My Comic-Utilizing "Comics Composition System" to Improve Students' Self-Efficacy and Satisfaction of Arts Learning

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***Abstract*—The research aims to understand the differences of self-efficacy between comic drawn on the computer and the paper. Many studies have indicated that applying simple and easy way to draw, it can increase satisfaction from what the children was drawing. To enhance the degree of completion on drawing would be able to improve a passion on art learning. The research therefore selected fifth grade students of Xinghua Elementary School in Taipei, to be participants. 62 effective samples are collected, conducting factor analysis, variance analysis, correlation analysis and regression analysis. The research introduced an easy-to-use comics composition system (CCS) and an easy and fun paper-based drawing course for identifying differences between the CCS and conventional paper-based drawings, to understand factors of self-efficacy related to art learning. The research found that compared with paper-based drawing, the CCS on the factors of mastery experience, vicarious experience and willingness to learn have good explanation. Applying CCS thus has better experience of personal success on art learning, as well as through the help of peers can enhance a willingness to learn, creating a better self-efficacy on drawing lesson.**

***Index Terms*—self-efficacy, scaffolding, comics composition system**

I. Introduction

Presently, comics are broadly considered a medium that exerts a negative effect on adolescents. Parents and teachers in the past were even advised to refrain from having children read comics [1]. However, as time passed, comics slowly became a medium used in aided teaching for improving the reading and learning abilities of learners; scholars began to discuss the effectiveness of comics on enhancing the reading and learning results of learners. For example, Norton [2] and Ujiie and Krashen [3] have used comics to stimulate learners' interest in reading. Swain [4] employed comics to elevate the reading skills of readers, and Norton and Vanderheyden [5] and Williams [6] have utilized comics to enhance the acquisition of a second language. In addition, Taiwanese researchers have introduced comics into elementary and junior high school curricula and used an action research method to include comics in the course design. Teachers have conducted research while teaching students and gradually adjusted the schools' course content to improve students' learning effectiveness [7]-[9]. These studies have shown that using comics in elementary and junior high school art education has gradually increased.

However, despite the increased application of comics in art education at home and abroad, no studies have proposed designing a comics scaffolding system, which would enable children to quickly arrange and synthesize items that they have drawn by producing a sequence of images and would increase children's learning effectiveness in drawing and enhance their self-confidence. Studies have found that children's confidence in drawing decreases with age. Kellogg [10] showed that children's confidence in learning to draw declines by the age of eight. Some studies have indicated that children begin to show signs of dissatisfaction with their drawings by the age of seven [11], [12]. Such a phenomenon may partly result from changes in their attitudes and confidence levels, which discourage them from learning art-related skills [13]. Therefore, appropriate support tools may be provided to improve children's enthusiasm and confidence when learning to draw. To obtain related research results, this study introduced an easy-to-use comics composition system (CCS) and an easy and fun paper-based drawing course for identifying differences between the CCS and conventional paper-based drawings. In addition, the effect of the two drawing methods on the confidence of elementary school students when learning to draw was explored. The present study had the following objectives: (a) analyze factors of self-efficacy related to art learning; (b) investigate the differences in students' self-efficacy between the CCS and paper-based drawing courses; and (c) explore the effect of CCS and paper-based drawing courses on students' self-efficacy. The results of this study are expected to facilitate teachers in refining their course content and in improving the confidence and learning results of elementary school students in comics-related learning.

II. Literature Review

A. Learning Effect and Self-Efficacy

Faith is a catalyst for success and an essential factor influencing students' learning [14]. Linnenbrink and

Manuscript received March 20, 2015; revised June 5, 2015.

doi: 10.18178/ijlt.1.1.33-37

Pintrich [15] showed that students actively participate and complete tasks only when they believe that they have the ability to do so. Therefore, faith is a crucial factor in elevating self-efficacy. Similar to many well-known theories developed for studying learning motivation, social cognitive theory was established for studying self-efficacy, a concept based on the 1970s learning theory of famous American psychologist Bandura that denotes the level of confidence that people have in their ability to complete a certain task.

Regarding Bandura's concept of self-efficacy, four crucial factors are used to measure people's task-completing confidence. These four factors are enactive mastery experience, vicarious experience, verbal persuasion and physiological and affective state [16], [17]. Enactive mastery experience is the most critical factor determining a student's self-efficacy; success raises self-efficacy, whereas failure lowers it. Vicarious experience is experienced as "if they can do it, I can do it as well"; when students see someone succeeding, their own self-efficacy increases. Verbal persuasion involves using persuasive language to make students believe that they are able to accomplish tasks; however, the effectiveness of this type of language is generally transient and weak. A physiological and affective state means that students judge their ability according to their physiological signs and emotional responses; for example, feelings of anxiety will be interpreted as a sign of inability, reducing their self-efficacy. These four factors can be used as a reference by teachers for judging whether students are able to complete their tasks; by effectively using this information, teachers are able to elevate students' self-efficacy and learning motivation [18].

In the field of education, Pintrich and Schunk [19] applied the concept of self-efficacy to students' academic-learning environment, observing the results from the perspective of student learning and examining learning motivation to understand this complex process. Liang [20] created a scale for measuring the self-efficacy of junior high school students: *perseverance*, *verbal persuasion*, *task completion*, *willingness to learn*, *achievement of goals*, and *physiological condition*. Perseverance measures students' ability to persevere and continue to work hard when encountering challenges. Verbal persuasion assesses improvements in students' learning situation when they receive encouragement from others. Task completion evaluates the level of satisfaction that students receive from completing tasks (with the level of satisfaction possibly being affected by students comparing themselves with their peers). Willingness to learn gauges students' interest in learning and the extent to which they are willing to learn. Achievement of goals investigates how much students demand of themselves and compare themselves with their peers in assessing their results, and physiological condition examines students' anxiety and nervousness.

Most studies on the relationship between self-efficacy and academic achievement have shown a significant and positive correlation between the two variables. Students with high self-efficacy are more willing to be involved in academic-learning activities and to "work to the end"; these efforts lead to superior academic performance, which in turn elevates the students' learning confidence [20]-[24].

B. Application of the Scaffolding Theory to the Experimental Design

The scaffolding learning theory states that a temporary, suitable support (called "scaffolding") must be provided to students by their teacher or peers with superior skills at the appropriate time to facilitate student learning, particularly when the concept or skill being learned is new. This temporary scaffolding is removed when students begin to acquire the concept or skill. By effectively using scaffolding, students' learning abilities can be improved; scaffolding as a learning method is superior to learners learning on their own [25].

In recent years, scaffolding theories have been widely used in studies on aided teaching; most of these studies have shown that appropriate scaffolding designs can facilitate student learning and that scaffolding designs are positively correlated with students' learning effectiveness. When learning to read, suitable scaffolding designs can facilitate students in understanding more concepts and in reducing the gap between what they already know and what they are expected to know (the target) [26]. In early childhood education, a simulated learning space that is entertaining and uses scaffolding can enhance children's imagination, interest in learning, and language and communication skills. Children who learn in such a learning space are entertained during the learning process [27]. Research on computer-aided teaching showed that effective online software improves students' composition-writing performance; they tend to write more, display more instances of unique writing styles, and demonstrate using traditional writing skills in their assignments [28]. In addition, studies have shown that scaffolding designs that use Internet-assisted software tools to facilitate students in making online queries produce more efficient and focused students compared with those not using these tools; moreover, the cognition of those using Internet-assisted software tools outperforms that of the others [29].

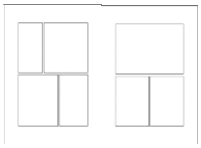
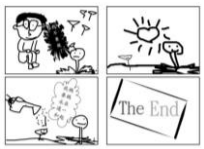
III. Research Methods and Design

A. Experimental Tools

This study investigated differences between CCS and paper-based drawings to identify elementary school students' confidence in learning to draw. Scaffolding theories were employed to form the structure of the experimental design and these theories were implemented in the CCS and paper-based drawing experiments by incorporating them into the elements for constructing comics (i.e., story structure, panel layout, and image composition), which enabled the students to conveniently form images by using their created elements (e.g., panels, backgrounds, and dialogue boxes) and facilitated their creation of comics.

This study proposed using CCS and paper-based drawing courses as scaffolding systems for drawing. Simple drawings were quickly and easily synthesized into the desired short comics by combining illustrations constructed using screentones, an arrangement of panels, and stories. These functions provided the students with confidence and an interest in drawing, subsequently elevating their art learning effectiveness. Table I shows the students' comics composition, paper-based drawing, and the final artwork.

TABLE I. DRAWINGS PRODUCED USING THE CCS- AND PAPER-BASED DRAWING METHODS

	CCS	Conventional paper-based drawing
Interface		
Art work displayed		

B. Questionnaire Design

The questionnaire design comprised two sections: quantitative and qualitative self-efficacy assessments. The quantitative self-efficacy assessment consisted of 24 question items. We used the self-efficacy concept proposed by Bandura [17] and modified the self-efficacy scale for junior high school students introduced by Liang [20] to develop our scale. Self-efficacy was divided into enactive mastery experience, vicarious experience, willingness to learn, and physiological and affective state. A 5-point Likert-type scale was used: 5 (*totally true*), 4 (*mostly true*), 3 (*somewhat true*), 2 (*mostly untrue*), and 1 (*totally untrue*). Question items that were left unanswered were noted as missing values. Consisting of four question items, the qualitative self-efficacy assessment was an extension of the quantitative assessment section and asked participants to describe their feelings in detail. Twenty-eight question items comprised the pretest questionnaire. The prototype questionnaire was tested by an expert for validity, and five students who met the participant requirements were recruited for a pretest to ensure the representativeness, accuracy, and readability of each questionnaire item. All of the participants were fully informed of their rights as participants (e.g., freedom to withdraw and privacy protection) and of the analytical process (i.e., that their data would not be analyzed individually but as a collective group).

IV. DATA ANALYSIS AND DISCUSSION

A. Descriptive Statistics and Factor Analysis

After removing those that were invalid, 62 questionnaires were obtained, with 41.9% being from male participants and 58.1% being from female participants. An analysis was performed using SPSS Version 18 software, and questionnaire reliability was analyzed using Cronbach's alpha. The questionnaire items, which measured the participants' self-efficacy, showed a Cronbach's alpha of 0.907. After removing each questionnaire item, the Cronbach's alpha values were all greater than 0.854, indicating that each questionnaire item exhibited high reliability.

For the factor analysis, questionnaire items with low factor loading (i.e., a factor loading less than 0.30) were removed. Various values were extracted using principal components analysis (PCA) and analyzed using varimax. According to existing theories, self-efficacy factors with an eigenvalue greater than 1 were obtained; these factors comprised enactive mastery experience, vicarious experience, willingness to learn, and physiological and affective state. The four factors produced a total explained variance of 71.69%.

On the basis of the literature, this study divided self-efficacy into the elements of enactive mastery experience, vicarious experience, willingness to learn, and physiological and affective state. The study results showed that physiological and affective state was the element most perceived by elementary school students to affect their learning to draw. Participant B3 stated that "I have taken drawing lessons before. However, my drawings were horrible despite my intention to do a good job. This has made me rather anxious about drawing." Other participants also expressed feelings of nervousness and fear when participating in drawing and art classes; some students even indicated stress and concerns because of the class content and length of the class (i.e., Participants A10, A23, A27, A28, B4, and B5).

TABLE II. SELF-EFFICACY MEAN ANALYSIS

Variables		Drawing tools	
			M
Self-efficacy	Enactive mastery experience	Traditional	3.28
		CCS	3.91**
	Vicarious experience	Traditional	3.05
		CCS	3.56*
	Willingness to learn	Traditional	3.35
		CCS	3.91**
	Physiological and affective state	Traditional	3.47
		CCS	3.59

*p < .05；**p < .01；***p < .001 indicate significant differences
Source of data: Compiled by the author of this study

B. Differential Analysis

To understand the differences in self-efficacy of participants who used different drawing tools, this study performed a test using an independent-samples t test. The results showed that enactive mastery experience, vicarious experience, and willingness to learn of students who used the CCS were superior to those of students who used paper-based drawing; however, no differences were

observed in their physiological and affective state. We hypothesized that, compared with paper-based drawing, the CCS was able to create more successful learning experiences. For instance, Participant B5 explained that, because of his poor grades in art classes, he had lost interest in drawing; however, the participant indicated that "using the CCS lifted my confidence in drawing comics." Other participants also expressed increased confidence in drawing comics after using the computer-based drawing system (Participants B8, B9, B10, B14, and B15). The results are shown in Table II.

C. Regression Analysis

This study performed a diverse and simultaneous regression analysis (confidence interval: 95%) on the effect of the drawing tool (i.e., the CCS or paper-based drawing) on self-efficacy. The self-efficacy dimensions (i.e., enactive mastery experience, vicarious experience, willingness to learn, and physiological and affective state) were set as the dependent variables, whereas the drawing tool (i.e., the CCS and paper-based drawing) was set as the independent variable. The results showed that, compared with paper-based drawing, the CCS exhibited a greater effect on the enactive mastery experience, vicarious experience, and willingness to learn of elementary school students.

TABLE III. REGRESSION ANALYSIS OF THE EFFECT OF THE DRAWING TOOL ON SELF-EFFICACY

Within-model variables		Dependent variable (Y)			
		Enactive mastery experience	Vicarious experience	Willingness to learn	Physiological and affective state
		Beta	Beta	Beta	Beta
Independent variable	Drawing tool	0.40**	0.30*	0.33*	0.06
Results	R^2	0.146**	0.075*	0.1*	-0.012

Note: *$p < .05$, **$p < .01$, and ***$p < .001$ indicate significant differences
Source: Compiled by the author of this study

V. CONCLUSION

The study results showed that, compared with paper-based drawing, the CCS demonstrated superior explanatory power regarding the enactive mastery experience, vicarious experience, and willingness to learn of elementary school students. The CCS was more effective for creating successful learning experiences and enabled students to have successful experiences through peer assistance. The successful experiences ultimately resulted in the students' increased willingness to learn and understand course content, which enhanced their confidence and results when learning to draw comics.

Enactive mastery experience denotes people's experience with their past performance; positive performance enables people to complete their tasks more effectively. Enactive mastery experience is an experience built on past experiences and item-usage frequency; the richer the experience is, the better the efficacy to complete a task. With children presently being surrounded by digital products and having favorable experiences on computers, their experience with and usage frequency of computers enable them to operate the CCS, a computer-drawing system, with ease. This expertise subsequently allows them to satisfy the prerequisites for enactive mastery experience, resulting in the explanatory power of the CCS regarding enactive mastery experience was superior to that of the paper-based drawing.

Vicarious experience is a type of self-efficacy that enhances self-learning through observation and imitation. Many studies have indicated that people who draw using computers can draw without the fear of being unable to "undo" mistakes. Because computer systems feature functions such as copy, paste, cut, and save, they facilitate users in quickly removing mistakes from their drawings and in producing drawings that can be compared with the original [30], [31]. Therefore, when drawing using computer software, users first examine the software functions before determining how to adopt them for completing their drawings, thus spending more time on system operations [32]-[35]. Therefore, introducing computer software that is easy to learn and operate and that enables friendly competition between students elevates the self-efficacy of vicarious experience. Compeau and Higgins [36] found that people's self-efficacy regarding computers can be improved by applying the self-efficacy of vicarious experience in computer courses. Therefore, the explanatory power of the CCS regarding vicarious experience was superior to that of paper-based drawing.

This study investigated the differences between CCS- and paper-based drawings to determine the effect of the two methods on elementary school students' confidence when learning to draw. The objective was to increase their enthusiasm in learning art skills and to serve as a reference for art teachers when teaching students about drawing comics. This study showed that, when learning to draw comics, students generally believed that the CCS was superior to paper-based drawing in increasing their confidence in drawing comics. This belief may have resulted from children presently being surrounded by computers and being familiar with and having considerable experience using computers, enabling them to feel at ease. In addition, computers tend to improve user performance, leading to increased confidence. This increase shows that using computer graphics systems can elevate artists' interest in learning. However, because this study only explored using comics in the art drawing education of elementary school students and did not include comparable data for high school, college, or university students, subsequent studies can investigate the effect of the CCS and paper-based drawing on students of higher grade levels, once the CCS has been improved.

ACKNOWLEDGMENT

The authors wish to thank Zhi-Hong Chen, Gang-Ren Fan and Rhui-Kwan Lee. This work was supported in part by a grant from Ministry of Science and Technology in Taiwan.

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