

# Pedagogical Analysis of Comics Textbooks for Data Science Education

## – Based on the Views of Students –

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**Abstract:** This research analyzes the impact of different types of comics on learning effects from the perspectives of students. We investigated students' views and experimented to examine the difficulty of learning different comics by asking them to read dialog comics, image-content combined comics and image-content separated comics. According to the result, we found that comic comprehension is related to the learning effects of using comics. Students who had high comic comprehension performed better in tests and comics attitude evaluation. On the contrary, those who had low comic comprehension show low interest in comic reading and prefer to use the normal textbook.

**Keywords:** comics, data science education

## 1. Introduction

Although many studies have proven that comics have positive effects on students' learning effects, there will be uncertainty when using comics as textbooks in class. By considering the views of the students, this research conducted experiments on the learning effects of different types of comics. Through the the result experiments, the views of students would be analyzed and the result would help to improve the current situation of using comics as formal textbooks.

## 2. Experiment

In the experiment, we involved 9 university students as participants and in the experiment, we used 3 Japanese comics which are about correlation coefficient. The students were asked to do the test and answer evaluation forms and questionnaire about the learning effects of different comics.

### 2.1 Subjects

Students are divided into 3 groups: Group K, Group L, Group G. So, there are 3 students in 1 group. All the students are adults and major in different fields and have not mastered correlation coefficient yet. According to t test, there is no significant difference in the preliminary test between groups.

### 2.2 Materials

#### Comics

According to the layout of the comics, the types of the comics are divided into dialog comic, image-content combined comic and image-content separated comic. Group K uses dialog comic "Know the Statistics<sup>(1)</sup>", Group L uses image-content comic "Learn Statistics-through Comics<sup>(2)</sup>", Group G uses image-content separated comic "Gentle Statistics<sup>(3)</sup>".

#### Test

The test questions are about the "correlation coefficient" and remain the same in all groups.

#### Evaluation

The comics evaluation: Ask the students about which comics they want to use and which comics are easy to understand in class and after class. The comics attitude evaluation: Ask the students how they like comics in 5 levels.(5: very like; 4: like; 3: whatever; 2: dislike; 1: very hate) The GPA evaluation: Ask the students about their academic performance.

#### CCCT(Comic Comprehension Test)

CCCT is proposed by Nakazawa<sup>(4)</sup> which is used to test the abilities of reading and understanding comics. Students are asked to answer all the questions in CCCT.

#### Questionnaire (Likert Type Scale)

Students are asked to judge the 12 statements on a 5-point scale from "strongly agree" to "strongly disagree". The statements are all about the learning effects of different comics. And the learning effects are measured in pre-experiment and post-experiment<sup>(5)</sup>.

### 2.3 Steps

Ask the students to take a pre-test on Correlation coefficient; Ask students to read the comics separately; Ask the students to take the same test (post-test) again; Ask students to answer evaluation forms and questionnaire; Finally ask them to take CCCT.

### 2.4 Result

The results of all groups are shown in tables as Table 1&2&3 shows. According to t-test, there is no significant difference in the results between groups except the result of post-test between L and G in 5% Significance level. The effect scores of each group are gained as the difference from pre-test and post-test. According to t-test, there is significant difference in the result between groups except the result of post-test between K and G in 5% Significance level. (note "Know the statistics" as K; "Learn Statistics-through Comics" as L; "Gentle Statistics" as G)

Table 1 test results

test:	K		L		G	
n	3		3		3	
	pre	post	pre	post	pre	post
M	9.33	12.67	6.33	11.67	6	12
SD	1.24	0.47	2.49	0.94	0.816	1.63

Table 2 CCCT results

CCCT:	K	L	G
n	3	3	3
M	173.33	150.33	146
SD	10.34	5.44	8.60

Table 3 GPA results

Grade:	K	L	G
n	3	3	3
M	3.33	3	3.67
SD	0.47	0.82	0.47

Table 4 effect scores

Dif:	K	L	G
n	3	3	3
M	3.33	5.33	6
SD	0.94	1.89	0.82

The correlation between the effect scores and other factors are shown in Table 5.

Table 5 correlation between effect scores and others

	CCCT	comics attitude	GPA
K(n=3)	-0.93	-1	0.5
L(n=3)	-0.43	-0.5	-0.5
G(n=3)	0.57	-0.87	0.87
Total(n=9)	-0.66	-0.67	0.19

### 3. Discussion

#### 3.1 The learning effects of different comics

The effects of using “Gentle Statistics” are better than other comics. It may be because that the comics divide the layout into 2 separated parts: comics part and knowledge part<sup>(6)</sup>. Students considered this kind of layout can help them to focus on different parts. And especially in the knowledge part, it is similar to the formal textbooks which students could accept the material in a short time.

#### 3.2 The evaluation of comics textbooks

Although the learning effects of using “Gentle Statistics” are the best, most of the students would like to use image-content combined comics and considered they are easy to understand after class, which is possible because the knowledge is explained by images and characters<sup>(6)</sup>. However, students would like to use dialog comics in class because they thought the teacher would explain the contents in these comics. And most of the students considered the dialogues help them to do role-playing and follow the progress in class.

#### 3.3 The effects of comics reading comprehension

Although there is no obvious relation between the learning effects and comics reading comprehension in each group. The result shows comics reading comprehension has positive effects on learning by comics. Besides, students who had high comics reading comprehension would like to use comics textbooks and they performed better in the test<sup>(7)</sup>.

### 4. Conclusion and Future work

As for the result, comics reading comprehension is related to the learning effects of using different comics textbooks. And in this research, the ratio of images and words in the comics had obvious influence on students’ learning effects. So, it needs to consider the influence of the words in the comics dialogues on learning effects which can also be considered from 2 views. As for teachers, dialogues play an important role for explaining knowledge. As for students, the dialogue part provides the basic knowledge of the comics textbook. In words, dialogue information directly affects the learning effect of students. Therefore, in the next experiment, the influence of the ratio of images and words and different expressions of the dialog will be studied.

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