

# **Influence of Differences in Teaching Strategies on Learner's Notetaking in Secondary Mathematics Education: Focusing on "Presentation" and "Illustration"**

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## **Abstract**

With the widespread use of large presentation devices, the range of ways to show class content has expanded. Notetaking is another element that varies depending on the board writing method; however, no direct measure of the relationship between notetaking behavior and the teacher's teaching behavior (e.g., speaking and writing on the board) exists. Therefore, we considered it necessary to find an appropriate board writing method to enhance notetaking.

The purpose of this study was to investigate the effects of differences in board writing methods on notetaking in secondary mathematics classes. We categorized the two types of methods used by professors for writing on the board in simultaneous classes as "presentation" and "illustration."

We conducted one "presentation" lesson and one "illustration" lesson for first-year high school students. The teacher used a PowerPoint in the "presentation" class and a blackboard in the "illustration" class. Notebooks were distributed to the students, collected, and evaluated.

The results suggest that in some situations, to make students' notetaking more fulfilling, "presentation" is better than "illustration."

*Keywords: Secondary education, Note-taking, board writing*

## **Introduction**

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) has reorganized all subjects into the three pillars of "knowledge and skills," "the ability to think, to make decisions, to express themselves and other abilities," and "an attitude of proactive learning and students' individuality" to foster in children the "zest for life" across knowledge, virtue, and body (MEXT, 2017a). We focused on "knowledge and skills," which are the foundation of the other pillars. In addition, in the study of mathematics, the acquisition of "knowledge and skills" using a mathematical viewpoint and way of thinking and the exploration of the acquired "knowledge and skills" through their utilization, will lead to knowledge that is useful in life and to the proficiency and mastery of skills (MEXT, 2017b).

To acquire "knowledge and skills," MEXT has promoted the development of large presentation devices with the objectives of "enlarged presentation for comprehensible lessons" and "individualized learning for the retention and application of knowledge and skills" (MEXT, 2018). The widespread use of large presentation devices has allowed

teachers to use a range of ways boards in the classroom. The method of utilizing the board (which is more effective), the blackboard, or the large presentation device varies depending on the subject and grade level (Nakahashi et al., 2011; Bamne & Bamne, 2016).

Students decide what to include and omit from their notes based on PowerPoint or other board documents (Stefanou et al., 2008). Here, notetaking is considered a factor that changes depending on the board’s writing method. However, no direct measurement of the relationship between note-taking behavior and the teacher’s teaching behavior (e.g., speaking and writing) exists (Yoshioka et al., 2020). Therefore, it is necessary to determine an appropriate way to use the board to make notetaking more fulfilling.

In this study, we categorized the methods used by professors in simultaneous classes into two types: “presentation” and “illustration.” “Presentation” is a method of explaining while showing materials prepared in advance, and “illustration” is a method of explaining while writing on the board.

### Purpose

This study aimed to investigate the effect of the difference between “presentation” and “illustration” on notetaking, a teaching strategy utilizing the board in secondary mathematics education.

### Methods

Eighty students—40 in each of two classes of first-year high school students—were surveyed from November to December 2021. Students attended one “presentation” and one “illustration” class. The first author classified the lessons into five developmental situations using Gagné’s nine teaching events (**Table 1**). In the “presentation” class, the second author gave a PowerPoint presentation on an electronic blackboard; in the “illustration” class, the second author wrote on a blackboard with chalk. After each class, students answered a questionnaire survey.

The teacher distributed notebook sheets at the beginning of the class, and the students took notes on the distributed sheets during the class. After the class, the notebooks were collected, scanned, and returned by the teacher on the same day.

**Table 1**

*Scene division based on Gagné’s nine professorial events*

Scene	Gagné’s nine professorial events	Lesson Contents
1	4 Present new matters	Check terminology
2	3 Check prerequisites	Find the greatest common divisor (least common multiple) from a fundamental number (multiple numbers)
3	5 Provide guidelines for learning	Example: Find the greatest common divisor (least common multiple)
4	6 Provide opportunities for practice	Exercises: Question to find the greatest common divisor (least common multiple)
	7 Provide feedback	
5	5 Provide guidelines for learning	Question in utilizing the greatest common divisor (least common multiple)

### Results

The students attended two types of lessons, and the author evaluated their notes using 12 items based on Tanaka et al. (2021) to evaluate how the notetaking content differed between the two types. The results of the Shapiro-Wilk

normality test showed no normality; therefore, to compare the classes, we conducted a Wilcoxon signed-rank test (**Table2**).  $M_1$  and  $SD_1$  are the mean and standard deviation of “presentation” in order, and  $M_2$  and  $SD_2$  are the mean and standard deviation of “illustration” in order.

For Scene 1, the “illustration” group showed a significant tendency for the “highlight text,” and for Scene 2, the “presentation” group scored significantly higher for the same. The “presentation” group was significantly more likely to “underline text” and to “use arrows.” Moreover, it showed a significant tendency to “enclose text.” For Scene 3, the “presentation” group showed significantly higher scores for “enclose text,” “underline text,” and “note the page numbers in the textbook,” while the “illustration” group showed significantly higher scores for “using arrows.” For Scene 4, the “presentation” group scored significantly higher for the item “Write down information written on the board,” and for Scene 5, “Use charts and graphs” was significantly higher in the “illustration” group.

**Table 2**

*Comparison of Note-taking in "presentation" and "illustration"*

Scene		presentation		illustration		$M_1-M_2$	Z	r
		$M_1$	$SD_1$	$M_2$	$SD_2$			
1	Highlight text	1.90	1.12	2.27	1.10	-0.37	-1.76 <sup>†</sup>	-0.28
	Enclose text	0.39	0.64	0.24	0.47	0.16	-1.66 <sup>†</sup>	0.46
2	Underline text	0.10	0.36	0.53	0.54	-0.43	-3.87**	0.33
	Highlight text	0.33	0.52	0.14	0.35	0.20	-2.24**	0.56
	Use arrows	0.16	0.37	0.51	1.08	-0.35	-2.00**	-0.45
3	Enclose text	0.61	1.43	0.16	0.46	0.45	-2.64**	0.73
	Underline text	0.63	1.52	0.10	0.30	0.53	-2.59**	0.71
	Note the page numbers in the textbook	0.59	0.50	0.02	0.14	0.57	-5.39**	1.00
	Use markings	0.43	0.67	1.18	0.84	-0.75	-4.26**	-0.75
4	Write down information written on the board	0.24	0.43	0.06	0.24	0.18	-2.71**	0.82
5	Use charts and graphs	0.28	0.45	0.69	0.47	-0.41	-3.77**	-0.68

$n = 51$

<sup>†</sup> $p < .10$ , \*\* $p < .05$ , r : effect size

## Discussion

The items with significant differences are examined according to Gagné’s nine professorial events as follows.

For Event 3, “Check prerequisites,” the results suggest that students were more likely to use the arrows for notetaking in the “illustration” lesson in Scene 2. The results for “highlight text” and “underline text” in Scene 2 may have been the result of the difference in the content of the writing on the board in the two types of lessons.

Regarding Event 4, “present new matters,” the results suggest that students were more likely to highlight letters for notetaking in the “illustration” lesson in Scene 1.

For Event 5, “Provide guidelines for learning,” the results suggest that students were more likely to underline notetaking in the “presentation” lesson in Scene 3. The results for Scene 3, “enclose text,” “note the page numbers in the textbook,” and “Use arrows” may have been the result of the difference in the content of the writing on the board in the two types of lessons. Scene 5 was the only scene in which diagrams appeared on the board. The item “Use diagrams” was significantly higher in the “illustration” group, in which students drew diagrams on the blackboard, compared to the “presentation” group, in which diagrams were projected from the beginning, suggesting that diagrams may have been perceived as unimportant by the students in the “presentation” section. On the other hand, students in the “illustration” group were more likely to try to understand the problem based on the diagram through notetaking.

For Event 6, “Provide practice opportunities,” and Event 7, “Provide feedback,” the results suggest that students were more likely to write the information written by the teacher in the “presentation” section in Scene 4.

However, because Scene 4 was a problem exercise, most students wrote and circled their answers in their notebooks; therefore, few students wrote down the information written on the board.

## Conclusion

In this study, we classified the use of the board into two types, “presentation” and “illustration,” and examined which was more effective based on the content of notetaking in each of Gagné’s nine professorial events.

However, in some situations, the content of the text was controlled by the “presentation” and “illustration” lessons, but the method of emphasis was not, which may have led to differences in the students’ notetaking. Therefore, it is necessary to unify the environment in terms of emphasis. In addition, we plan to investigate the effects of learning and memory retention of the students in future studies, which we could not measure in this study.

## References

- Bamne, S. N., Bamne, A. S. (2016). Comparative study of chalkboard teaching over PowerPoint teaching as a teaching tool in undergraduate medical teaching. *International Journal of Medical Science and Public Health*, 5(12), 2585
- MEXT (2017a). Atarasiigakushusidouyourounokangaekata -Chuoukyouikusingikainiokerugironnkarakaiteisositezissi he-. <http://www.pref.nara.jp/secure/39251/2908setsumeikaiteisyushi1.pdf>
- MEXT (2017b). Chugakkougakushusidouyouroukaikasetu Sugakuhen. [https://www.mext.go.jp/component/a\\_menu/education/micro\\_detail/\\_\\_icsFiles/afieldfile/2019/03/18/1387018\\_004.pdf](https://www.mext.go.jp/component/a_menu/education/micro_detail/__icsFiles/afieldfile/2019/03/18/1387018_004.pdf)
- MEXT (2018). ChihouzititainotamenogakkounoICTkankouseibisuisinnotebiki. [https://www.mext.go.jp/component/a\\_menu/education/micro\\_detail/\\_\\_icsFiles/afieldfile/2018/08/29/1386784\\_4.pdf](https://www.mext.go.jp/component/a_menu/education/micro_detail/__icsFiles/afieldfile/2018/08/29/1386784_4.pdf)
- Nakahashi, Y., Sato, Y., Terashima, K., Nakagawa, H. (2011). The Effect of Interactive Whiteboards for Reading in the Japanese Class. *Education Media Study*, 17(2), 41-51
- Stefanou, C., Hoffman, L., & Vielee, N. (2008) Note-taking in the college classroom as evidence of generative learning. *Learning Environments Research*, 11(1), 1-17
- Tanaka, H., Yamane, T., Uozaki, Y., Chujo, K. (2021). Daigakuseiniokerunotetakingnohouryakusiyounokiteiin. *Japan journal of educational technology*, S44047
- Yoshioka, M., Fuji, K., Sato, K. (2020). Time Series Evaluation of Students’ Note-Taking and Their Teacher’s Behavior in a University Class: Using a New Device for Measuring Handwriting. *Japanese journal of behavior analysis*, 35(1), 30-41