Graphic Cognitive Study on the Implementation of Traditional Dyeing Process

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Abstract: Nowadays, teachers generally instruct through teaching aids, such as text, image, or video in the education field. Relevant research shows that in human vision, graphics are easier to understand and remember than words. Therefore, by using the two media of text and picture, the content can visualize through an information graphic, which makes it easier for learners to read and understand, to increase the learning effect. This research used plant dyeing teaching in the traditional dyeing process as the theme. It aimed to explore the auxiliary results of the "text and picture instructions" applied to teaching courses. The purpose was to understand what kind of media characteristics students had a better understanding of and reduce the time of self-exploration in the operation process. This research adopted "experimentation" and "participant observation" two research methods. Through literature review and conducting experimental sample design, the study devised five kinds of instructions for different situations to perform in the pre-test. Then I received the test data of eight subjects when they manipulated these five distinct types of instruction. The outcomes indicate that short operation time does not mean high accuracy. According to the results, it is easier for the subjects to understand "text instruction". This finding also reveals that the form of picture instruction has no clear advantage in the cognitive process of the viewer, which is also slightly different from the relevant literature. However, the result can use as a reference for the follow-up experiments, and it expects that it will help students obtain the optimal media characteristics of instruction in the course learning.

Key words: teaching aids, cognition of text and picture, media characteristics, dyeing teaching

1.Introduction

1.1 Research Background

With the evolution of the current digital age, information exchanges have generally existed in the daily lives of people (Goodwin, 2002; Lai & Burden, 2020; Chen, H. F. & Fan, Y. W., 2000; Huang, S. Y., 2020). Jill N. once said, "when sensory reception is in a powerful emotional situation, it can increase people's deep memory." (Colin & Malcolm, 1999). As a result, most research literature tends to believe that graphics can convey information more effectively than texts, not only vivid but also easy to understand and deepen vision memory (Biehal, Stephens & Curio, 1992). We have used words, which are the essential symbol of language, as the visual symbol

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of communication between people since the early days. However, the form of texts limits by communication factors such as region and culture. Based on the type of graphic and text, both of the carriers have their characteristics and differences. In the teaching process, the teacher organizes the specific content of the course into relevant charts through text, graphic, and other forms, and the information will be summarized analysis and fusion to compare. Finally, integrate the style of the graphic instructions to convey and communicate with the viewer. As teachers, they expect students to use simplified, fast, and effective learning methods in the current mature media technology environment to understand the received information efficiently and internalize the cognitive information into individual professional skills and operational experience (Su M. G. & Zhang W. H., 2020). According to the relevant literature of teaching media, multi-element learning with common sense provides various forms for information producers to understand comprehensively. However, is it possible that the assistance of multimedia may also lead to the problem of excessive information and cause cognitive psychological load on information receivers? Moreover, does it mean that simple information is complicated? These situations become the theme of this study.

1.2 Research Purposes

The purpose of this study is to explore the effect of the form of the text and picture instructions on individual cognition. This paper attempts to record, sort out and compare the cognitive status of different media forms from the subjects' operation step by step with the static text and picture instructions as to the test base and the traditional dyeing as the teaching theme. The purpose of this study is as follows:

- Sort out the various types of visual symbols in the presentation of the characteristics of the situation and application.
- Understand the learners' acceptance and understanding of the carrier form of the static cognition of text and picture.
- Revise the research design based on the results of pre-tests and apply them to the experimental design of subsequent research.

2. Literature Review

2.1 Application of the Information Graphic

In the science of art design, the main research foundation is the way and cognition of visual sensory information transmission. Use vision media as a means of contact to achieve intercourse and communication between people. The so-called visual medium mentioned above presents symbolic elements and expressions. These symbolic elements, such as graphics, pictures, and text, etc., are composed of single or multiple parts and have meaningful connotations to enhance the communication effect of the individual in the transmission of visual information (Ge J., 2015). From the recipient's point of view, the individual makes meaningful interpretations and responses to the vision message through the reception and cognition of the visual senses, combined with the extraction of the template of the individual's visual experience. We can see that these visual elements that are intuitive or need to be understood still contain the level of convention formed by individual interpretation and meaning. The so-called concept of multi-meaning of the picture or multi-meaning of the text is based on the experience and learning of the individual (Goodwin, 2002; Keulen & Boendermaker, 2020).

At present, texts are still the main carrier form for individuals to receive knowledge, followed by graphics in a broad sense (Chiang S. B. & Sun C. W., 2014). As a prime and widely used media, texts have become an

indispensable element in human life from the early days to the present (Ge J., 2015). Most multimedia contains texts that can convey or assist their meaning in various ways. For example, color size, font, color, putting the bottom line, and putting animation can help the texts convey its content (Wu S. Y., 2004). However, the graphic is a collective term for another symbol. The detailed division of the graphic is image, icon, and picture, which is a form of expression that is different from the text and has become a carrier of expressing visual content and communicating with people (Begleiter, 2001). People are born with the ability to respond to graphic stimuli. Compared with texts, graphics are easier to remember and learn and have more imagination space (Zhai Z. P. & Wang W. Y., 2009). It is also easy to be absorbed and not easy to be forgotten. In other words, the stimulation of visual information is affected by way of individual reception, cognition, and understanding, which relatively affects the memory and continuity of message. It is a critical medium for people to communicate (Lankow, Ritchie & Crooks, 2012). Besides, people receive information in many ways, among which vision is the primary way. Nearly 80% of the information received by the eyes exceeds the sum of other paths (Xu Z. F., 2016). It shows that the visual sensory approach for individuals in information reception and knowledge learning, etc., we must pay attention to and widely used cognitive approach

If observing the current visual design applications, we will derive a variety of information architecture representation methods according to the user's different orientation and requirements. The most common way is to present information and text content in graphics visualization. This type of information design and communication is mainly through simple and easy to understand graphic design. First, form the visual focus or feature of the theme to stimulate the awareness and curiosity of the viewer. Then achieve the effect of message transmission (Smiciklas, 2012). Also, most topics are explained and narrated to strengthen the viewer's understanding and memory. The visual form that plays this task includes maps, indicators, articles, and intricate textbooks. Therefore, in the design skills of this kind of infographics, communication is relatively the core of the appeal of message transmission. Correspondingly, there are also multimedia expressions that user interaction as information transmission, which constitutes a complex effect of information transmission and communication. In the study of Lankow, Ritchie and Crooks (2012), the form of this type of information graphic subdivides into three categories: static, dynamic, and interactive (Lin Y. C., 2015). A variety of compound information presented through different forms of expression (Huang J. R., 2011) can enhance the effect of information absorption and obtain more volume (Dur, 2014).

Based on the above definition and literature review, I found that text and graphic not only play their respective functional roles but text and picture transcoding applications are also relatively wide-ranging. From picture book design to film pre-production stage, programs and forms such as text scripts and storyboard scripts usually apply to state the content description of the relevant media appropriately. For example, the composition in the storyboard script includes text descriptions and picture expressions (Begleiter, 2001; Ware, 2019). Before entering the stage of storyboard, the cognition and reaction process of image visualization relatively affect the performance results of picture composition. Every concept, idea, or literal explanation can be kept in people's memory. Through the mutual influence of the cognition and feeling of various senses, images will store in memory. It presents to any cognitive selected medium by the reproduction of image media (Begleiter, 2001). In short, the conversion process of text into a picture or picture into text seems not complicated. It is not easy to carry out if there is no considerable professional ability and the practice is not competent (Sun C. W., Chen J. X. & Chiang S. B., 2009). Moreover, even if they have the same content, there may be different reactions and expressions among distinct individuals. The similarities and differences of this kind of transcoding are also the

conceptual basis which humanities and arts constitute.

2.2 Overview and Application of Natural Dyeing

The cultural history of human life is closely related to color. In the past, people obtained pigments from animal, plant, or mineral components as dyes (Chen J. L., 2001; Huang X. M., 2003), allowing color elements to appear in local cultures, customs, and history. However, the evolution of industrial technology made cheap chemical dyes and industrial process innovation. Therefore, natural dyes have gradually declined due to the influence of many factors (Shen G. Q., Yang C. X. & Zhang D., 2009; Chen Q. H., 2002), which also directly impacts this traditional livelihood application technology. When economic development reaches a certain level, people gradually realize the pollution of these artificial components to the environment. Under the reflection of environmental protection and health, the world began to advocate "environmental protection, green energy, and ecology" and tried to use concrete measures to return to the past and coexist with nature. Besides, in recent years, natural dyes have been generally integrated into life in the form of education, and the next generation has deeply embedded in the thinking of the ecological concept. It also allows the public to find the joy of color from the natural environment (Li L., 2013).

In terms of material composition and application approach, there are also a considerable number of applied literature records in the view of the wide variety of natural dyeing materials if focusing on plant types (Chen Q. H., 2002; Chen J. L., 2001). Moreover, the pigment acquisition of plants will vary with different parts. It also involves the correlation of many parameters from the dyeing steps and procedures. Among them, the pigment extraction effect of several dyeing materials will become the focus of evaluation for the dyeing methods of natural fibers such as cotton, hemp, silk, and wool due to factors such as temperature, bath ratio, and material composition (Chen Q. H., 2002). In the early days of industrial development, people developed synthetic dyes by unintended mistakes. Also, some dyeing materials have good color saturation but low fastness. Subsequently, gradually developed the mordant dyeing method of media dyeing, relatively improve the color fastness and other issues (Qiu Y. L. & Wei S. D., 1990; Huang X. M., 2003). Because of this, chemical dyes replacing natural dyeing in people's lives because of low prices, color easy to control, and other advantages. Fortunately, people found that the effects of natural dyes and applications on individual health and the environment are more and more gentle than chemical dyeing due to the popularization of education and the evolution of technology. If the combination of science and technology and technology to improve its dosing and process, natural dyeing technology should have a new positioning and value (Huang X. M., 2003). Therefore, to promote the living environment, the diversity and integrity of color development of natural dyed wood are expected to construct a complete traditional dyeing color order system in the future. These concepts depend on the way education is conducted. Use effective forms of communication to pass on these concepts and knowledge to get more people to respond.

2.3 Relevance of Teaching Plans and Teaching Aids

Teaching plans are instructing projects that teachers design ahead of educating (Shi X. Y., 2011; Chen M. J., Yang Q. Y., Lin M. C. & Ye Y. F., 2008; Chen X., 2006). First, it is necessary to make specific plans for the expected teaching goals, learning content, activities, assessments, and teaching aids, and present their ideas through written materials, so that teachers can implement in teaching. The specific projects generally include teaching objectives, teaching content, teaching methods, processes, activities, and evaluations, which receive feedback during each stage of implementation (Lin J. C., 2018; Huang S. F., 2014; Su H. M. & Huang R. M., 2001). Among them, teaching aids become a tool used by teachers to help explain, operate, or assist individuals to

understand. From the perspective of learners, use teaching aids to assist individuals in learning knowledge or skills. Specifically, teachers in classroom teaching are used to explain models, physical objects, charts, or digital files of certain things, so that students can quickly understand related contents of teachers' classes (Wu S. Y., 2004; Lu S. Y. & Lin D. W., 2013; Han X. F., 2009). Students can understand the key points of teachers' teaching plan through various presentation forms. At the same time, they can complete some practical operations and exercises with the help of teaching aids.

Before teaching, teachers generally plan and design all aspects of instructing (Cai J. & Li S. J., 2010; Chiang S. B. & Lin J. Z., 2019). Teachers will initially study the needs of the teaching process based on their experience and take the expected benefits of the course, the content of the curriculum, and the knowledge and skills learned by the students into the overall consideration (Keulen & Boendermaker, 2020; Lu S. Y. & Lin D. W., 2013). Therefore, as an educating tool, teaching aids should appropriately match with the content of the curriculum teaching plan. It also takes the teaching objectives and directions as the assessment project of students' learning effectiveness, providing a reference for teachers to revise teaching activities in the future (Lin J. C., 2018; Su H. M. & Huang R. M., 2001). Thus, there is a close relationship between the teaching plan and teaching. In other words, we can regard teaching aids as media for dissemination because teaching plans use teaching aids to show content through behavioral activities (Cai J. & Li S. J., 2010; Han X. F., 2009). In a broad sense, the media of this teaching refers to the use of information as an interactive tool for emotional communication; the narrow interpretation talks about media, including print media, radio media, and network media, etc. Different media have their characteristics, but they all aim at communication (Liu Q., 2010). Besides, the above mass media will also be due to the diversity of features or not, divided into a combination of single or multiple media, including text, images, graphics, pictures, animation, and sound, etc. (Wu S. Y., 2004). These integrated use of multimedia forms as a means of expression has become the current teaching aids that rely on the application of the trend. Summarizing the as-noted above focal points and documentation, we can understand that in the teaching process, to stimulate students' interest and improve teaching effectiveness, teachers will introduce multimedia media such as graphics, text, and sound as teaching aids. Through the stimulation of the individual's senses, cognition, and response after receiving the message shown from the literature that it is relatively more efficient than the traditional way teachers teach. In addition to receiving relevant systemic knowledge, teaching aids can also get a positive evaluation of student feedback (Cai J. & Li S. J., 2010).

3. Research Method

3.1 Experimental Content Setting

This study used "experimentation" and "participant observation" two research methods for trial operations. According to several kinds of literature on the experimental framework and procedures of color dyeing and rendering, as well as the process dyeing methods and dyeing materials (Sun Y. S., 2000, 2003), the research considered that gardenia is available and still existing in daily life. The color rendering effect of its yellow dyeing is simpler to absorb among vegetable dyes, but it is not an advantage in terms of color fastness (Li L., 2013; Li T. W., Guo W. G., Li Y. P. & Qiu Y. R., 2017). The plant gardenia uses as the dyeing material, so the theme of this dyeing cloth is named "gardenia dyeing on the cotton towel". Referring to the description of various literature, the study divided the complete dyeing operation process for yellow gardenia into 28 steps, as five different forms of instructions as the text content, as shown in Table 1.

Table 1　Experimental Text of the Pre-test

Step	Text description	Step	Text description
1	Put on your gloves before you take the following steps to dye the towel.	15	Put the white cotton towel into the mordant dyeing basin for mordant dyeing, and count for five minutes.
2	Measure 1000 c. c water with measuring cup and pour it into the iron pot.	16	Measure 1000 c. c water with a measuring cup and pour it into the empty iron pot to form a dyeing basin.
3	Place the iron pot on the gas stove and boil until boiling.	17	Place the dyeing basin on the gas stove and bring to the boil.
4	Put the white cotton towel on the table.	18	Pour 25 g of dried and crushed gardenia fruit in the tray of egg tart into an empty tea bag.
5	Use six popsicle sticks and six rubber bands to create at will patterns on the white cotton towel by tying, clamping and rolling.	19	After boiling, put the tea bag filled with dried gardenia fruits into the dyeing basin and boil for 5 minutes.
6	Measure 1000 c. c water with measuring cup and pour it into a clear water basin.	20	Remove the white cotton towel from the mordant dyeing basin, clean and wring dry.
7	Put the white cotton towel that has finished tying, clamping, and rolling in a basin of clear water to soak.	21	Wait for 5 minutes to turn off the fire in the dyeing basin after boiling, and take out the gardenia dye solution.
8	Turn off the fire after water boiling.	22	Remove the dyeing basin from the gas stove with a dish towel.
9	Remove the iron pot from the gas stove with a dish towel.	23	Put the white cotton towel into the dyeing basin for dyeing.
10	Pour the boiling water in the iron pot into the mordant dyeing basin.	24	Use bamboo chopsticks to stir it in the dyeing basin frequently to make the color evenly when dyeing the cloth.
11	Pour 8g of alum in the tray of egg tart into the boiling water in the mordant dyeing basin.	25	Remove the cotton towel from the dyeing basin and wring dry after dyeing for five minutes.
12	Measure 300 c. c of water with a measuring cup and pour it into the mordant dyeing basin again.	26	Rinse thoroughly in a bucket and wring dry.
13	Use bamboo chopsticks to stir evenly in the mordant dyeing basin to dissolve the alum into the mordant solution.	27	Remove popsicles and rubber bands to see the effect of the dyed pattern.
14	Remove the white cotton towel from the water basin and wring dry.	28	Place the cotton towel in a ventilated place to dry.

The purpose of this study is to explore the form of text and picture instructions and the understanding of the viewer's cognition. After the relevant literature collating and discussing, I have confirmed the setting of five processing situations. After the researcher's practical experience in advance, the experimental structure of this study integrates the related reference materials. It also sets five different media forms of "instruction" as the stimulus of the experiment. According to the evolution of the media form, they are A. Words, B. Illustrations, C. Images, D. Words + Illustrations, and E. Words + Images. The sample details are shown in Table 2. In terms of operational definition, "word" is the description of sentences; "illustration" is a simplified painting image with the characteristics of things; "image" is the details of the steps gained by photography. Since this pre-test version first understood the cognitive effects of static media, multimedia such as dynamic movies and sounds were not within the scope of this research design.

3.2 Experimental Structure and Process

In the experimental framework, as shown in Table 2, the test subjects were recruited and then assisted by the teacher from National Chung-Hsing Senior High School. The course name of the teacher is "art life". All the students who participated in the pre-test had dyed operation experience. The subjects were all high school seniors. Ten testers participated in the pre-test, and two of them did not conform to the research design due to the operation

details. Finally, the research took the material of eight test subjects as the basis of pre-test data, and their codes were A-1, B-1, B-2, C-1, C-2, D-1, E-1, E-2. Each group of two students enters the assistance of different forms of instruction. Meanwhile, the study consulted the students who were willing to serve as assistants from the class to assist the students pre-tested in each group of the experiment and record the video of the group. A supervisor was responsible for the registration of test items in each group. In the part of manipulating variables, the course of gardenia traditional dyeing included in this study took as the theme. The study used static media as the base, controlling A. Words, B. Illustrations, C. Images, D. Words + Illustrations, and E. Words + Images, a total of five kinds of situational processing to test the subjects' cognitive understanding of the instruction. The test students were assigned to each group randomly, and they drew lots with a draw box for the assignment of situational processing of subjects. Each group of supervisors assisted in the pre-operation instructions and environmental control and controlled the procedures and timing at the moment of testing. At the same time, they observed the explicit behavior of the students during the operation and described special situations and personnel behaviors in text form. Subsequently, the researcher performed statistics, discrimination, and coding according to the data types after the experiment. Finally, another coder conducted a data correctness review to explore the learning effectiveness of the subject's operating experience. The specific dependent variables acquired are "number of operation errors (correct rate)" and "operation time".

Table 2   Experimental Contents of the Pre-test Version

Gardenia Dyeing on the Cotton Towel, 5 Style Guidelines.				
A. Words	**B. Illustrations**	**C. Images**	**D.Words+Illustrations**	**E. Words+ Image**

The procedures of the researcher's pre-test were mainly trying to understand the difficulties of the subjects in the manipulation steps. Therefore, this study focused on the steps of the dyeing towel and used the prepared materials and tools to guide the implementation of text and picture media. Thus, in our pre-test, researchers first introduced contextual operations in the form of text instruction. I hoped to take this experience to understand the interpretive ability of the text to optimize the text description or procedure to become the design of the image composition of the action in each processing situation, as planning for the presentation of other experimental stimuli. Subsequent pre-tests were conducted by the subjects to understand whether the learning process of the students in the dyeing unit was different due to the distinct forms of text and picture instructions and to understand and respond to the operation time and error rate data. During the experiment, supervisors and researchers of each group entered into the experimental operation activities using participant observation. They selectively observed the operation of some subjects. Excepting calculating the number of errors in each step and the time-consuming, they also timed, as usual, to fully record the actual measurement results of each subject if the subject's operation was interrupted during the process. They would also highlight particular circumstances.
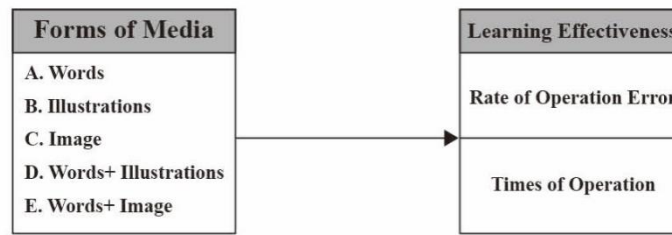
Figure 1   Structure of the Experiment

4. Research Result

The pre-test operation completed after about two hours. When each group was in progress, the instructor provided operational instructions before the test, the teacher coordinated the guidance, and the researcher observed the explicit behavior of the unusual case of each group. All the instructors and test subjects of the "Art Life" course had experience in dyeing operation. After the disassembly of the experimental text, there were a total of 28 steps in the experiment. Except for the instructors' paper records, each group took 28 steps recording. After completing each procedure, the recording interrupted. The recording function restarted at the beginning of the next step, and so on for experimental operation recording. There were three items for pre-test, including "the number of operation (correct rate)", and "special object observation".

4.1 Analysis of the Impact of "the Number of Operation Errors (Correct Rate)" on Learning Effectiveness

Table 3 provides the original data for the implementation of descriptive statistics, starting with a discussion of the situational processing of the subjects in each group. From the data, I found that there was a 13 difference in the number of errors between B-01 and B-02 of the illustration group of the error rate of the participants in each situational processing group. The difference between the two subjects of C-01 and C-02 of the image group is similar in the number of errors, which had only two differences. In the word and image groups, there is a difference of five mistakes. The results from the above groups in the number of operation errors showed that the illustration group instructions in the subjects' cognitive differences were the largest. In terms of the number of individual operation errors, the maximum number of errors found was B-2 (22 times), and the minimum number of faults was A-1 (2 times). The difference between the two was as many as 20 mistakes, showing the text instruction in the understanding of dyeing operation guidance was better than other forms.   And there was a gap of 20 operation errors between the text instruction and the illustration instruction. However, in terms of situational grouping, the two subjects in the image group generally had a high number of operating errors, 18 and 16 apart. Relatively, the instruction of the image group is more problematic in the subjects' cognitive understanding. Sorting out the above data, the number of errors of 8 testers, in the mutual comparison, the number of faults of C-01, C-02 of the image group was more. And, B-01 and B-02 of the illustration groups had the second-most errors. A-01 of the word group had the least mistakes.

Moreover, after the average of the individuals in each situational processing group, the order of the least error rate in presenting the average error rate was word group < word + illustration group < word + image group < illustration group < image group. Therefore, after the average number of groups, we found that the image group was the group with the most average number of errors. The study also found that the error rate of the "word + illustration group" (7 errors) was slightly lower than that of the "word + image group" (7.5 errors), indicating that

the cognitive and operational responses of students significantly improved after adding words. Adding words to the factor to distinguish and observe, it is clear that the average error rate of the simple "illustration group" and "image group" is far more than the "word + illustration group" and "word + image group". Therefore, in terms of descriptive statistics, we have drawn several comparative findings. Generally, the average error rate of text instructions is low. Also, the number of errors reduce when we added a collaborative description in text form in the form of illustrations and images. In other words, the relative increase in the accuracy rate shows that in the form of the text instruction. The subjects are still generally adapted to accept the explanation in the form of text. Illustrations and images are relatively forms of expression that aid understanding.

Table 3 Experimental Content of the Pre-tested

Treatment	Subject Number	Total Number of Errors		Total Average Errors
Words	A-01	2		2
Illustrations	B-01	9	13	15.5
	B-02	22		
Images	C-01	18	2	17
	C-02	16		
Words + Illustrations	D-01	7		7
Words + Images	E-01	10	5	7.5
	E-02	5		

4.2 Analysis of the Impact of "Operation Time" on Learning Effectiveness

Table 4 shows the results of descriptive statistics in the calculation of subjects' "operation time". The research mainly divided the time spent by the testers, with 10 seconds as a time unit. From the collated data, I found that the total number of errors of B-01 and B-02 of the "illustration group" differs by 13 intervals. After averaging the times of the two and comparing them with the original times, the difference is one interval. C-01and C-02 of the "Image group" had a total of 24 intervals of error times. After averaging the times of the two and comparing them with the original times, there was a difference of one interval. The difference between the total number of errors of E-01 and E-02 of the "text + image group" was five errors. After averaging the times of the two and then comparing it with the original times, the difference was one. According to the above-mentioned data, the amount of "operating time" of the subjects is also reflected in the error rate of the operation, which is the polarization of the reaction correlation. One is that the shorter the time, the lower the error rate. This situation mainly occurs when the steps described in the instruction are relatively simple and easy words or actions. The more complicated the words or the continuous actions, the longer the time of comprehension gradually occurs. The other is that the longer the time, the higher the error rate. Given this discovery, we can discuss whether it is the wrong result of accepting more complicated actions and difficult to understand words and sentences, which is worthy of further discussion.

Table 4   Manipulation Time Distribution in the Subject Pre-test

Subjects / Times	A-01	B-01	B-02	C-01	C-02	D-01	E-01	E-02
0~10	8	4 7 8 9 17 20 21 23 24 25 26 28	4 7 8 9 14 15 17 21 22 24 27 28	4 8 9 15 19 20 22 23 24 25 26 28	4 7 8 12 13 14 15 19 20 21 22 23		21	8 21
11~20	1 3 4 7 14 15 17 19 20 22 24 27	12 13 14 15 19	3 11 12 13 19 23	7 10 11 12 1 14 17 21 27	3 6 9 11 16 17 18 25	15 22 24 28	3 4 7 8 9 12 13 14 15 17 19 20 22 24 25 28	3 4 6 7 9 14 15 17 19 20 22 23 24
21~30	2 9 11 26 28	6 10 1 22	2 16 25 26	6 16 18	10 24 26 28	4 9 17 19	10 11 27	2 10 11 12 13 16 25 28
31~40	10 12 13	2	1 6 10	1 3	1 27	8 20 21 25	6 26	1 26 27
41~50	16 23	1 3 18	18			3 7 11 14 23 26	2 16 18	
51~60		16			2	2 12 13		18
61~70				2		1 6 16 18 27	1	
71~80		27						
81~90			20		5			

Subjects / Times	A-01	B-01	B-02	C-01	C-02	D-01	E-01	E-02
91~100						10		
101~110	25						23	
111~120								
121~130						5		
131~140								5
141~150				5				
151~160								
161~170	18	5						
171~180								
181~190							5	
191~200	21							
201~210								
211~220	6							
221~230								
231~240								
241~250								
251~260								
261~270								
271~280								
281~290	5							
291~300			5					

Secondly, the study examined the operation time results of the subjects in the five different forms of instructions from Table 5. At this stage, through case generalization, the study compared the operation time of each tester in the operation time distribution, more than five steps (inclusive). Since there were a total of eight valid subjects during the pre-test phase, I used half (four) of the eight students as the average benchmark for each step of the discussion. The study found that from Table 4 that in 0–10 seconds, there were more than four subjects (inclusive) in this distribution area of the 4th, 8th, and 21st steps. In 11-20 seconds, there were more than four subjects (inclusive) in this distribution area of the 3rd and 19th steps. In 31–40 seconds, the first step was to have more than four subjects (inclusive) in this distribution area. It showed that the text instruction of each procedure may become the main reason for "the number of operation errors (correct rate)" and "operating time". From the completeness of the description of the text to the illustration, the shoot position of the image, the angle of view and the emphasis on close-up, etc., it will affect the students' cognitive understanding during the dyeing operation. Also, it will lead to the length and accuracy of the operation.

Reviewing the results of the descriptive statistics in Table 5, I can roughly find that there was an 89-second difference between the operation time of B-01 and B-02 of the "illustration group". After averaging the operation time of the two groups and comparing it with the original time, the difference was only one second. The operation difference between C-01 and C-02 was 54 seconds. After averaging the operation time of the two groups and comparing it with the original time, the difference between them was 0 second. There was no difference. The

difference between the operation time of E-01 and E-02 of the "word + image group" was 200 seconds. After the average operation time of the two groups and compared with the original time, the difference was 100 seconds, which was relatively large. It shows that the individual's own experience and comprehension ability relatively influence the calculation gaps that are assigned to any group of processing situations after averaging. Besides, there are only one person's data in two situational processing this time, leading obvious that the descriptive average seems to have a biased interpretation at this stage.

Table 5   Distribution of the Subjects Manipulated Times

Subject Number	Clusters	Time Distribution of Manipulating	Time Distribution Trends of Manipulate
A-01	Words	0 ~ 10 11 ~ 20 21 ~ 30 31 ~ 40 41 ~ 50 101 ~ 110 161 ~ 170 191 ~ 200 211 ~ 220 281 ~ 290	11 ~ 20 21 ~ 30
B-01	Illustrations	0 ~ 10 11 ~ 20 21 ~ 30 31 ~ 40 41 ~ 50 51 ~ 60 71 ~ 80 161 ~ 170	0 ~ 10 11 ~ 20
B-02		0 ~ 10 11 ~ 20 21 ~ 30 31 ~ 40 41 ~ 50 81 ~ 90 291 ~ 300	0 ~ 10 11 ~ 20
C-01	Images	0 ~ 10 11 ~ 20 21 ~ 30 31 ~ 40 61 ~ 70	0 ~ 10 11 ~ 20

Subject Number	Clusters	Time Distribution of Manipulating	Time Distribution Trends of Manipulate
		141 ~ 150	
C-02		11 ~ 20 21 ~ 30 31 ~ 40 41 ~ 50 51 ~ 60 61 ~ 70 91 ~ 100 121 ~ 130	0 ~ 10 11 ~ 20
D-01	Words+ Illustrations	0 ~ 10 11 ~ 20 21 ~ 30 31 ~ 40 51 ~ 60 81 ~ 90	41 ~ 50 61 ~ 70
E-01	Words+ Images	0 ~ 10 11 ~ 20 21 ~ 30 31 ~ 40 41 ~ 50 61 ~ 70 101 ~ 110 181 ~ 190	11 ~ 20
E-02		0 ~ 10 11 ~ 20 21 ~ 30 31 ~ 40 51 ~ 60 131 ~ 140	11 ~ 20 21 ~ 30

Observing the total time of the eight subjects from the contents of Table 6, in mutual comparison, the operation time of A-01 of the word group was longer, and the operation time of C-01 and C-02 of the image group was shorter. I have learned that the word group needed to take more time. After reading the text, it seemed that individuals are careful to think for a longer period in the cognitive and understanding stage. However, the comprehensive analysis of the data with the number of errors showed that the number of mistakes they made was relatively small.

Table 6   Total Times of Pre-test

Subject Number	Total Time/Sec.	Total Average Time/Sec.
A-01	1,476	1,476
B-01	708	753(752.5)
B-02	797	
C-01	568	541
C-02	514	
D-01	1,313	1,313
E-01	888	788
E-02	688	

5. Conclusions

5.1 Experimental Discussion

According to the average data of the eight subjects, the research found that less operation time did not mean the higher accuracy of the operation. Based on the consideration of this study, I suggest that it should take the number of errors as the main item to identify the form of instruction, which is easier to understand for obtaining a more objective type of application. Taking the subject A-01 as an example, although the operation time of A-01 was longer than that of eight subjects, the number of errors was less. Yet, there were five times that A-01 needed to be reminded by the instructor in the process. It can be inferred that some subjects' reaction time may be prolonged by careful reading, thinking, and other procedures in the process of conversion to understanding. However, the number of errors in each step was relatively small. In other words, deeper cognition and comprehending will help individuals to respond correctly to the learning content. Therefore, understanding the length of time should provide one of the options for reference.

The study also took C-01 and C-02 as examples among the observation subjects. The overall average operating time of these two was shorter among the eight subjects, but the number of errors shown in their operating records was more. There were many reasons for this. But inferences from video observations, individual stereotypes may cause the student's negligence in understanding. The actual operation was not as simple as imagined and caused the omission of its steps. I inferred that this was one of the reasons for the excessive number of errors. Generally speaking, when an individual reads or watches different forms of instruction, it will take some time to adapt to the visual presentation form. However, it may be due to the cognitive biases of subjective consciousness, the stereotypes of the text, or the physical and psychological conditions of the current test, etc., which may cause the two subjects to make too many mistakes during the operation. It requires an in-depth understanding of the post-event interview method. These inferences are also interfering variables worthy of follow-up discussion.

Based on the above findings, another conclusion of this study also found that eight subjects were randomly assigned to different groups to test for five types of situational cognitive operations, and the data showed that the "text" instruction was liable for subjects to understand. The relative inference is that the application frequency, channel, and learning application of text in the medium of visual communication are the most important. In terms of the carrier that ordinary people are accustomed to receiving information, the teaching field mainly uses text as a

medium for communicating knowledge and information. Although the text has the greatest for cognition and imaginative space, most people have generally accustomed to the form of text-based communication, which may reduce the above-noted media adaptation period. Relatively, it might likely affect the test. Subjects who received the "text" instruction had a better time response and a lower error rate. The results of this analysis indicate that the instruction in the form of "images" shows that there were not many advantages or learning tendencies in individual cognitive understanding. From side observations and simple interviews with several subjects afterward, I have known that too much information content may increase the cognitive load of the viewers, leading to a high number of errors in response to the operating instructions. It is also the inference of this study, and the relevant literature said slightly different, which is worth adding to the follow-up research design in-depth discussion.

5.2 Experimental Correction

This pre-test is a preliminary test of five instructions for different situational processing. From the results of the above analysis, I found that there was not much difference between the interval options among the average values. Therefore, using this predicted result as a reference for correction in subsequent experiments to facilitate the formal test of this research, the correction suggestions are as follows:

(1) In this pre-test, the benefit of statistical results is relatively low because of the small number of subjects in each group. Therefore, I should take the normal distribution as the norm in the formal experiment. The number of testers in each group should be more than 10 to enhance its credibility and make the statistical results more objective. I will simplify the text and the number of steps first base on the results of this pre-test and the suggestions of the subjects. And then, I will modify the contents of the instruction of five different situations simultaneously.

(2) In the process of recording the experiment, the school teachers had helped to explain the experimental rules. Yet, there were still some subjects who did not follow the rules, which caused repeated reminders from time to time. Therefore, in the formal test, I will remind the assisting teacher again before the test to remind the subjects to abide by the operation specification to avoid affecting the comprehensive evaluation of the experiment.

(3) In this pre-test, I got the auxiliary data by staged video recording. Because some subjects sometimes forgot to speak out to explain their psychological conditions, the videographer could not know from the apparent behavior that the steps have been completed and continue to record. As a result, I could not distinguish the subsequent review of the auxiliary video as the previous or next step. This situation also violated the operating rules. The subjects must complete and stop before they can operate the prompts for the next step, leading to some operation steps not being implemented. The follow-up solution will take full video recording and then use specific actions to indicate the completion of the steps. It will improve the record of some steps that were missed during an individual operating in the formal experiment, which reduces the integrity of the video-assisted analysis.

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