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An Investigation of Basic Design Capacity Performance in Different Background Students

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ABSTRACT
The technological and vocational higher education system in Taiwan is offering an undergraduate degree for design-based vocational high school students and general high school students whose qualitative and quantitative abilities are evaluated through a student selection examination. This study focused on the conceptual understandings of 64 freshmen with different backgrounds in design who have taken a full 18-week basic design course. Through this curriculum arrangement, the research team aimed to understand the distinctive learning achievements and basic design capacity of people in those two diverse background groups. The results revealed that general high school students received higher evaluations on overall performance capabilities than vocational high school students did in the experiment, contradicting the common notion that students who graduate from vocational school have stronger design skills than students of other backgrounds do. We conclude that the technical and vocational education system might not effectively execute the design practical training curriculum. Another reason may be the credentialism present in Taiwanese society.
Keywords: basic design, learning achievement, different backgrounds, student-centered

INTRODUCTION

In general, design education in all fields has two primary concepts: the practices and design communication concept at the foundation course level, the idea that students focus on specialized projects in the studio, and the idea that students prepare profession-specific projects for further education or career. In this curriculum structure, younger designers learn design through fundamental instruction in the early stage.

The original basic design education course was developed in 1919 as a result of the Bauhaus movement in Germany. The course was first called “Preliminary Course and Basic Course.” It was also taught at the New Bauhaus school by László Moholy-Nagy as “Foundation Design” (Gürer, 1999; Aypek, 2012). Basic design theories are commonly

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State of the literature

- Basic design education is the mother all of designs
- The course of basic design is leading students to produce functional and creative solutions design problems and make them attain the ability to have professional knowledge and skills and be peculiar and innovative
- The new basic design teaching system has a significant importance role in developing students' mindsets

Contribution of this paper to the literature

- This paper is trying to point out the challenges of current situation in the higher technological design education system of Taiwan.
- We did a few of tests in students' basic design capacity performance and found possible factor which is general high school students might be a better designer candidate further than the stereotype of vocational students.
- This new founding may swap and adjust the overall enrollment ratio and distribution in Taiwan higher design education system.

regarded as atelier courses composed primarily of design components, principles, and visual creations, as well as providing information about how to use these principles and technical features. The discipline of basic design concerns the specific relationships and structures of elements, shapes, and forms. The components and principles that comprise early design education should be analyzed separately and then gradually synthesized according to design principles (Aypek, 2012; Wong, 1993).

Therefore, the technological and vocational higher education system is offering an undergraduate design degree for design-based vocational school students and general high school students whose qualitative and quantitative design abilities are evaluated through a student selection examination. University faculty must address students' differing levels or even lack of design knowledge within one class. Currently, the teacher-centered teaching approach is less effective than it was before. Course instruction methods must be adjusted and modified to become more student-centered.

From this perspective, in addition to teaching the fundamental concepts of design, basic design education provides an opportunity to understand students' original and creative personalities through their processes of creation and design. Foundational design education encourages students to maintain their original and creative personalities and initially removes old "known" and "common" customs that students have already gained (Balci, 2004; Gence, 2006; Sayin, 2012). Teachers must encourage students to maintain or develop inquisitive personalities, activities and awareness during the training process. Students can uncover the extraordinary qualities in ordinary life and continuously aspire to introduce "new" concepts (Sayin, 2012).

This study focused on basic design education in the field of product design in Taiwan to discover the challenges of the current situation in Taiwan's technological design higher education system, which places students with mixed design backgrounds in one single class. Teachers face challenges in developing the skills of 50 students with different levels of design knowledge. Vocational high school students had studied design for 3 years, whereas general high school students had not. Therefore, we expected that the vocational high school students would exhibit improved learning achievements. However, the reality differed from our expectations. We assumed that the problem may be induced by the notion that credentialism in Taiwan causes failures in technical training. This study thus examined student performance during a primary basic design course to discover possible evidence of distinctive education outcomes by the credentialism culture in Taiwan.

REVIEW OF THE LITERATURE

An assumption of basic design education

A major startup learning approach is being adopted in education to improve students' knowledge. Gropius (1937) stated that a starter education is a process to improve intelligence, emotions, and ideas; to encourage individual awareness of the relationships among the phenomena comprising life; and to create a complete individual who approaches everything in life. According to this notion, Dietrich (1947) defined basic design education as an objective setting of the basis for any artistic expression. Denel (1998) separated this fundamental education into three stages. The first stage aims to provide students with basic design skills. The second stage is for instruction regarding professional conduct. The final stage allows students to create individual scale of values (Danel, 1998; Akbulut, 2010).

Basic design skills embolden students to be more courageous and independent, to take risks in the learning process, and to express their individuality in a course (Sarahl, 1998; Kocadere, 2012). Basic design skills also evoke students' own cognitive-perceptual abilities and operations by enabling them to effectively apply basic terminology, technical materials, and intellectual concepts (Aypek, 2012). Designers require the ability to solve multiple problems and various situations in different design solutions from living things. Educating students in basic design can help students define and solve problems and reinforce the creations and expressive possibilities at their command (Sausmarez, 1983; Kocadere, 2012). Resuloglu (2012) stated that basic design education can guide the motivation of designers' creativity and the process of generating new ideas, which is considered "as becoming sensitive to a question" (Kowaltowski et al., 2010; Resuloglu, 2012).

Designers are sensitive to and aware of living problems that are part of their nature without education. Basic design can be interpreted as "the grammar of visual language," which helps us to communicate visually with others. The first design course was implemented at the Bauhaus school in Germany. It was known as the "Preliminary Course" or the "Basic Course." At the New Bauhaus school, Moholy-Nagy presented the course as "Foundation

Design" (Gürer, 1999; Aypek, 2012). The Basic Course was referencesed as the essential teaching methods of basic design principles and practice since 1949. The Basic Course involves teaching and learning about student creation by introducing them to shapes, colors, rhythm, and light with various materials and individual ideas (Memikoğlu et al., 2015). Basic design education has been discussed considerably in Gestalt theory (Resuloglu, 2012). Gestalt theory plays a major role in students' fundamental design learning to create a foundation for understanding art and creation to the extent that these concepts are learnable and teachable (Seylan, 2005; Aypek, 2012).

"Gestalt" is a German word, and it can be translated as "shape" or "form" and refers to how visual input is perceived by humans (Gürer, 1998). Gestalt psychology was founded by Max Wertheimer and has been added to over the years by other authors. The most common design principles of Gestalt are introduced in the basic design curriculum, such as harmony, contrast, balance, space, form, and geometry (Gürer, 1998). This study adopted six design principles, (space, balance, contrast, repetition, alignment, and proximity) as the experimental topics for the recruited participants.

Broadly, the principle of design is found in fields that go beyond product design, visual communication design, and architecture only. Most philosophers of technology have followed the aesthetic model from the philosophy of technology as well (Schummer et al., 2009). Engineering and graphic engineering programs generally start with the relationships among a point, a line, and a plane in projection according to the basic disciplines of descriptive geometry, orthographic projection, engineering drawing standards and annotation, and computer-aided engineering graphics in their first-semester course. The purpose is to help students understand the role of engineering graphics in the design process and how to apply the engineering graphic language and draw freehand sketches to achieve visualization, mechanical drafting, and communication for reverse engineering in addition to communication between teams of engineers and executors. Agoke and Ng addressed how engineering graphics can help engineers make their teams interdisciplinary, improve communication, and accomplish the practice and the learning outcomes; assessments indicated improvement after the aforementioned instructions were followed (Agoke and Ng, 2012). Moreover, the similar course structure of the basic principles of graphic engineering as a trail experiment course in Faculty of Engineering, Faculty of Chemical and Process, Faculty of Electrical, Electronics and System, Faculty of Mechanical and Material in the National University of Malaysia named The Graphical Engineering Course (KF 1173) (Mutalib et al., 2012) However, the course outcomes showed a similar pattern of academic performance to the one before, and academic performance was even considered low. This course is no longer listed on the NUM website, which may indicate that graphic design principles still have different teaching methodologies, interpretations, and contributions in specialized fields. Therefore, this study focused on only the narrowed artistic design disciplines.

Visual communication by designers

A designer is a meaning manager. In addition to outdated methods and techniques, designers must understand the transformations of processes, methods, and mediums of design. The process is often the same, but methods may change slightly and the media can differ substantially. Ideally, the teaching structure in a foundational course should be implemented step by step. The basic lesson usually entails adopting a single element as the very beginning task for freshman students. Özkaynak and Üst (2012) explained it as

> *"without expertise in mediums, a designer is only able to facilitate what others do; they become a means or a manager, a step in communication, repeating existing content without adding value. This makes such an individual easily replaceable."*

The new system of basic design learning has become more student-centered. Designers should express themselves with visual elements in meaningful approach (Özkaynak & Üst, 2012). The course should increase the level of perception and cognition apart from old school practical teaching. Encouraged students demonstrated original views, intuition, and thoughts and supported their own creative powers and personalities, thus revealing the potential of individual sense, intuitions, and dreams, which is the major aim of basic design education (Özer, 1986; Aypek, 2012). Therefore, a new basic design teaching system implemented for freshmen plays a substantial role in developing students' mindsets (Çelik, 2014). In summation, the new theory of basic design education does not have a strong relationship with previous theories. Every designer is an individual and an independent visual manager at the early learning stages.

METHODOLOGY

Participants

This study was performed in the fall academic term with 64 (45 female, 19 male) first-grade students. A certain proportion of the recruited students attended a general high school and the others attended a vocational school that applied design-based education for 3 years (Years 10–12) at the Department of Creative Product Design in Taiwan. Group A received 54 h (3 h/week for 18 weeks) of a fundamental course in "Basic Design in 2D," which involves the principles of design. Group B also received 54 h (3 h/week for 18 weeks) of a fundamental course in "3D Construction Design," directly. The learning activities for each group included case presentations, group discussions, and simulation courses related to specific topics in different disciplines.

Experimental task

After the 18-week courses, both groups were given the same basic design expression tasks involving six principles, namely balance, proximity, alignment, space, repetition, and contrast. The principles are defined as follows.

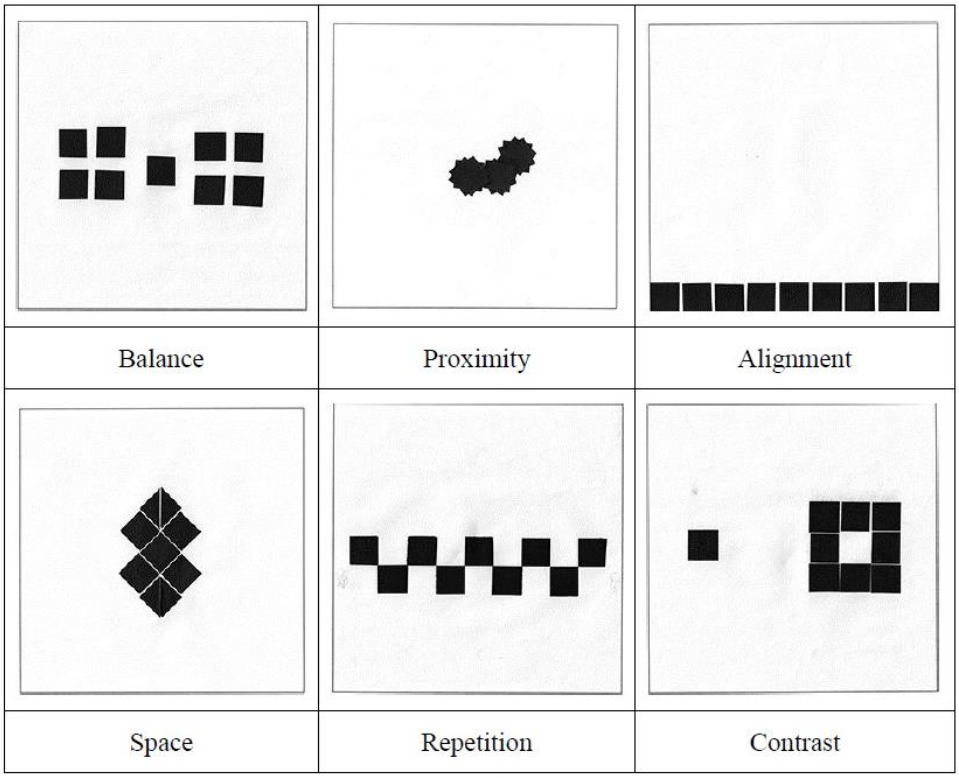

Figure 1. Representational works on exercises

Balance is the equal distribution of visual weight in a design.

Proximity is the placement of items in relation to each other.

Alignment is an extension of proximity. It involves placing items so that they line up. Alignment is a concept that requires grouping and organizing information to create order.

Space includes margins, gutters, the space between lines of a specific type (leading), and the offsetting of text from images (text wraps) and any other part of the page that is empty.

Repetition involves creating visual consistency in page design, such as using the same headline style, the same style of initial capitals, or repeating the same basic layout from one page to another.

Contrast entails distinguishing items by creating differences.

In this experimental task, which originated from Akbulut (2010), the students were asked to create nine compositions on a 20 x 20 cm white construction paper with nine 2-x-2 cm black squares. The students were given 2 h to complete and submit their work. Students were permitted to overlap or fold the black squares, to make 3D compositions, or to place the black squares out of the setting format. At the end of the exercises, each student submitted three compositions to be evaluated by design experts (**Figure 1**).

Experimental design

The experiment had a 2 (2D/3D fundamental instruction: Group A and Group B; between-subjects) x 2 (sex: male and female; between-subjects) x 2 (educational background: general high school vs. vocational high school; between-subjects) x 6 (design principles: balance, proximity, alignment, space, repetition, contrast; within-subjects) design. The experiment was comprised of six tests.

The main outcome variables were evaluated using a score of the basic design learning outcomes. In this study, three experts within the field were asked to mark each item on a 7-point Likert scale (1: *very poor*; 2: *poor*; 3: *fair*; 4: *good*; 5: *very good*; 6: *excellent*; 7: *exceptional*). Expert 1 has 16 years of experience in visual communication design teaching and has a strong connection with the design industry. Expert 2 has 10 years of experience in design principles and has specialized in creative training and graphical design. Expert 3 has two PhDs in design and has been involved with creativity studies for more than 10 years.

Procedures

Participants were required to satisfy three criteria before participating in the experiment. First, they had to have completed the basic design course. Second, they had to understand the purpose of the experiment before taking part. Third, they had to sign a consent form to agree to participate in the experiment. This experiment involved assessing six design criteria. These design criteria were explained to the participants before the experiment. Participants were given six A4-sized white sheets, with each sheet having a square measuring 20 x 20 cm. Each participant had 54 black squares measuring 2 cm x 2 cm. For each task, participants could use no more than nine black squares. They were permitted to overlap or fold the black squares, to make 3D compositions, or to place the black squares out of the setting format. The approximate total experiment time was 120 min.

Statistical analyses

The variance in the results was analyzed using SPSS v.18.0 software (SPSS Inc., Chicago, IL), and post hoc analyses were conducted using the least significant differences (LSD) test. The level of significance used for all analyses was $\alpha < 0.05$. The differences in the participants' learning outcomes regarding the instruction type (i.e., with and without instruction in design principles), educational background, and gender were analyzed.

RESULTS

The results of the basic design capacity associated with gender, educational background, and instruction type (i.e., with and without fundamental instruction) are shown in **Table 1**. Variance analysis indicated that two-factor interactions between gender and basic design ability were exhibited significantly differently in experts' valuations [$F(2,124) = 3.271$, $p = 0.041$]. Simple main effect tests revealed that female students displayed no significant differences among these three factors. However, significant differences existed between male

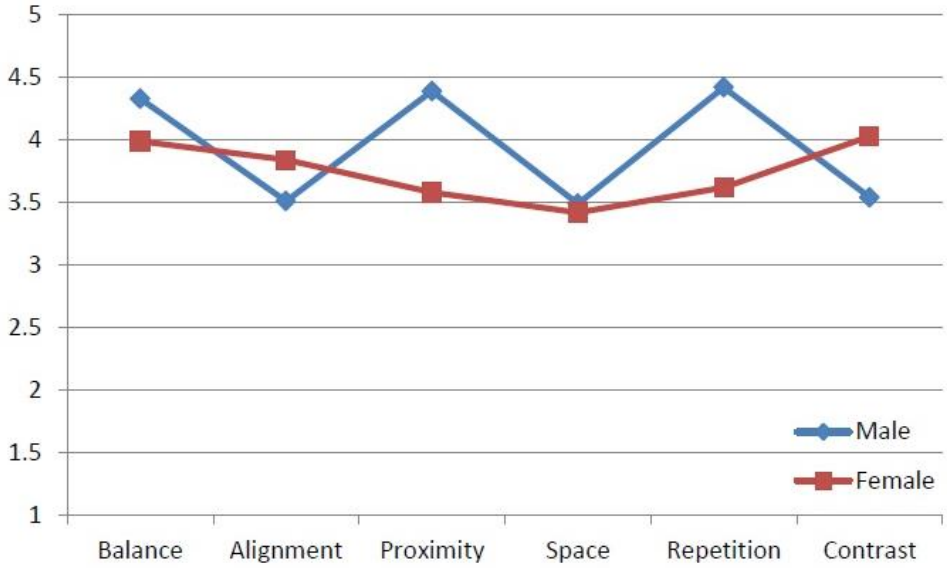

Figure 2. The design capacity of score analysis chart in gender differences

students in three fundamental design capabilities [F(5,90) = 2.43, p <0.05]; post hoc analysis showed that male students exhibited stronger basic design capabilities in balance and contrast than they did in alignment. In the design capabilities of balance, alignment, and space, no significant differences in the effects of gender were found. Regarding the basic capabilities of proximity, male students had a significantly stronger design expression than female students did [t (62) = -2.03, p < 0.05; **Figure 2**].

Students' backgrounds demonstrated a significant difference regarding the overall infrastructure capacity, as shown in **Figure 3** [F(1,62) = 7.52, p < 0.001]. Students from the vocational high school displayed no significant differences, whereas general high school students displayed a significant difference [F(1,32) = 8.83, p < 0.001]. Post hoc analysis revealed that students had higher performance in balance and alignment than they did in space. Regarding the other five design capabilities, no significant differences in students' backgrounds existed. The general high school students had significant differences in balance capability, whereas vocational high school students did not [t(62) = 2.477, *P* = 0.016]. However, in the other five design capabilities, there were no differences between students' backgrounds.

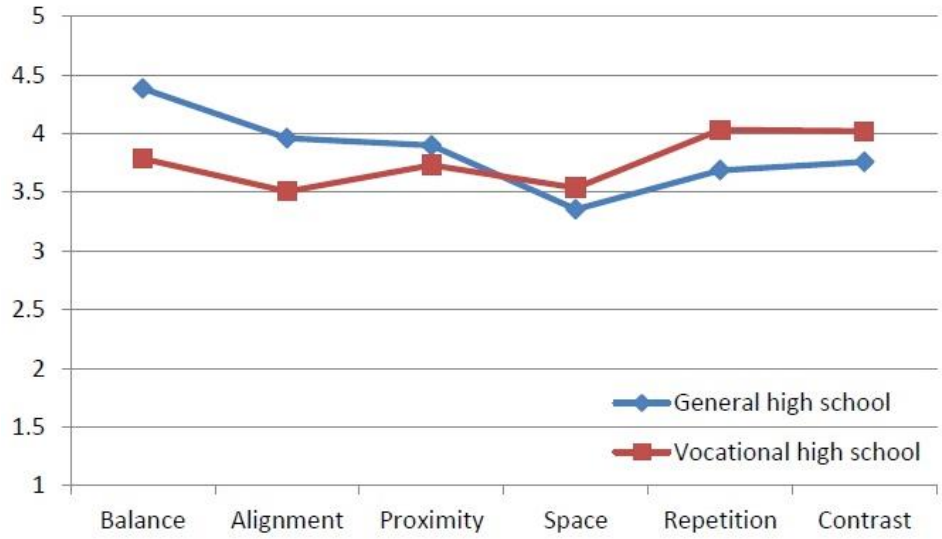

Figure 3. The design capacity of score analysis chart in d

Table 1. Basic design capacity performance under different independent variables

	Balance	Ailment	Proximity	Space	Repetition	Contrast
Sex						
Male (19)	4.33	3.51	4.39	3.49	4.42	3.54
Female (45)	3.99	3.84	3.58	3.42	3.62	4.03
Background						
General high school (33)	4.38	3.96	3.90	3.35	3.69	3.76
Vocational high school (31)	3.79	3.51	3.73	3.54	4.03	4.02
Training*						
3D Basic instruction (24)	3.71	3.57	3.29	3.24	3.17	3.75
2D Basic instruction (40)	4.33	3.84	4.13	3.57	4.27	3.97

* $=P<0.05$

A significant difference existed between instruction groups regarding foundational design capacities [F(1,62) = 11.36, p = 0.001]. The analysis showed that the improvement in the total score was greater in Group A than in Group B (3D Basic instruction vs. 2D Basic instruction: 3.45 vs. 4.02). According to post hoc tests, the balance, proximity, and repetition tasks demonstrated a significant difference between the groups [t (62) = 2.470, p = 0.016; t (62) = 2.261, p = 0.027]. After 18 weeks of instruction, Group A displayed stronger expert evaluations in balance, proximity, and repetition than Group B did (**Table 1**).

CONCLUSIONS

This study shows that design students who came from a high school background and underwent 18 weeks of instruction regarding basic design demonstrated higher learning performance than did vocational school students who took a fundamental design course. The result is unexpected and supervising to this research team. This result might disprove the common notion that students who graduate from vocational school are usually more

experienced in design and usually have higher design learning achievement than general high school students do because it contradicts this stereotype.

The Ministry of Education in Taiwan has restricted the number of general high school students who can enroll in the higher technological and vocational education system. The government intends to reduce the quota in the future. This study found evidence that general high school students might be stronger design candidates than vocational students. Hence, Taiwan's vocational education system should achieve a balance between the idea of credentialism and practical skill training for the future. Designers who start their learning paths or careers early may make their creations richer and deeper over time, which is the real intention of the vocational and technical education system.

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