaging.	4.84	Very Great Extent
After the utilization of VGD module, I have created my own personal product packaging designs.	4.76	Very Great Extent
After completing the learning modules, I use the module for the development of graphic designs for product packaging more often.	4.83	Very Great Extent
If there would be training available for Visual Graphic Design, I will use the VGD module for product packaging to help myself.	4.86	Very Great Extent
It is important to me that the Visual Graphic Design module for product packaging is always available.	4.80	Very Great Extent
VGD modules helped me become more adept in creating designs for product packaging?	4.93	Very Great Extent
Average	4.82	Very Great Extent

3.3. Booth and Product/ window display

This unit covers the knowledge, skills and attitude required to incorporate the principles of visual design and communication into the design and production of booth and product window displays. It may be gleaned in Table 5 that students also use the module for Booth and Product/ window display and was found to be a "Very Great Extent" (4.87); This was revealed when students personally use the module for the development of graphic designs for booth and product/ window display (4.85), after the utilization of VGD module, the students are comfortable in developing graphic designs for booth and product/ window display after the utilization of VGD module (4.81); after the utilization of VGD module, the students are capable in creating their personal designs for Booth and Product/ window display (4.86).

Table 7 Utilization of Visual Graphic Design Module in terms of Booth and Product/ window display

Indicators	Mean	Interpretation
I personally use the module for the development of graphic designs for booth and product/window display of VGD Modules.	4.85	Very Great Extent
After the utilization of VGD Module, I am comfortable in developing graphic designs for Booth and Product/ window display.	4.81	Very Great Extent
After the utilization of VGD module, I have created my own personal designs for Booth and Product/ window display.	4.86	Very Great Extent
After completing the learning modules, I use the module for the development of graphic designs for Booth and Product/ window display more often.	4.93	Very Great Extent
If there would be training available for Visual Graphic Design, I will use the VGD module for Booth and Product/ window display to help myself.	4.85	Very Great Extent
It is important to me that the Visual Graphic Design module for Booth and Product/ window display is always available.	4.90	Very Great Extent
VGD modules helped me become more adept in creating designs for Booth and Product/ window display?	4.89	Very Great Extent
Average	4.87	Very Great Extent

After completing the learning modules, students use the module for the development of graphic designs for Booth and Product/ window display more often (4.93); if there would be training available for Visual Graphic Design, students will use the VGD module for Booth and Product/ window display to help themselves (4.85); it is important for the students that the Visual Graphic Design module for Booth and Product/ window display is always available (4.90); and VGD modules helped the students to become more adept in creating designs for Booth and Product/ window display (4.89)

3.4. Level of Performance of Students in TESDA National Certification

The process of creating graphic design cannot be easily defined: each designer has their own way of seeing the world and approaching their work. Graphic Design Process features a series of in-depth case studies exploring a range of both universal and unique design methods (Skolos and Wedell, 2019).

It may be gleaned in Table 6 that the students are exemplary showed an outstanding performance during the national certification performance in terms of print media to have a competent result. This was revealed when 100% of the students identified the target audience and medium, students received and interpreted the creative brief, the students selected appropriate visual design and communication techniques to fulfil the creative, technical, and production requirements of the brief (100%), students gathered relevant materials and media based on their compatibility to the creative and technical specifications of the selected media (100%), students compared and evaluated the range of delivery platforms and materials available for various designs and media (100%), students demonstrated ability in written and verbal supporting presentations and reports where relevant (100%), students developed vector graphics based on client brief using a high-end application (100%), students demonstrated ability to find and use information relevant to the task from a variety of information sources (100%), students reviewed details of the client brief according to identified preference setting requirements and clarifies any confusion with client or supervisor (100%).

Table 8 Students National Certification Performance in terms of Print Media

Indicators	Competent (2)	%	Not Yet Competent (1)	%
Identified target audience and medium	80	100.0	0	0.00
Received and interpreted the creative brief	80	100.0	0	0.0
Selected appropriate visual design and communication techniques to fulfil the creative, technical, and production requirements of the brief	80	100.0	0	0.0
Gathered relevant materials and media based on their compatibility to the creative and technical specifications of the selected media	80	100.0	0	0.0
Compared and evaluated the range of delivery platforms and materials available for various designs and media *	80	100.0	0	0.0
Demonstrated ability in written and verbal supporting presentations and reports where relevant *	80	100.0	0	0.0
Developed vector graphics based on client brief using a high-end application *	80	100.0	0	0.0
Demonstrated ability to find and use information relevant to the task from a variety of information sources*	80	100.0	0	0.0
Reviewed details of the client brief according to identified preference setting requirements and clarifies any confusion with client or supervisor	80	100.0	0	0.0
Assembled client copy and images to conform to the brief requirements	80	100.0	0	0.0
Import graphics, layers, product shots and other elements from other applications and formats and places correctly	80	100.0	0	0.0
Correctly imposed pages and combined elements to suit specified sheet size	80	100.0	0	0.0
Completed document set up to conform to the final media and brief requirements	80	100.0	0	0.0
Incorporated bleed allowance in margins and borders	80	100.0	0	0.0
Maintained alignment of the basic elements based on the overall balance of the layout and correct color blends and gradients	80	100.0	0	0.0
Created digital proof or PDF (digital document file format) to present to client	80	100.0	0	0.0
Set export options to the best settings for the final media and save and exports the file	80	100.0	0	0.0
Checked document to ensure correct layout file and that there are no non-printable elements	80	100.0	0	0.0
Determined correct format for the color separation as per requirements of the pre-press workflow system	80	100.0	0	0.0
Composed pages incorporating elements and features that meets the client's design brief and is print ready *	80	100.0	0	0.0
Demonstrated ability to apply the principles of visual design and communication*	80	100.0	0	0.0
Prepared different sets of page layouts according to the listed criteria*	80	100.0	0	0.0

Students assembled client copy and images to conform to the brief requirements (100%), students import graphics, layers, product shots and other elements from other applications and formats and places correctly (100%), students correctly imposed pages and combined elements to suit specified sheet size (100%), students completed document set up to conform to the final media and brief requirements (100%), students incorporated bleed allowance in margins and borders (100%), students maintained alignment of the basic elements based on the overall balance of the layout and correct color blends and gradients (100%), students

Graphic designers create visual concepts, using computer software or by hand, to communicate ideas that inspire, inform, and captivate consumers. They develop the overall layout and production design for various applications such as advertisements, brochures, magazines, and corporate reports (Bureau of Labor of Statistics, 2017).

In terms of electronic media, it may be gleaned in table 7 that the national certification performance of students resulted as "Competent". This was revealed when the students identified correctly and completely showed the objectives and desired outcomes for the electronic media competency (100%), the students identified target user/audience to determine the format and delivery platform of the electronic materials through discussion with relevant personnel (100%), the students showed sufficient knowledge of the elements of good design specifically for use in electronic media (100%), the students showed sufficient knowledge of the range of design techniques for electronic media (100%), the students showed sufficient knowledge of the range of delivery platforms available for electronic media (100%), the students compared the range of design techniques and delivery platforms and, by way of such comparison, chooses the most appropriate technique and delivery platform that meets the objectives and desired outcome of the electronic media (100%), the students generated a feasible range of visual design and communication ideas which respond to the creative brief and provide creative solutions to all design issues (100%), the students gathered relevant materials and media based on their compatibility to the creative and technical specifications of the electronic media (100%), the students continuously reflected on and assessed creative ideas and solutions for implications on budget, timeline, technical feasibility and suitability to meet the brief (100%), the students identified and implemented additional requirements or modifications to the design (100%), the students identified relationship between the visual elements, hardware, and software required (100%), the students applied visual design and communication techniques (100%), the students evaluated design outcome on whether it is able to meet the creative and technical requirements set for the project (100%), the students used appropriate font (typeface, style, size, and color)—evaluation can be based on generally accepted standards or as required/specified in the creative brief (100%), the students used images, illustrations, or icons that are relevant to the content and target audience (100%), the students laid out the contents/elements of the page according to generally accepted standards of usability (e.g., the most important contents are at the top of page, left hand-side) (100%), the students used the appropriate amount and design of links and navigational buttons (100%), the students used appropriate background music and/or sound effects (100%), the students complied with generally accepted ethics, values, and norms (i.e., intellectual property and copyright protection, non-violence, environmental conservation/ protection, protection of women and children's rights, cultural tolerance/diversity, etc) (100%), the students Observed proper rules of grammar and speech (e.g., no typographical errors, first letter of proper names are capitalized, etc) (100%).

Table 9 Students National Certification Performance in terms of Electronic Media

Indicators	Comp etent (2)	%	Not Yet Compete nt (1)	%
Identified correctly and completely the objectives and desired outcomes of the electronic media based on received creative brief	80	100.0	0	0.0
Identifies target user/audience to determine the format and delivery platform of the electronic materials through discussion with relevant personnel	80	100.0	0	0.0
Shows sufficient knowledge of the elements of good design specifically for use in electronic media	80	100.0	0	0.0
Shows sufficient knowledge of the range of design techniques for electronic media	80	100.0	0	0.0
Shows sufficient knowledge of the range of delivery platforms available for electronic media	80	100.0	0	0.0

Compares the range of design techniques and delivery platforms and, by way of such comparison, chooses the most appropriate technique and delivery platform that meets the objectives and desired outcome of the electronic media *	80	100.0	0	0.0
Generates a feasible range of visual design and communication ideas which respond to the creative brief and provide creative solutions to all design issues*	80	100.0	0	0.0
Gathers relevant materials and media based on their compatibility to the creative and technical specifications of the electronic media*	80	100.0	0	0.0
Continuously reflects on and assesses creative ideas and solutions for implications on budget, timeline, technical feasibility and suitability to meet the brief	80	100.0	0	0.0
Identifies and implement additional requirements or modifications to the design	80	100.0	0	0.0
Identifies relationship between the visual elements, hardware, and software required	80	100.0	0	0.0
Applies visual design and communication techniques*	80	100.0	0	0.0
Evaluates design outcome on whether it is able to meet the creative and technical requirements set for the project	80	100.0	0	0.0
Used appropriate font (typeface, style, size, and color)—evaluation can be based on generally accepted standards or as required/specified in the creative brief	80	100.0	0	0.0
Used images, illustrations, or icons that are relevant to the content and target audience	80	100.0	0	0.0
Laid out the contents/elements of the page according to generally accepted standards of usability (e.g., the most important contents are at the top of page, left hand-side)	80	100.0	0	0.0
Used the appropriate amount and design of links and navigational buttons	80	100.0	0	0.0
Used appropriate background music and/or sound effects	80	100.0	0	0.0
Complied with generally accepted ethics, values, and norms (i.e., intellectual property and copyright protection, non-violence, environmental conservation/ protection, protection of women and children's rights, cultural tolerance/diversity, etc)	80	100.0	0	0.0
Observed proper rules of grammar and speech (e.g., no typographical errors, first letter of proper names are capitalized, etc)	80	100.0	0	0.0

Packaging and packaging design have become significant factors in the marketing of diverse "consumer goods" and have a main role in communicating product benefits to the customer. Czinkota & Ronkainen (2007) deem that product packaging is connected to other variables in the marketing mix (Rundh 2009, p. 988). Cateora & Ghauri (2000) say that these variables are within the control of the company and they help to adapt to the changes in the business environment (Rundh 2009, p. 988). According to Packaging Federation (2004 a,b), these changes occur in different areas: new technology, materials development, logistics requirements, environmental issues, consumer preferences; all are the key factors for making decisions on marketing strategy (Rundh 2009, p. 988).

It may be gleaned in Table 8 that the students are exemplary showed an outstanding performance during the national certification performance in terms of product packaging design to have a competent result. This was revealed when 100% of the students reviewed and confirmed details of the client brief according to identified preference setting requirements, the students interpreted and identified the objective and desired outcomes of the product packaging (100%), the students identified prospective buyers/customers to determine the form and materials of the product packaging (100%), the students gathered and compared relevant materials and media based on their compatibility to the creative and technical specifications of the product packaging (100%), the students generated range of visual design

and communication ideas which are technically feasible, respond to the brief and provide creative solutions to all design issues (100%), the students applied visual design and communication techniques (100%), the students evaluated market to fit design packages and production design process (100%), the students evaluated and discussed initial discussions and design brief against the findings (100%),

Table 10 Students National Certification Performance in terms of Product Packaging

Indicators	Competent (2)	%	Not Yet Competent (1)	%
Reviews and confirms details of the client brief according to identified preference setting requirements	80	100.0	0	0.0
Interprets and identifies the objective and desired outcomes of the product packaging	80	100.0	0	0.0
Identifies prospective buyers/customers to determine the form and materials of the product packaging	80	100.0	0	0.0
Gathers and compared relevant materials and media based on their compatibility to the creative and technical specifications of the product packaging *	80	100.0	0	0.0
Generates range of visual design and communication ideas which are technically feasible, respond to the brief and provide creative solutions to all design issues *	80	100.0	0	0.0
Applies visual design and communication techniques *	80	100.0	0	0.0
Evaluates market to fit design packages and production design process	80	100.0	0	0.0
Evaluates and discuss initial discussions and design brief against the findings	80	100.0	0	0.0
Produces design prototype according to the creative and printing/technical requirements and ensure that selection is based on solid understanding of the characteristics and capabilities of intended buyers/customers	80	100.0	0	0.0
Evaluates design prototype on whether it is able to meet the creative and technical requirements set for the project	80	100.0	0	0.0
Identifies and implement additional requirements or modifications to the design	80	100.0	0	0.0
Prepares final design files and prototype-guide for mass/volume production	80	100.0	0	0.0
Identifies appropriate format for saving the graphic given the various elements in the graphic	80	100.0	0	0.0
Checks document to ensure correct layout file and that there are no non-printable elements	80	100.0	0	0.0
Develops understanding of methods for presenting packaging designs to clients	80	100.0	0	0.0
Presents /launches new design/label according to client's requirements	80	100.0	0	0.0

The students produced design prototype according to the creative and printing/technical requirements and ensure that selection is based on solid understanding of the characteristics and capabilities of intended buyers/customers (100%),

the students evaluated design prototype on whether it is able to meet the creative and technical requirements set for the project (100%), the students identified and implemented additional requirements or modifications to the design (100%), the students prepared final design files and prototype-guide for mass/volume production (100%), the students identified appropriate format for saving the graphic given the various elements in the graphic (100%), the students checked document to ensure correct layout file and that there are no non-printable elements (100%), the students developed understanding of methods for presenting packaging designs to clients (100%), the students presented /launched new design/label according to client's requirements (100%).

Booth and product or Window displays are important means by which retailers communicate with both current and potential consumers. Window displays play an especially important role for bricks-and-mortar store environments because they serve as "silent salesmen" that can differentiate store characteristics (Klokis, 2002). Therefore, how window displays catch consumers' attention and influence their behaviors has become of interest to researchers (Edwards & Shackley, 1992; Sen, Block & Chandran, 2002).

It may be gleaned in Table 9 that the students are exemplary showed an outstanding performance during the national certification performance in terms of booth and product/ windows display design to have a competent result. This was revealed when 100% of the students reviewed and confirms details of the client brief according to identified preference setting requirements, the students interpreted and identified the objective and desired outcomes of the Booth and Product/ window displays (100%), the students identified all relevant factors which may determine and affect visual design and communication concepts and application through the breakdown and interpretation of the brief (100%), the students identified target user/audience to determine the format and specifications of the Booth and Product/ window display materials (100%), the students generated range of visual design and communication ideas which are technically feasible, respond to the brief and provide creative solutions to all design issues (100%), the students gathered and compared relevant materials and media based on their compatibility to the creative and technical specifications of the Booth and Product/ window display (100%), the students applied visual design and communication techniques (100%), the students discussed and collaborated visual design & communication ideas, as required, to ensure contribution of a range of ideas and creative solutions to the initial concept (100%), the students continuously reflected on and assessed creative ideas & solutions for implications on budget, timeline, technical feasibility and suitability to meet the brief (100%), the students researched and compared techniques and tools for visual design and communication, range of materials and typographical and visual elements that are appropriate and available for use in the production of Booth and Product/ window displays (100%), the students identified relationship between the visual elements and environmental factors required (100%), the students organized research media and findings for use throughout the design development process, updating as required (100%), the students evaluated and discussed initial discussions and design brief against the findings (100%).

Table 11 Students National Certification Performance in terms of Booth and Product/ window display

Indicators	Competent (2)	%	Not Yet Competent (1)	%
Reviews and confirms details of the client brief according to identified preference setting requirements	80	100.0	0	0.0
Interprets and identifies the objective and desired outcomes of the Booth and Product/ window displays	80	100.0	0	0.0
Identifies all relevant factors which may determine and affect visual design and communication concepts and application through the breakdown and interpretation of the brief	80	100.0	0	0.0
Identifies target user/audience to determine the format and specifications of the Booth and Product/ window display materials	80	100.0	0	0.0
Generates range of visual design and communication ideas which are technically feasible, respond to the brief and provide creative solutions to all design issues. *	80	100.0	0	0.0
Gathers and compared relevant materials and media based on their compatibility to the creative and technical specifications of the Booth and Product/ window display *	80	100.0	0	0.0

Applies visual design and communication techniques	80	100.0	0	0.0
Discusses and collaborates visual design & communication ideas, as required, to ensure contribution of a range of ideas and creative solutions to the initial concept	80	100.0	0	0.0
Continuously reflects on and assess creative ideas & solutions for implications on budget, timeline, technical feasibility and suitability to meet the brief	80	100.0	0	0.0
Researches and compares techniques and tools for visual design and communication, range of materials and typographical and visual elements that are appropriate and available for use in the production of Booth and Product/ window displays	80	100.0	0	0.0
Identifies relationship between the visual elements and environmental factors required	80	100.0	0	0.0
Organizes research media and findings for use throughout the design development process, updating as required	80	100.0	0	0.0
Evaluates and discusses initial discussions and design brief against the findings	80	100.0	0	0.0
Develops and presents design prototype to assessor approval.	80	100.0	0	0.0
Gathers and sources required materials based on approved prototype.	80	100.0	0	0.0
Produces and sets up actual Booth and Product/ window displays in accordance with selected design techniques and tools	80	100.0	0	0.0
Ensures that the creative and technical requirements of the brief are fulfilled and that all elements are fully documented	80	100.0	0	0.0
Constantly consults relevant personnel throughout the production to ensure harmony and compatibility of the design with technical requirements	80	100.0	0	0.0
Evaluates design outcome on whether it is able to meet the creative and technical requirements set for the project	80	100.0	0	0.0
Identifies and implements additional requirements or modifications to the design	80	100.0	0	0.0

The students developed and presented design prototype to assessor approval (100%), the students gathered and sourced required materials based on approved prototype (100%), the students produced and set up actual Booth and Product/ window displays in accordance with selected design techniques and tools (100%), the students ensured that the creative and technical requirements of the brief are fulfilled and that all elements are fully documented (100%), the students constantly consulted relevant personnel throughout the production to ensure harmony and compatibility of the design with technical requirements (100%), the students evaluated design outcome on whether it is able to meet the creative and technical requirements set for the project (100%), the students identified and implemented additional requirements or modifications to the design (100%).

3.5. Impact of Utilization of VGD Module to the Performance of Students TESDA National Certification

In conducting the study, it was hypothesized that the utilization of visual graphic design module significantly affects the national certification performance of senior high school students. To determine the extent of influence of the utilization of visual graphic design module on the national certification performance of students, the data were subjected to regression analysis. Result of the regression in Table 10 revealed that the utilization of visual graphic design module in terms of print media, electronic media, product packaging and Booth and Product/ window display produced B coefficients of -0.3, 0.056, 0.091 and 0.005 with associated probability less than the significance level set at 0. 05. The findings indicate that for every unit of increase in the visual graphic design module in terms of print media, electronic media, product packaging, and Booth and Product/ window display, national certification performance of students

could generate a -0.06, 0.95, 0.18, and 0.009. The obtained Beta coefficients of -0.06, 0.95, 0.18, and 0.009 indicate that visual graphic design module variables individually influence the national certification performance of senior highs school students. The obtained F-value of .901 which was found significant at .05 alpha indicates that the utilization of visual graphic design module formed a very significant set of predictors for the national certification performance of senior high school students.

Table 12 Regression analysis of Visual Graphic Design Module on National

Variables	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig.
(Constant)	1.441	0.361		3.987	0
Print media	-0.03	0.076	-0.06	-0.394	0.695
Electronic media	0.056	0.083	0.095	0.669	0.506
Product packaging	0.091	0.08	0.18	1.138	0.259
Booth and Product window display	0.005	0.094	0.009	0.05	0.96
R-squared = .046					
F-value = .901					
p-value = .468					
alpha = 0.05					

3.6. Implications Drawn from the Findings of the Study

A number of implications were drawn from the findings of the study as follows:

- The utilization of visual graphic design module could benefit students to become more adept in creating graphic designs. The creativity and innovation of students in terms of developing designs would be developed more than any time in the past.
- Orientation and training of students serves as a vital role to introduce the opportunities in utilizing the visual graphic design module, most specifically for the national certification performances.
- Students who are utilizing the Visual Graphic Design will enhance their graphic design skills in terms of print media designs, electronic media designs, product packaging designs and booth and product/ window display design.
- With relation to the national certification performance, it was that the more the students utilize the visual graphic design module, the more confident they are during the national certification performance evaluation, and in developing their own personal designs.

3.7. Conclusion

This chapter presents the summary of the major findings, the conclusions arrived at based on the findings, and the recommendations given in accordance with the conclusions.

3.8. Findings

3.8.1. **Problem 1.** *Extent of utilization of visual graphic design module*

The extent of utilization of visual graphic design module was found to be "very great extent" in terms of print media, electronic media, product packaging, and booth and product/ window display.

*3.8.2. **Problem 2.** Level of performance of students in TESDA national certification*

The level of performance of students as a whole was identified as "competent" in terms of developing designs of print media, electronic media, product packaging, and booth and product/ window display.

*3.8.3. **Problem 3.** Impact of utilization of VGD module to the performance of students TESDA national certification*

Result of the regression in Table 8 revealed that the utilization of visual graphic design module in terms of print media, electronic media, product packaging and Booth and Product/ window display produced B coefficients of -0.3, 0.056, 0.091 and 0.005 with associated probability less than the significance level set at 0. 05. The findings indicate that for every unit of increase in the visual graphic design module in terms of print media, electronic media, product packaging, and Booth and Product/ window display, national certification performance of students could generate a -0.06, 0.95, 0.18, and 0.009. The obtained Beta coefficients of -0.06, 0.95, 0.18, and 0.009 indicate that visual graphic design module in terms of print media, electronic media and Booth and Product/ window display contribute individual effects in the national certification performance of senior highs school students. The obtained F-value of .901 which was found significant at .05 alpha indicates that the utilization of visual graphic design module formed a very significant set of predictors for the national certification performance of senior high school students.

*3.8.4. **Problem 4.** Implications drawn from the findings of the study*

A number of implications were drawn from the findings of the study as follows:

The utilization of visual graphic design module could benefit students to become more adept in creating graphic designs. The creativity and innovation of students in terms of developing designs would be developed more than any time in the past.

- Orientation and training of students serves as a vital role to introduce the opportunities in utilizing the visual graphic design module, most specifically for the national certification performances.
- Students who are utilizing the Visual Graphic Design Module will enhance their graphic design skills in terms of print media designs, electronic media designs, product packaging designs and booth and product/ window display design.
- With relation to the national certification performance, it was that the more the students utilize the visual graphic design module, the more confident they are during the national certification performance evaluation, and in developing their own personal designs.

4. Conclusions

In the light of the findings of the study, the following conclusions were drawn:

o The utilization of visual graphic design module was able to help the students to qualify the students in TESDA national certification.
o High passing rate of students in TESDA national certification is a good picture of school culture because it can lead to improved delivery lessons in school.
o The findings suggest that teachers' performance have still more room for improvement.
o The utilization of visual graphic design module significantly influenced the national certification performance of student.
o The implications drawn from the findings of the study can serve as baseline data in further improving the visual graphic design module utilization.

Recommendations

Based on the findings and conclusions of the study, the following recommendations are hereby submitted:

o That the utilization of visual graphic design module may still be further improved to maintain the very great extent rate. Dissemination of these findings may be necessary as bases for further development.
o That visual graphic design module should regularly utilize to maintain the high passing rate of the students.
o It is therefore exigent that the utilization of visual graphic design module could continuously benefit the senior high school students to have an outstanding result to the national certification performance

- o That utilization of visual graphic design should regularly employ in order to further improve the visual graphic design skills of the students.
- o That the implications drawn from this study be used by school in developing strategic plans that will further improve the students TESDA national certification performance.

Compliance with ethical standards

Disclosure of conflict of interest

All authors contributed positively to the writing of this manuscript and there no conflict of interest as agreed to the content of this research. The researchers have no affiliations with or involvement in any organizations, or entities with any financial, and non-financial interest in the subject matter, materials, and methods discussed in this study.

Statement of informed consent

Informed consent was obtained from all individuals respondents included in the study

References

[1] Abeer R.A and Kowla A.A.R.G. The Effect of Educational Modules on the Direct and Postponed Study's Achievement of Seventh Primary Grade Students in Science, in Comparison with the Conventional Approach. 2012

[2] Ovelyn M., Baharom DG., Noriza Ag. Kifleeb, Molod I. The Effectiveness of Using Teaching Module Based on Radical Constructivism toward Students Learning Process. 2013

[3] Choo M.C and Marina B.A.B. The Impact of Using Modules in the Teaching and Learning of English in Malaysian Polytechnics: An Analysis of the Views and Perceptions of English Language Lecturers. 2013

[4] Audrey B. Design Studies: Theory and Research in Graphic Design, The Rise of Research in Graphic Design. 2006. pp.14-23

[5] Chihmin T. The Effects of Window Display Setting and Background Music on Consumers' Mental Imagery, Arousal Response, Attitude and Approach-Avoidance Behaviors.2009

[6] Polyakova K. Packaging design as a Marketing tool and Desire to purchase.2013

[7] Amanda DiSilvestro (2016). Why Photoshop is No Longer an Extra Skill for Modern Marketers Retrieved from https://searchenginewatch.com/2016/06/27/why-photoshop-is-no-longer-an-extra-skill-for-great-marketers/

[8] Ayo Aluko (2016). Earn Money Online with Photoshop Retrieved from https://www.linkedin.com/pulse/earn-money-online-photoshop-ayo-aluko/

[9] Dawn Berryman (2015). How Can Photoshop Help My Home Business? Retrieved from https://www.theworkathomewoman.com/photoshop/

[10] Derrick Storyje (2017, November). From Darkroom to Desktop – How Photoshop Came to Light http://thedigitalstory.com/notes/History_of_Photoshop_Feb_2000.pdf

[11] Emmanuel Ekow Asmah (2011). Rural livelihood diversification and agricultural household welfare in Ghana http://www.academicjournals.org/article/article 1379517769_Asmah.pdf

[12] Emmanuelle Auriol (2013). Toulouse School of Economics. Barriers to formal entrepreneurship in developing countries

[13] Frank Ellis (2018, January). Household Strategies and Rural Livelihood Diversification Retrieved from https://www.researchgate.net/publication/227618383_Household _Strategies_and_Rural_Livelihood_Diversification

[14] Gerald Choplin and Priscilla Claeys (2017). The Right to Decent Income and Livelihood Retrieved from https://peasantsrights.eu/assets/pdf/droits_revenus_decents_ ENG_web.pdf

[15] Kyle W. Bell (2017). Photoshop vs Picasa retrieved from https://yourbusiness.azcentral.com/photoshop-vs-picasa-6090.html

[16] Lori Cameron (2017). The Most Sought-After Computing Careers of 2017 Retrieved from https://computer.org/jobs

[17] Los Alamitos, Calif. (2017, December). Top 10 Technology Trends for 2018: IEEE Computer Society Predicts the Future of Tech Retrieved from https://www.computer.org/web/pressroom/top-technology-trends-2018

[18] Mia-Pia, C.V. (2014). ALL ABOUT GAFE A Study on a Learning Module on the use of Google Apps For Education with a Rural Hawaiian Middle School's Faculty. Retrieved from https://sites.google.com/a/konawaenamid.k12.hi.us/all-about-gafe/

[19] Samuel Gibbs (2015, February). The 25 best Alternatives to Photoshop Retrieved from https://www.theguardian.com/technology/2015/feb/19/25-alternatives-to-photoshop-image-editing

[20] Sara Latch (2017). The Way Adobe Photoshop Will Make Money from Your Digital Photos Retrieved from http://www.redsfreshseafoodhouse.com/the-way-adobe-photoshop-will-make-money-from-your-digital-photos/

[21] Simon, M.K., and Goes, J. (2013). Dissertation and scholarly research: Recipes for success (2013 Ed.). Seattle, WA, Dissertation Success, LLC. Retrieved from http://dataanalysiswaringi.blogspot.com/2017/03/likert-scale-data-analysis-and.html

[22] Shapiro, Ellen. "Design schools 101: what challenges face graphic design students and teachers these days? There's too much new technology to cover, for starters--and there's not always enough funding to keep up with demand." Print, vol. 58, no. 2, Mar.-Apr. 2004, p. 41+. Gale In Context: College, https://link.gale.com/apps/doc/A114820514/GPS?u=phnl&sid=GPS&xid=2f2c9714.

[23] Osterer, Irv. "Type faces." Arts & Activities, vol. 135, no. 2, Mar. 2004, p. 24. Gale In Context: College, https://link.gale.com/apps/doc/A113759407/GPS?u=phnl&sid=GPS&xid=813d1267.

[24] Anderson, Kent. "Creativity 32." School Arts, vol. 103, no. 5, Jan. 2004, p. 64+. Gale In Context: College, https://link.gale.com/apps/doc/A112314215/GPS?u=phnl&sid=GPS&xid=2b7eed28. Accessed 28 May 2020.

[25] Bishop, Al. "Partners in technology: our graphic experience: [The students] experienced the thrill of seeing their work distributed to 40,000 people." The Technology Teacher, vol. 61, no. 4, Dec. 2001, p. 26+. Gale In Context: College, https://link.gale.com/apps/doc/A80746805/GPS?u=phnl&sid=GPS&xid=498e91e2.

[26] Lambert, N.M. "Ambrose, Gavin. The fundamentals of creative design." CHOICE: Current Reviews for Academic Libraries, vol. 49, no. 6, Feb. 2012, p. 1049. Gale In Context: Biography, https://link.gale.com/apps/doc/A281789105/GPS?u=phnl&sid=GPS&xid=73305af4.

[27] Labuz, R.M. "Gardner, Bill. Logo creed: the mystery, magic, and method behind designing great logos." CHOICE: Current Reviews for Academic Libraries, vol. 51, no. 10, June 2014, p. 1789. Gale In Context: Biography, https://link.gale.com/apps/doc/A370321888/GPS?u=phnl&sid=GPS&xid=ad3063e4.

[28] Scott R. Bartholomew, Liwei Zhang, Greg J. Strimel, Esteban Garcia Bravo, A Tool for Formative Assessment and Learning in a Graphics Design Course: Adaptive Comparative Judgement, The Design Journal, 10.1080/14606925.2018.1560876, (1-23), (2019).

[29] Susan Giloi, Lynn Quinn, Assessment of Sustainable Design: The Significance of Absence, The Design Journal, 10.1080/14606925.2019.1651601, (1-19), (2019).

[30] Katherine Hepworth, Cesunica E. Ivey, Chelsea Canon, Heather A. Holmes, Embedding online, design-focused data visualization instruction in an upper-division undergraduate atmospheric science course, Journal of Geoscience Education, 10.1080/10899995.2019.1656022, (1-16), (2019).

[31] Doris H. Kincade, Windi D. Turner, Oscar J. Solis, Elizabeth H. Dull, Assessing Millennials in College-Level Fashion Design Studios: A Study of Evidence-Based Practice, International Journal of Art & Design Education, 10.1111/jade.12167, 38, 1, (47-59), (2018).

[32] Paulo Roberto Nicoletti Dziobczenski, Oscar Person, Sonja Meriläinen, Designing Career Paths in Graphic Design: A Document Analysis of Job Advertisements for Graphic Design Positions in Finland, The Design Journal, 10.1080/14606925.2018.1444874, 21, 3, (349-370), (2018).

[33] Pieter du Toit, Reflecting on more than 20 years of involvement in a postgraduate higher education qualification for academics: May I dare use an auto-ethnographic lens?, The Journal for Transdisciplinary Research in Southern Africa, 10.4102/td.v14i2.481, 14, 2, (2018).

[34] Tan Xurui, Yu Yaxu, Li Qiangqiang, Mao Yu, Zhou Bin, Bao Xueming, Mechanisms of Creativity Differences Between Art and Non-art Majors: A Voxel-Based Morphometry Study, Frontiers in Psychology, 10.3389/fpsyg.2018.02319, 9, (2018).

[35] Kani Ulger, The creative training in the visual arts education, Thinking Skills and Creativity, 10.1016/j.tsc.2015.10.007, 19, (73-87), (2016).

[36] Prajana Marwan Sejati, C. A. Budiningsih, undefined Pujianto, Multimedia in Disaster Risk Reduction, Journal of Physics: Conference Series, 10.1088/1742-6596/1233/1/012090, 1233, (012090), (2019).

[37] D. S. Gubsky, A. B. Kleschenkov, I. V. Mamay, Virtual laboratory for microwave measurements, Computer Applications in Engineering Education, 10.1002/cae.22164, 27, 6, (1496-1505), (2019).

[38] Dmitry Gubsky, Irina Ivanova, Anatoly Kleschenkov, Developing of computer models of modern measuring instruments for a remote virtual laboratory, ITM Web of Conferences, 10.1051/itmconf/20193011001, 30, (11001), (2019).

[39] Branislav M. Notaroš, Ryan McCullough, Sanja B. Manić, Anthony A. Maciejewski, Computer-assisted learning of electromagnetics through MATLAB programming of electromagnetic fields in the creativity thread of an integrated approach to electrical engineering education, Computer Applications in Engineering Education, 10.1002/cae.22073, 27, 2, (271-287), (2018).

[40] Magdy F. Iskander, Four Decades of Academic Career in Electromagnetic Research and Education, The World of Applied Electromagnetics, 10.1007/978-3-319-58403-4, (5-53), (2018).

[41] M. Parai, P. Shenoy, K.Y. Loh, Students' perception of technology-assisted learning in undergraduate medical education – A survey, The Social Science Journal, 10.1016/j.soscij.2014.08.007, 52, 1, (78-82), (2015).

[42] Arcadi Pejuan, Xavier Bohigas, Xavier Jaén, Cristina Periago, Comparative study of three audio processors as environments for laboratory activities on wave physics and acoustics, Computer Applications in Engineering Education, 10.1002/cae.20534, 21, S1, (E89-E99), (2011).

[43] Elisabeth Ilie-Zudor, Zsolt Kemény, Marcell Szathmári, László Monostori, The role of OSC-based projects in meeting new challenges of education—concept and exemplification, Computer Applications in Engineering Education, 10.1002/cae.20518, 21, S1, (E141-E151), (2011).

[44] Elisabeth Ilie-Zudor, Marco Macchi, László Monostori, Stefano Scotti, Zsolt Kemény, Engineering education on supply-chain management for students and for employees in industry, Computer Applications in Engineering Education, 10.1002/cae.20293, 19, 1, (81-88), (2009).

[45] Ali Fuat Guneri, Sukran Seker, The use of Arena simulation programming for decision making in a workshop study, Computer Applications in Engineering Education, 10.1002/cae.20182, 16, 1, (1-11), (2008).

[46] Tacha Serif, Gheorghita Ghinea, Lampros Stergioulas, Sherry Y. Chen, Thanassis Tiropanis, Sofia Tsekeridou, Satellite-based delivery of educational content to geographically isolated communities: a service based approach, Personal and Ubiquitous Computing, 10.1007/s00779-007-0185-9, 13, 3, (229-241), (2007).

[47] Lucio Ieronutti, Luca Chittaro, Employing virtual humans for education and training in X3D/VRML worlds, Computers & Education, 10.1016/j.compedu.2005.06.007, 49, 1, (93-109), (2007).

[48] Ismael Orquín, Miguel-Ángel García-March, Pedro Fernández de Córdoba, Javier F. Urcheguía, Juan A. Monsoriu, Introductory quantum physics courses using a LabVIEW multimedia module, Computer Applications in Engineering Education, 10.1002/cae.20100, 15, 2, (124-133), (2007).

[49] A. Alper Ozalp, Nonadiabatic and frictional constant area duct flow: A visual software based simulation for compressible systems, Computer Applications in Engineering Education, 10.1002/cae.20068, 14, 1, (64-75), (2006).

[50] S.K Ong, M.A Mannan, Virtual reality simulations and animations in a web-based interactive manufacturing engineering module, Computers & Education, 10.1016/j.compedu.2003.12.001, 43, 4, (361-382), (2004).

[51] A. Alper Ozalp, S. Ayse Ozel, An interactive software package for the investigation of hydrodynamic-slider bearing-lubrication, Computer Applications in Engineering Education, 10.1002/cae.10047, 11, 3, (103-115), (2003).