

# Improvement in Computer Literacy through Creating Digital Storytelling

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**Abstract** "Creation of storytelling" using PowerPoint was conducted so as to raise computer literacy and to foster the students' self-understanding. They were required to draw a figure using Excel and stick it on a report. They were expected to write their reports using Word. The pre and post literacy in functions of the software of three kinds was investigated to know the computer literacy which was able to be developed by "creating the storytelling". As a result, the pre literacy in functions of PowerPoint was lower than those of Word and Excel. After this practice, the post literacy in the functions of PowerPoint significantly became higher. This paper will report that students became able to utilize the functions of PowerPoint as same as those of Word and Excel. Principal component analysis will be conducted for elongation in the literacy of PowerPoint. Cluster analysis will be conducted using the principal component score as a variable. As the results, students will be divided into four groups: the group whose elongation in the general literacy of PowerPoint is higher, the group whose elongation in literacy related to an animation is higher, the group whose elongation in the overall literacy of PowerPoint is third, and the group whose elongation in the skill of PowerPoint and Excel is lowest.

**Keywords:** *storytelling, slide-show storyboards, literacy in software, peer assessment, activity to revise, selfunderstandinge*

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## 1. Introduction

At present, instructional design is considered to develop the effective, efficient, and attractive class and "blendedlearning" is being implemented (Adachi 2007, Miyaji 2005). It has been reported that implementation method of "Blended Learning" is incorporated for the training sessions in the corporate world [Bersin 2004]. Miyaji, et al. fuse using e-learning outside a class during class in a lecture and some media and report that I developed the class that there is an effect in. The author is moving forward with university education that will nurture problem solving ability with incorporation of making things by hand and rating activities [Miyaji 2006]. As the support for the lecture, a proposal has been made to increase study opportunities for various students, and to be able to correspond to individual students so that they can prepare/review at "anytime and anywhere" [Central Council 2008].

Creative activities that produce works that inform and entertain people by describing real and imaginary events, using graphics, narration, and music are called storytelling [1]. In digital storytelling, still pictures such as photographs, figures, and drawn pictures are displayed sequentially to create a storytelling and narrated. Digital stories can be easily reconstructed, and producers can distribute a story to many people through the Internet.

A practice method or a purpose is reported a lot in until now about storytelling [2,3,4,5,6]. Sadik calls digital storytelling a meaningful technology-integrated approach [2]. Effects of creating digital storytelling are reported as follows. Still pictures are easy to handle for the producers of such assignments, and students can reflect upon memories or what they have learned through reviewing still pictures. It has been reported that the practical class improved the quality of their text narratives through the practice of digital storytelling [7]. It has been reported that storytelling task showed the effect of similar patterns to the other tests in written language comprehension [8].

When persons used WBT as a supplementary material, Hirose et al. have reported that the person who has weak point awareness toward PC operation used the WBT for the number of fewer times as a study on the software literacy [9]. In addition, Yamagishi et al. reported that achievement degree of operation for the applied software is low for persons who have uneasiness about PC utilization [10].

The literacy of word processor, spreadsheet and presentation becomes required as a member of society. The literacy of presentation is inferior to the literacy of word processor and spreadsheet about students in our department. We made a study on designing and devising a class so that these three kinds of literacy rose in the same degree. We adopted evaluation and modified activities through creating storytelling using PowerPoint. We told meaning to revise it and method to convey oneself idea to the other persons. As a summary of the classes, students

were required to write the report which included consideration for the contents of the work, self-evaluation, peer-evaluation after filling in them. Effects of creating three kinds of digital storytelling on student attitude were reported [11]. It was reported that the blended class which utilized e-learning inside and outside the class was effective [12]. We conducted the blended class which utilized e-learning under such contents. In this paper, we investigated the literacy in the software function in pre and post time to know the literacy in a computer as an effect of creating storytelling in this class. We will analyze them and report knowledge obtained from them.

## 2. Instructional Design and Method

The target subject in this study is called an information science experiment, consisting of three hours per week as one of the compulsory subjects in the second semester at

the department of information science in a university. The content which the author was in charge of was “creating digital storytelling.” Students are separated into three groups. Each group creates the storytelling for four weeks. Each class session was 180 minutes long, and the class proceeded according to the plan shown in Table 1. The themes of each group are different as shown in Table 1. Each group carried out the class by four weeks. The first, second and third groups created each theme of storytelling from 1 to 4, from 5 to 8, and from 9 to 12 weeks respectively. The class was conducted by a teacher and a teaching assistant. After explaining the activity contents of the day at the beginning of each class, the teachers walked around the classroom and responded to questions as needed. The number of students attending a lesson was 63 persons in total. These of three groups are 21, 22 and 20 persons respectively.

Table 1. Lesson plans

Week	Theme			Experiment contents	Distributed survey sheet and deliverable in the session
	First group	Second group	Third group		
1	Self-understanding	Children's story	Future course	Submitting a story, Creating story slides	Attitude related to abilities (pre)
2				Creating story slide, Narating a story, Self-evaluation	Complete story slide, Self-evaluation 1
3				Viewing 1, Peer evaluation 1, Modifying slides, Self-evaluation 2	Peer evaluation 1, Modified slides, Self-evaluation 2, Report 1
4				Viewing 2, Peer evaluation 2, Self-evaluation 3	Peer evaluation 2, Self-evaluation 3, Report 2, Attitude related to abilities (post)

### 2.1. Purpose of Classes

One of the purposes of this class is to heighten students' literacy in computer and self-expression through creative activities. The literacy in computer means that the PC can be smoothly operated using functions of Word, Excel, Power Point and so on.

Self-understanding and self-analysis are important when searching for jobs. Another purpose is to deepen self-understanding and a meaning to work through creating a storytelling on the assigned theme.

### 2.2. Lesson Plans

The teacher gathered together three groups for a class some days ago. Then he distributed an experiment description document (A4 paper, 31 pages) to the students and explained the outline of class method. Based on the experiment description document, the teacher explained the experiment's purpose, contents, plan, slide creation method, experimental method, and related details. He distributed one A4 sheet as shown in Figure 1 to the students. Six pictures and the narrative stories could be entered using both sides of the sheet. Students were assigned to write a story on the right-hand page and to draw a related picture within the square frame on the lefthand page before the first session. The illustration and character for an animation are drawn outside of the square frame. The students were instructed to paint handwritten picture with colored pencils.

The students were instructed to download the story slide of the “My course in the future” as an example for their assignment.

The teacher explained how to animate slides in the first session. They subsequently scanned the images of their sheet with an image scanner. Then they imported the images to Paint software, which were installed as part of Windows XP Microsoft suite of files. The students cut the images on Paint software and pasted them on slides with PowerPoint. The teacher instructed a student who completes the work and has room at time so as to attach an animation using a function of PowerPoint.

At the beginning of the second session, the teacher explained how to write reports. They were required to enter the final image works into PowerPoint to create their slides. They attached an animation to illustrations and characters for deeper understanding for their stories. Students then recorded their storytelling narrations using a microphone while viewing their slide show after their works were completed. At the end of the second session, the students required to submit the file of the storytelling slide. Students themselves rated their works on an evaluation sheet after completing the works.

At the start of the third session, the teacher printed and distributed a peer evaluation sheet and a handout in which all works by the students were printed. The slide shows of all members in the class were sequentially projected on the screen and viewed. Then they were required to evaluate them for one minute. After the students evaluated each story, the evaluations were entered into the peer evaluation sheet. After viewing all the story slide shows, the students entered the rating value and comment to spreadsheet in Excel, and the files were submitted using the Internet. The teacher gathered and summarized the evaluations in each student's file, then gave each student access to an e-learning portal so that they could download the peer evaluations. The teacher also pointed out the

points that should be revised in the printed work and distributed instructor feedback to each student. The students were then required to modify their digital stories and slides by referring to the peer evaluations and the instructor feedback provided. Students performed the second self-assessments after modification in the third session. After the correction, they submitted the file of the story slide. Students themselves rated their works again.

The modified story slides were viewed again in the same manner as during the third session, and then evaluated once again in the fourth session. The second

peer evaluation was entered into an assessment spreadsheet, and the files were also submitted.

The teacher gathered and summarized the evaluations in each student's file, then gave each student access to an e-learning portal in the same manner as in the third session. Students then pasted the second peer assessment for themselves on an assessment spreadsheet. By comparing the first and second evaluations, students could learn from and interpret the appropriateness of the corrected elements. Students performed the third self-assessments after the final evaluation in the fourth session.

Student Number: I101145 Name: Momotarou Okayama Contents of a story slide	
<b>Preface</b> 	<b>Preface</b> <b>My course in the future</b> I101145 Momotarou Okayama I want to talk about the work that myself wants to get from now on.
<b>1</b> 	<b>1. The type of job</b> At first, I thought about what myself wanted to do in various ways. I make use of the knowledge that I cultivated in this university until now and want to develop the software which everybody is easy to use and is not sold commercially so far. I want to show an idea in various ways and want to suggest to the boss that I want to create. Thus I must do my best if I am recognized.
<b>2</b> 	<b>2. Contents of the work</b> At last I had a section manager recognize my idea. I do my best. Suggestion would be accepted steadily. Financing software, education software, game software, accounting software, etc. An order would come steadily. I would not have time to take a rest.
<b>3</b> 	<b>3. Starting a business</b> It is so. It is said that someone strengthens a viewpoint at 30 years old. Let's start a business. I would call my friends. Let's build our companies. I would develop various software, and the know-how became my thing a great deal until now, too. I would make use of this and want to make a fresh start.
<b>4</b> 	<b>4. Job hunting</b> I look for the company where I can send such life to. Therefore I thought about a future, yearly income, and regionality. It is a future to be the most important in these. I participate in a company information session. An interview finally begins. I would receive an interview and take a written exam every week. A notice of unofficial decision would come at last. But this is still beginning. I would do my best from now on so that I can show ability enough in a company arranged informally.
<b>The end</b> 	<b>The end</b> I think enough and prepare, and then want to spend such life without the regret. The end.

Figure 1. Sheet example in which a story and a picture are entered (Entered case)

### 2.3. Theme of Storytelling

The storytelling of the theme directed was created in this class. Students draw six pieces of pictures matched with the scene of the story of the theme and create a slide of PowerPoint in accordance with it. We require students to consider about oneself, to view a work to another persons to know the reaction, and to revise a work through creating digital storytelling. A student talks about oneself through creating a slide work, after writing its scenario so that a person can understand it.

As expression unlike the sentence, a student was made to consider how to draw and express a picture to supplement the sentence in the story. A student was made to tell one's thought to a person utilizing a PC, using characteristic of a picture and the narration, and being made a story plain. A digital picture book completes when a story was narrated using a microphone so as to promote the understanding of the story contents attaching animation and to reach the feeling of the contents of the story.

We made the first group create a work according to theme of "self-understanding", the second group create a work according to theme of "a children's story", and the third group create a work according to theme of "a future course" as a theme of storytelling. Each group creates it in four weeks respectively.

A story related to autobiographical topics was made to deepen self-understanding as the first theme. "My hobby," "my memories," "a childhood dream" and so on are shown as an example. A student was required to create a story which reflects and tells oneself about contents related to oneself.

A student was required to create the story for children so as to make a student understand to act for a person as the second theme. "Fantasyland," "a dog's adventure," "an insect's life" and so on are shown as an example. Students were told to create a story that a child would interest in or that is educational and useful for a child.

A student is made to create a story about one's future to make a student have consciousness to work after having

done a self-analysis enough as the third theme. "A job that I would like to get," "workplace where I want to work," "my dream job" and so on are shown as an example. The students were requested to think about a future course and to create the work with an attitude towards work based upon this theme.

## 2.4. Contents of Report

The student reports of about 15 pages were written in three steps using Word, and were submitted on the days prior to the 3rd, 4th and 5th sessions. Students are required to make tables and graphs of self-evaluation, peer evaluation and the change of awareness related to ability using Excel. Students are required to paste them in report. The elements corrected were noted by the teacher and the report was returned during lesson hours. The report are modified and re-submitted within one week after returning it. Contents of the report consist of the following 11 items: (1) what are storytelling and digital picture books? (2) contents of the story slide show, (3) structure of the product, (4) self-evaluation of story and its slide show, (5) peer assessment from viewing the story slide show, (6) the elements of the story and the slide show modified based on peer assessment feedback, (7) the correction elements modified based on teacher feedback, (8) evaluation of the peer's product, (9) changes of the contents in re-evaluation of the corrected product, (10) change of awareness related to their abilities improved by the course, and (11) discussion about the items (2)–(10).

## 2.5. Function of E-learning

The students obtained the template of the report and assessment spreadsheet file from the e-learning portal. The teacher created the worksheet required for the evaluation activities of the lesson as an Excel assessment spreadsheet. The contents of the assessment consist of three self-assessments, two peer-evaluations, and pre- and post-evaluation of the student's awareness related to his/her own ability. The file was submitted through the elearning portal. Students can use the following functions.

### (1) Browsing

The example of story slide, how to draw illustration, how to create story slides, and set-up procedure of animation can be browsed.

### (2) Download of files

The paper sheet in which a story and a picture are entered (Word file), template of the report (Word file), template of the assessment spreadsheet (Excel file), results of peer assessment, and experiment description document (PDF file) can be downloaded.

### (3) Upload of files

Report (Word file), assessment spreadsheet (Excel file), and story slide (PowerPoint file) can be uploaded.

### (4) Bulletin board

### (5) E-mail for question.

## 2.6. Device Which Raises Computer Literacy

Students are required to use Word, Excel, PowerPoint, and the paint software in this lesson for raising computer literacy. A report is written using Word. Charts and tables related to evaluation activity are created using Excel. Their charts and tables are pasted in report. Slides are

produced using PowerPoint. An illustration and a picture in accord with a story are drawn to foster understanding of the story. It is taken in with an image scanner. The image was processed using paint software. It is pasted in a slide. Animation was attached to a character etc. While the completed slide was made into the slide show, narration was put in using a microphone and was recorded. Each slide was copied. It is pasted in a report. Then the explanation about the created work was written. We devised so that what was created using one software or tool was associated with other thing and might be used by other software as just described.

## 3. Analysis Results

Literacy in software functions was investigated before and after the course. Based on the assessed changes in literacy, the degree of achievement of the objectives of this course was estimated. In this study, the term *literacy* represents the skill and ability of use of software functions shown in Table 5. Hereinafter the existence of significant difference is inferred using a criterion of a level of significance of 5%.

### 3.1. Description of Computer Functions in Which Literacy is Acquired

Students were advised to describe in a report what they have understood in the course about the use of a personal computer. They stated that they have learned to use either "narration, PowerPoint, personal computers, Word, Paint, animation, image scanners, or Excel", as presented in Table 2. In all, 102 descriptions and an average of 1.65 per person were obtained. All students described that they gained literacy in at least one function. These student reports suggest that the objective of this course "strengthening computer literacy" was realized.

### 3.2. Computer Literacy Investigation Method

Literacy in software functions was investigated as shown in Table 5, to measure computer literacy more quantitatively than the descriptions written in the report and to ascertain the details of its improvement. The survey was administered twice, before (at the beginning of the first lesson) and after (at the closing of the fourth lesson) the course. Students were advised to fill out a questionnaire that surveys literacy level in the functions of three application software: PowerPoint, Word, and Excel. Nakamura et al. proposed measurement of basic knowledge about information technology using questionnaire on computer technical terms and reported its application to evaluation of information education that we could know enough the understanding degree easily and in a short time [13].

The questionnaire presented a total of 60 items, respectively including 25, 17, and 18 items on the functions of PowerPoint, Word, and Excel. Responses of 62 students who answered both before and after the course were used. Literacy levels were classified as "1. do not know, 2. know the name but cannot use, or 3. can use." Students were asked to assign an appropriate number from 1–3 to each item. This rating suggests that the present survey is based on students' personal assessments.

**Table 2. Personal computer functions for which literacy is acquired**

Literacy contents	No. of students
Narration	29
PowerPoint	26
PC	17
Word	8
Paint	8
Animation	6
Image scanner	6
Excel	2
Sum	102

### 3.3. Comparison of Literacy for Three Software Applications

Table 3 presents the variance analysis results of average literacy in all items for each of three software applications, where *m*, *SD*, *F*, *p*, *Cond*, *Error*, and *df* respectively signify the average, standard deviation, *F* value,

**Table 3. Result of variance analysis of literacy in three application software**

PowerPoint				Word				Excel			
pre		post		pre		post		pre		post	
m	SD	m	SD	m	SD	m	SD	m	SD	m	SD
2.33	0.67	2.92	0.23	2.82	0.45	2.96	0.15	2.58	####	2.93	####
Sum of square		df		Mean square		F value	p	*** p<.001			
Cond	Error	Cond	Error	Cond	Error						
6.37	4.23	5	114	1.27	0.04	34.3	***				

**Table 4. Result of multiple comparison of literacy for three application software**

Time	Software	Pre		Post		
		Word	Excel	Power Point	Word	Excel
Pre	PowerPoint	***	***	***	***	***
	Word	-	n.s.	n.s.	n.s.	n.s.
	Excel	n.s.	-	**	**	+
Post	PowerPoint	n.s.	**	-	n.s.	n.s.

\*\*\* p< .001, \*\* p< .01, + p< .1.

### 3.4. Applications Comparison of Literacy in Each Software Function

Wilcoxon’s signed-rank test was performed to rank values obtained before and after the course for each function of the three software applications. The result is shown in Table 5, where *z* denotes the Wilcoxon test statistic. A significant difference was observed in 23 of 25 items for PowerPoint. Many students were surprised that a story was presentable in a slide show with voice narration. Presumably, this is the reason why "11 Record narrations" is greatly strengthened. Moreover, literacy in items 15–25 related to animation was remarkably improved compared with other items. Students were instructed to assign a motion to characters, personae, etc. in all six pages. This is regarded as having brought about a good effect.

No significant difference was found in items "1 Launch PowerPoint" and "8 Execute a slide show" for PowerPoint. Their respective rankings had been 2.92 and 2.90 before the course. Improvement was not found after the course because there was little room for improvement.

Significant difference was found in 10 of 17 items for Word for the reasons given below. Items "26 Role of windows in Word" and "28 Page layout" were improved because students were asked to use Word to write a report.

significance probability, between-groups, withingroups, and degrees of freedom. The factor of conditions was significant, as evident in Table 3 ( $F(5,114) = 34.3, p < 0.001$ ).

Multiple comparisons were conducted according to Tukey's method. The result is presented in Table 4, where n. s. represents no significant difference, which indicates that literacy in PowerPoint was significantly lower before the course than that in Word or Excel. However, literacy in PowerPoint was significantly improved after the course, up to a level at which no significant difference was found from either Word or Excel. No literacy difference was observed in Word, although literacy tended to be improved significantly in Excel after the course compared with before.

Consequently, results suggest that this practice brought about a good effect on literacy not only in PowerPoint but also in Excel.

Because they were instructed to insert a table in their reports, items "34 Draw a ruled line" and "35 Erase a ruled line" were enhanced. Moreover, because they put the graphs for self-evaluation and peer-evaluation or slides for storytelling in their reports, item "37 Insert an image" was improved. Item "42 Count text characters" cannot be used fully yet, although significant difference was found. Students were advised to include the number of characters and graphs into a table in their reports when they were asked to summarize the story contents. Therefore character counting was explained by necessity. Nevertheless, the story was so short that characters were easily countable without using the function "Count text characters." Therefore, not all the students used the function. Significantly different tendencies were found in each of items 32 and 38.

No significant difference was found in five items for Word: items "30 Change font", "31 Character style", "36 Input characters", "39 Print previews", and "40 Print." They had already been well understood (ranked as much as almost 3 before the course), so there was little room for improvement. No significant difference was recognized.

Significant difference was observed in 14 of 18 items for Excel. The reasons are considered below. Items "48 Arithmetic operation", "49 Copy a formula", and "60 Function" were improved because students were ordered to execute arithmetic operations and to copy the results to some cells when calculating the average of self-evaluation or evaluation of others. Items "45 Make a table", "46 Save a table", and "50 Edit a table" were improved by creating a table with Excel. Item "53 Change the number of digits" was enhanced because students were ordered to arrange the place after the decimal point when writing average ranks in a table in the report. When making a table, students were advised to narrow or extend column width and to center numbers in the case of a numerical column,

if needed, for better appearance. These operations strengthened items "51 Width change of rows and columns", "52 Centering", and "54 Draw a ruled line." Students used Excel in various scenarios and tasks, such as placing data into an evaluation sheet, creating a table, and drawing a graph. For this reason, item "44 Role of window in Excel" was enhanced. Although there were few occasions to print something using Excel before this practice, one required part was exclusively printed with a

print range specified in this course. This improved item "55 Designate print range" and "57 Print." When making a report and an evaluation sheet, students were instructed to perform operations so that a table might be well understood by everyone. The items strengthened as above suggest that this instruction enhanced effectiveness. Marginally significant difference was found in two items 47 and 59 for Excel.

Table 5. Survey results of literacy in software functions

Items of evaluation			Pre		Post		Test	
			m	SD	m	SD	z	p
PowerPoint	1	Start of PowerPoint	2.9	0.4	3.0	0.0	1.6	
	2	Role of the Window of PowerPoint	2.5	0.7	2.9	0.3	3.4	***
	3	Layout of slide	2.7	0.6	3.0	0.2	3.5	***
	4	The size of place holder and change of the position	2.1	0.8	2.5	0.7	3.1	**
	5	The input of title and change of font size	2.7	0.5	3.0	0.1	3.3	***
	6	Input of text	2.8	0.5	3.0	0.1	3.1	**
	7	Saving a slide	2.9	0.4	3.0	0.1	2.0	*
	8	Practice of slide show	2.9	0.4	3.0	0.2	1.2	
	9	Interruption of slide show	2.8	0.5	2.9	0.2	2.1	*
	10	Setting of background	2.6	0.6	3.0	0.2	4.4	***
	11	Recording of the narration	1.6	0.7	3.0	0.0	6.7	***
	12	Print of distribution document	2.4	0.7	2.9	0.2	4.6	***
	13	Setting of slide show	2.5	0.6	3.0	0.2	4.9	***
	14	Setting of effect to change a screen	2.2	0.7	2.9	0.3	5.4	***
	15	Setting of animation	2.3	0.7	3.0	0.2	5.2	***
	16	Method to play back repeatedly	2.0	0.7	2.8	0.5	5.4	***
	17	Setting special effects in a text	2.1	0.8	2.9	0.4	4.9	***
	18	Setting special effects to an object	2.0	0.8	2.8	0.5	4.9	***
	19	Change of animation	2.2	0.8	3.0	0.1	5.5	***
	20	Practice of animation	2.3	0.8	3.0	0.1	5.1	***
	21	Change of the kind of animation	2.2	0.8	3.0	0.1	5.5	***
	22	Change of the order of animations	2.2	0.8	3.0	0.1	5.4	***
	23	Changing to distribute time of animation	2.0	0.8	2.9	0.3	5.4	***
	24	Deletion of the animation	2.3	0.8	3.0	0.0	4.9	***
	25	Setting of the trace of animation	2.0	0.8	3.0	0.3	5.6	***
Word	26	Role of the window of Word	2.6	0.7	2.9	0.4	3.1	**
	27	Saving of a document	2.9	0.5	3.0	0.0	2.1	*
	28	Layout of page	2.7	0.5	3.0	0.2	3.2	**
	29	Setting of letter format	2.9	0.4	3.0	0.1	2.4	*
	30	Change of font	2.9	0.4	3.0	0.0	1.6	
	31	Character style, a size, underline	2.9	0.3	3.0	0.2	1.2	
	32	Making of table	2.8	0.5	2.9	0.3	1.8	+
	33	Insertion of table	2.7	0.5	2.9	0.2	2.9	**
	34	Drawing a ruled line	2.8	0.5	3.0	0.2	2.6	*
	35	Undrawing a ruled line	2.8	0.5	2.9	0.2	2.5	*
	36	Input of the letter	2.9	0.4	3.0	0.0	1.6	
	37	Pasting up of image	2.8	0.5	3.0	0.1	2.6	**
	38	Print of document	2.9	0.4	3.0	0.0	1.9	+
	39	Print preview	2.9	0.4	3.0	0.0	1.6	
	40	Print	3.0	0.3	3.0	0.0	1.0	
	41	Pasting up of letter	2.8	0.5	3.0	0.0	2.6	**
	42	The number of letters in the sentence	2.6	0.6	2.8	0.5	2.6	*
Excel	43	Start of Excel	3.0	0.3	3.0	0.0	1.0	
	44	Role of the window of Excel	2.7	0.6	2.9	0.3	2.8	**
	45	Making of table	2.9	0.4	3.0	0.2	2.0	*
	46	Saving a table	2.9	0.4	3.0	0.2	2.2	*
	47	Opening the saved table	2.8	0.5	2.9	0.2	1.8	+
	48	Arithmetic operation	2.5	0.6	2.8	0.4	4.2	***
	49	Copy of a numerical formula	2.5	0.6	2.9	0.4	4.2	***
	50	Editing of table	2.6	0.6	2.9	0.3	3.7	***
	51	Width change of row and colomnn	2.7	0.6	2.9	0.3	2.5	*
	52	Keep the center	2.8	0.5	3.0	0.0	2.4	*
	53	Change of the number of numerical figures	2.5	0.6	2.9	0.4	4.2	***
	54	Drawing a ruled line	2.7	0.6	2.9	0.3	3.2	**
	55	Appointing print range	2.7	0.6	2.9	0.4	2.7	**
	56	Print preview	2.8	0.5	3.0	0.2	2.2	*
	57	Print	2.9	0.4	3.0	0.0	2.1	*
	58	Making of graph	2.7	0.6	2.8	0.4	1.2	
	59	Editing of graph	2.7	0.6	2.8	0.4	1.8	+
	60	Function	2.4	0.6	2.7	0.5	2.9	**

\*\*\* p<.001, \*\* p<.01, \* p<.05, + p<.1.

No significant difference was found in two items for Excel. "43 Launch Excel" and "58 Make a graph" had already been well understood, ranked as much as almost 3 before the course. Therefore, there was little room for improvement. No significant difference was found.

## 4. Discussion

### 4.1. About Elongation of Information Literacy of Three Kinds of Software

Word, Excel, PowerPoint are taught in a class of the information literacy in the first grade. The literacy in Word functions was already 2.82 beforehand because various functions of Word is used for writing the report of the various subjects. This shows that the literacy in Word is gradually improved from the first grade. Because Excel may be used when the report which needs a chart or a table is written, it is not used all the time. It is thought that Excel do not make progress as Word. It is rare that students use PowerPoint after having learned it in first grades. It is thought that many students forget literacy in it because they do not use it.

The author tried to use these three kinds of software in this practice. The author maintained information literacy as much as possible in this way and conducted it to improve more. The author let students do various operations from the input of the letter to an animation so that literacy in PowerPoint which is lowest improved in this class. In this way this class is designed so as to increase the information literacy that a student could get. As well as it, using the same function several times was conducted to fix it. As a result, literacy of PowerPoint became at the same level as Word and Excel and became according to the aim as showed in 3.3 section. It was shown that literacy of PowerPoint of students could be promoted to degree like Word and Excel by four times of this class.

For an available degree of PowerPoint, a result of t-test between mean elongation = 0.31 of general items 1-12 and mean elongation = 0.76 of items 13-25 related to an animation was significantly different ( $t(1423)=13.6$ ,  $p<.001$ ). This verifies that the latter was bigger. The elongation of the mean available degree of items related to an animation has improved greatly more than the elongation of other general items. This is suggested that what students were asked to add some kind of movement to a letter, the character and so on in all slides brought a good effect. It is suggested that what not only telling that we can do it, but also we let students really do it brings cultivating ability to be able to use.

For mean elongation of PowerPoint, coefficients of correlation  $r$  between it and the mean elongation of the available degree of Word and between it and the mean elongation of the available degree of Excel was  $r=0.15$  ( $F(1,57)=1.35$ ,  $p>.1$ ) and  $r=0.33^*$  ( $F(1,57)=6.78$ ,  $p<.05$ ) respectively. The coefficient of correlation between the mean elongation of the available degree of Word and Excel was  $r=0.68^{***}$  ( $F(1,57)=48.5$ ,  $p<.001$ ). This verifies that the mean elongation of the available degree of PowerPoint reveals not much a correlation for the mean elongation of the available degree of Word and Excel, and there is moderate correlation between the mean elongation

of the degree of Word and Excel. It is thought that the correlations become small because the mean elongation of the available degree of PowerPoint is not only bigger than that of Word and Excel, but also interest in animation depends on each student and a student shows different elongation for it.

### 4.2. Principal Component Analysis for Elongation of Information Literacy

We have conducted principal component analysis by using elongation of literacy in functions of PowerPoint. The post-extract load of principal components 1 and 2 were 45.8% and 11.0% respectively. The cumulative load for such components was 56.9%. Coefficients of principal components 1 and 2 are shown in Table 6. Since the coefficients of rating items for component 1 are between 0.10 and 0.93, and are all positive, we believe that coefficients of component 1 are the variable synthesizing all items. Especially, the coefficients for items 13 to 25 related to animation are between 0.58 and 0.93, and are larger than the coefficients for items 1 to 12 because the coefficients are between 0.10 and 0.47. Based on these findings, component 1 is called "Elongation of a skill related to an animation". Furthermore, the coefficients of general rating items 1, 2, 3, 5, 6, 7, 8, 9 in component 2 are between 0.59 and 0.73, and are larger than coefficients for other items. Based on these findings, component 2 is called "Elongation of the general skill of PowerPoint". Elongation of literacy in PowerPoint can be explained by these two components.

Table 6. Coefficients of evaluation items

No.	Evaluation items	Comp.1	Comp.2
1	Start of PowerPoint	.174	-.183
2	Role of the Window of PowerPoint	.175	.608
3	Layout of slide	.279	.313
4	The size of place holder and change of the position	.323	-.164
5	The input of title and change of font size	.167	.060
6	Input of text	.152	.051
7	Saving a slide	.062	-.002
8	Practice of slide show	.088	.030
9	Interruption of slide show	.132	.336
10	Setting of background	.402	.271
11	Recording of the narration	.390	.400
12	Print of distribution document	.155	.667
13	Setting of slide show	.613	.425
14	Setting of effect to change a screen	.648	.240
15	Setting of animation	.767	-.101
16	Method to play back repeatedly	.541	.114
17	Setting special effects in a text	.754	.120
18	Setting special effects to an object	.798	-.037
19	Change of animation	.910	.017
20	Practice of animation	.864	-.256
21	Change of the kind of animation	.908	-.064
22	Change of the order of animations	.925	-.137
23	Changing to distribute time of animation	.876	-.178
24	Deletion of the animation	.813	-.291
25	Setting of the trace of animation	.862	.065

### 4.3. Classification of Students using Principal Component for Elongation of Information Literacy

Cluster analysis was conducted using the principal component score obtained in 4.2 section about elongation of the literacy in PowerPoint as a variable. As the result, 59 students for the analysis were classified into four clusters (groups). The number of the students who belonged to two groups of them was alone each. Therefore the two students were removed as isolated data. Principal component analysis and cluster analysis were again conducted for remaining 57 students.

Principal component analysis was conducted by the same way as 4.2 section. As the result, loading after the extraction of principal component 1 and 2 were 47.4% and 7.7% respectively. These cumulative loading becomes 55.1%. Each evaluation item is arranged in descending order of coefficients of the component 1 in component matrix as shown in Table 6. Cluster analysis was conducted using the principal component scores obtained for the elongation of literacy in PowerPoint as variables. As the result, 57 students were classified into four clusters (group G1 - G4). Groups G1 - G4 are shown in Figure 2 using scores of principal component 1 and 2.

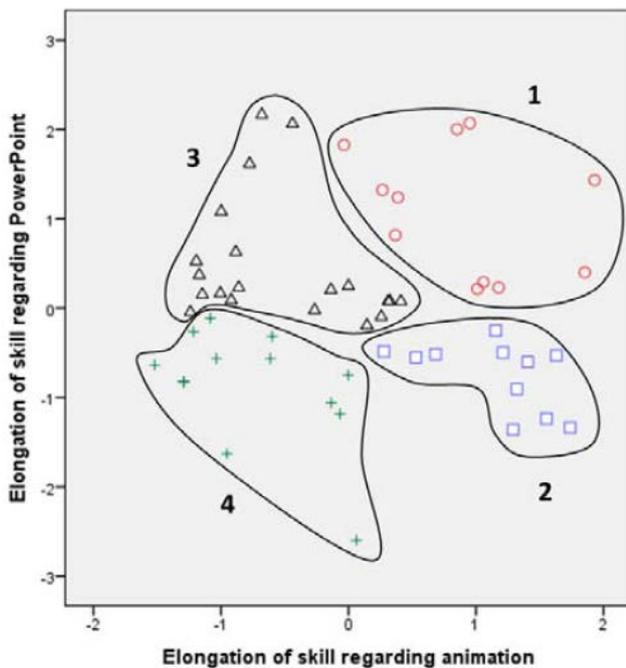


Figure 2. Classification of students using principal component analysis and cluster analysis for skill elongation

Students (circle mark) belonging to group 1(G1) are 11 people of the top right corner. The mean elongation for PowerPoint is 0.93, the same as G2 and the highest in four groups. The mean elongation of this group in the skill of Word and Excel is high as the same way as G4.

Students (square mark) belonging to group G2 is 11 people of the lower right. The mean elongation of this group for PowerPoint is 0.93, the same as G1 and the highest in four groups. The elongation of this group in the skill of Word is the highest group. The mean elongation of this group in the skill of Excel is higher.

Students (triangle mark) belonging to group G3 are 20 people of the left upper. The mean elongation for

PowerPoint is 0.39. The elongation in the skill of PowerPoint is the third group. The mean elongation of this group in the skill of Excel is the third group, too.

Students (plus mark) belonging to group G4 are 15 people left lower. The mean elongation for PowerPoint is 0.18 and lowest in four groups. The elongation of this group in the skill of Word and Excel is lowest.

### 4.4. Comparison of Students Groups Classified Using Principal Component for Elongation of Information Literacy

Average and standard deviation are shown in Table 7 for three kinds of elongation (elongation in the skill of PowerPoint, Word and Excel) for four student groups. m and SD mean average and standard deviation respectively. For these three kinds of elongation, the analysis of variance with two factors was conducted between four groups. The result is shown in Table 8. Where SS, df, MS, F, and p mean a sum of squares, degrees of freedom, mean square, F value, and significance probability respectively. Significant difference was recognized between the mean elongation of the group from this results ( $F(3,3408)=79.9, p<.001$ ). Significant difference was recognized between software names. Interaction was recognized between groups and software names ( $F(6,3408)=30.0, p<.001$ ).

Therefore analysis of variance was conducted. The result is shown in Table 9. In the case of PowerPoint and Excel, significant difference was recognized between the mean elongation of four groups. In the case of Word, significant difference tendency was recognized between the mean elongation of four student groups.

Therefore multiple comparison was conducted by Bonferroni method. The result is shown in Table 10. These results show that a relationship of  $G2=G1>G3>G4$  is satisfied between the elongation of the skill of four groups for PowerPoint. A relationship of  $G2=G1=G3=G4$  is established for Word. A relationship of  $G1=G2>G3=G4$  was established for Excel. Where sign > means significant difference and the case of  $G_m>G_n$  means that  $G_m$  is significantly larger than  $G_n$ . "=" mean that there is not a meaningful difference between two groups. The relationship for PowerPoint means that the mean elongation of group G2 and G1 is significantly larger than G3 and the elongation of G3 is significantly larger than G4. For Excel, It means that the mean elongation of group G1 and G2 is significantly larger than that of G3 and G4. For Word, there was not a significant difference between the mean elongation of these four student groups.

In this way, it is natural that a difference for the elongation in PowerPoint is mutually recognized in four groups classified using the elongation in the skill of PowerPoint. Students become two groups in Excel. Students become one group because a meaningful difference disappears mutually for Word. A mean elongation in the skill of PowerPoint is generally large. A mean elongation for Excel is some small. It is thought that significant difference in improvement is not found between four groups because there is not meaningful improvement for Word in its entirety.

By the explanation up to here, student group G1 and G2 seem to be no difference. Therefore t-test was conducted between the average elongation of the general items and between the average elongation of the items related to an

animation in PowerPoint for two groups G1 and G2. As a result, both were significantly different. It was found that the mean elongation in group G1 was larger than that in G2 for the general items ( $t(262)=2.38$ ,  $p<.01$ ). It was found that the mean elongation in group G2 was larger than that in G1 For the items related to an animation

( $t(284)=2.62$ ,  $p<.01$ ). In this way it was found that elongation in the general skills and skills related to an animation was different each groups even if the mean elongation of the whole items in group G2 was the same as that of group G1 in the whole PowerPoint. By these, we can understand the reason why students are parted in four groups.

**Table 7. Means and standard deviations for elongation of three kinds of software of four groups**

Group	G1		G2		G3		G4		Total	
	m	SD	m	SD	m	SD	m	SD	m	SD
PowerPoint	0.93	0.81	0.93	0.84	0.39	0.60	0.18	0.55	0.54	0.75
Word	0.13	0.46	0.14	0.41	0.09	0.35	0.03	0.33	0.09	0.38
Excel	0.27	0.53	0.24	0.43	0.11	0.03	0.05	0.49	0.15	0.47
Total	0.50	0.74	0.50	0.73	0.22	0.51	0.10	0.48	0.30	0.62

**Table 8. Analysis of variation for two factors among four groups**

Factors	SS	df	MS	F-value	p
Groups	72.1	3	24.0	79.9	***
Software name	177.2	2	88.6	294.5	***
Group*Software name	54.2	6	9.0	30.0	***
Error	1025.3	3408	0.3		
Summation	1629.0	3420			*** $p<.001$

**Table 9. Table of analysis of variance for each software**

Software name		SS	df	MS	F-value	p
PowerPoint	Between	142.3	3	47.44	157.70	***
	Within group	1025.3	3408	0.30		
Word	Between	1.9	3	0.63	2.11	+
	Within group	1025.3	3408	0.30		
Excel	Between	7.3	3	2.44	8.11	***
	Within group	1025.3	3408	0.30		

\*\*\*  $p<.001$ , +  $p<.1$ .

**Table 10. Results of significance difference test among groups**

Software	Group	G2	G3	G4
Power Point	G1	=	> *	> *
	G2		> *	> *
	G3			> *
Word	G1	=	=	=
	G2		=	=
	G3			=
Excel	G1	=	> *	> *
	G2		> *	> *
	G3			=

## 5. Conclusion

Students were instructed to create slides about storytelling of contents related to their self-understanding and self-analysis for their career decision, using PowerPoint to strengthen computer literacy. This article described the practice method and measured literacy for computer functions before and after the course. Results were reported herein.

Literacy in functions of PowerPoint was lower than that in either Word or Excel before the course. However, through practice, literacy in functions of PowerPoint was enhanced significantly. Students reported that they had learned to use PowerPoint as they had Word and Excel, which suggests that the functions that are necessary for a

presentation were more useful after the practice than before the practice. When making slides, reports, and evaluation sheets during the creation of storytelling, students were instructed to produce a work so that it might be well understood by everyone, which seems to have enhanced effectiveness.

Principal component analysis will be conducted for growth of the literacy of PowerPoint. Cluster analysis will be conducted using the principal component score as a variable. As the results, students will be divided into four groups: the group whose growth in the general literacy of PowerPoint is higher, the group whose growth in literacy related to an animation is higher, the group whose elongation in the overall literacy of PowerPoint is third, and the group whose elongation in the skill of PowerPoint and Excel is lowest. By growth in the literacy of Excel, students were divided into two groups. By growth in the literacy of Word, there was not different in these four groups.

As our future plans, we want to analyze an attitude survey and a survey for degree of literacy to clarify the difference in effect that students can get by the making the slide work of storytelling talking about oneself and the slide work to introduce a product.

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