

# **Investigation of Psychological and Environmental Factors that Influence Assignments Completion**

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## **1. Introduction**

### **1.1 Education in Today's Japan**

The Ministry of Education, Culture, Sports, Science, and Technology (MEXT) (2020) has indicated the need to improve classes from the perspective of proactive, interactive, and authentic learning (so-called active learning) in the new curriculum guidelines to be implemented in high schools on an annual basis starting in 2022. It is essential to realize this improvement, not within a single lesson but a coherent unit or subject matter. In addition, since there will be no reduction in learning content from the existing curriculum guidelines, high school mathematics departments are required to plan lessons that consider teaching content and time allocation (MEXT, 2018). Thus, in today's Japan, students are expected to study more in-depth content in a limited amount of time.

Therefore, flipped classroom teaching is an effective way to realize the improvement of teaching required today.

### **1.2 Flipped Classroom**

According to Bergmann and Sams (2012), a flipped classroom is a learning method in which students do essential learning, such as the content of explanatory lectures, before class as homework, and learning necessary for retention of knowledge and cultivation of applied skills, such as tutorials and project learning. Abeysekera and Dawson (2015) found three critical components of flipped classroom teaching:

1. Information-transmission teaching moves to outside of class time
2. Lesson time used for learning activities
3. Students require completing pre-and/or post-class activities to benefit from in-class activities fully

These components suggest that it is possible to incorporate active learning into class time without reducing the learning content by introducing flipped classroom teaching.

One of the characteristics of flipped classroom teaching is the relationship between home-studying (preparation and review) and face-to-face teaching. According to Shinogaya (2012), all learning breaks down into three stages: prior learning, core learning, and post-learning. Shibukawa (2021) summarized the flow of learning in lecture-based and flipped classroom teaching based on three stages of learning (Table 1).

Table 1. Difference between lecture-based class and flipped classroom

Learning Stage	Lecture-based Teaching	Flipped Classroom Teaching
Prior Learning	Preparation Ex) Reading Textbook	Pre-Class Learning Ex) Watching lecture videos Acquire new knowledge
Core Learning	Class Lesson Ex) Knowledge Acquisition	Class Lesson Ex) Engaging in developmental activities
Post Learning	Revision Ex) Summarize Class	Post-Class Learning

On the one hand, in lecture-based teaching, students learn the content of the class through preparation, acquire knowledge in the face-to-face class lesson, and practice problems and summarize the class content in the revision. On the other hand, in a flipped classroom teaching, the student acquires knowledge of the lesson's content in the pre-class learning, performs exercises in the face-to-face class lesson, and summarizes the content in the post-class learning. In this way, in the flipped classroom, students need to learn new knowledge on their own while studying at home. Therefore, the materials for the pre-class learning in the flipped classroom need to be designed so that the teacher's explanation of the study contents, the pre-class learning, and the face-to-face class lesson is considered one learning process.

However, the implementation of prior learning can be problematic because there are no instructors present where learners can conduct prior learning.

### 1.3 Problems with Pre-Class Learning in Flipped Classroom

Some prior studies have shown that pre-class learning did not work well in flipped classroom teaching. One of the reasons is that learners do not carry out pre-class learning. For example, in Yamamoto et al. (2018)'s practice, a teacher needs to provide individual attention if students do not do the pre-class learning. Furthermore, Long et al. (2017) found that students might not prepare for pre-class learning, so teachers need to encourage their motivation for pre-class learning before in-class activities for all students to enjoy active learning. Wei et al. (2020) also stated that teachers need to encourage students to conduct pre-class learning to make in-class activities more active. Thus, the learner's implementation of prior learning is a necessary element for the success of the flipped classroom.

Based on the above, we thought it necessary to examine what kind of support is needed to improve the rate of students' implementation of assignments.

## 2. Purpose

It is still unclear what kind of support effectively encourages high school students to carry out their assignments. Therefore, this study aims to investigate the difference in the awareness of the students who submitted their assignments and those who did not submit their assignments, examine the factors that affect the students' implementation of the assignments, and propose support methods for each factor.

## 3. Methods

### 3.1 Participants of Research

We surveyed 80 second-year high school students (40 students in each of two classes) enrolled in a public high school in Chiba Prefecture, Japan. The participants are taking a course called "Mathematics B," The unit covered in this study is "Space Vector."

### 3.2 Flow of Research

Figure 1 shows the flow of this survey. This survey was conducted within the "Space Vectors" unit in October 2020. The subject took a class on "Components of vectors and operations with components" within the unit. In the class, new knowledge was explained, and problems were practiced. In the review assignment, the students were required to practice five similar problems to the problems in the class. After the students submitted their assignments, a questionnaire survey was conducted on their motivation to perform the assignments.

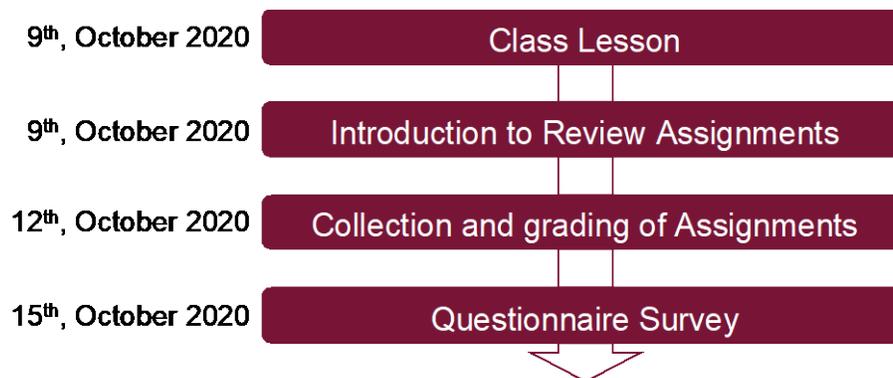


Figure 1. Flow of Research

### 3.3 Questionnaire survey

A unique questionnaire was developed and administered to investigate the psychological situation and the learning environment in the students were performing the assignment. The questionnaire items were divided into three categories based on the different ways in which the students carried out the assignments:

- (1) When they carried out the assignments and finished them
- (2) When they carried out the assignments but did not finish them
- (3) When they did not carry out the assignments

The total number of questions was 17 items: (1) 7 items, (2) 5 items, and (3) 5 items, and each item used a 5-point Likert scale (1 = disagree, 5 = very much agree). In addition, they were asked about the most significant causes for each of the times when they performed the assignments and when they did not perform the assignments in an open-ended question.

#### 4. Results

Among the 80 participants in this study, 53 (approximately 66%) who responded to the questionnaire without flaws were included in the analysis. Table 2 shows the implementation status of the assignments for the 53 participants in the analysis.

Table 2. Status of students' implementation of the assignments

Group	n	Score (5-point scale)		
		<i>M</i>	<i>SD</i>	
Submitted	42	4.36		0.84
No-Submitted	11	-		-
total	53			

#### 4.1. Reliability of the Questionnaire

To investigate the reliability of the original questionnaire, Cronbach's alpha was calculated for the responses to the 17-item questionnaire. As a result,  $\pm = 0.73$ , the results of the questionnaire used in this study are considered reliable and will be analyzed.

#### 4.2. Attitudes toward Assignment Implementation and Environmental Differences

In this research, a comparison of means was conducted on the responses to the questionnaires to examine whether there were differences in attitudes and environments between students who submitted the review assignment (submitted group) and those who did not submit the assignment (not submitted group). Shapiro-Wilk's normality test was conducted on the results of the questionnaire for each group, and no normality was found. In addition, there was a difference in the sample size of each group (submitted group=42, not submitted group=11). Therefore, Mann-Whitney's U test was adopted as the analytical method for comparing the means.

We compared the differences in attitudes toward the implementation of the assignment between the submitted and un-submitted groups based on the responses to the first question (When they carried out the assignments and finished them) of the questionnaire survey. The results are shown in Table 3.

Table 3. Differences in attitudes toward completing assignments

(1) When they carried out the assignments and finished them	Submitted		Not Submitted		<i>M<sub>1</sub>-M<sub>2</sub></i>	<i>U</i>	<i>r</i>
	<i>M<sub>1</sub></i>	<i>SD<sub>1</sub></i>	<i>M<sub>2</sub></i>	<i>SD<sub>2</sub></i>			
1 I do assignments because I believe that I should do the assignments at	4.26	0.59	3.55	1.04	0.71	136.50 <sup>†</sup>	0.32

school.

2	I do assignments because I believe that turning them in is related to my grades.	4.07	0.78	3.64	1.12	0.43	178.00	0.18
3	I do assignments because it is necessary for me to do so to understand and master the course content.	3.83	0.85	3.45	1.13	0.38	187.00	0.14
4	I do assignments because I know the purpose of doing them.	3.67	0.85	3.09	1.14	0.58	148.50 <sup>†</sup>	0.26
5	I do assignments because I like learning about the subject assigned.	2.76	1.10	2.45	1.04	0.31	195.00	0.11
6	I do assignments because I enjoy learning about the subject assigned.	2.71	1.15	2.45	1.21	0.26	204.00	0.08
7	I do assignments well in advance of the deadline.	2.76	1.19	2.45	1.44	0.31	196.00	0.12
n=53, 5-point Likert scale							†p<.100	

As a result of comparing students' attitudes toward "carrying out and completing assignments," there was a significant tendency toward the submitted group on the p<.100 criterion for items (1)-1 and (1)-4.

We compared the difference in the awareness of the submitting group and the not-submitting group regarding the case where they carry out the assignments but do not finish it, based on their responses to the second question (When they carried out the assignments but did not finish them) of the questionnaire survey. The results are shown in Table 4.

Table 4. Differences in attitudes when assignments are done but not completed

	(2) When they carried out the assignments but did not finish them	Submitted		Not Submitted		$M_1 - M_2$	$U$	$r$
		$M_1$	$SD_1$	$M_2$	$SD_2$			
1	I do not finish assignments when I feel that they are too much.	3.14	1.18	2.73	1.42	0.41	184.50	0.14
2	I do not finish assignments when I feel that I cannot solve the problems.	2.50	1.09	3.27	1.35	-0.77	153.00 <sup>†</sup>	0.24
3	I do not finish assignments when I do not know what to refer to when doing my assignments.	3.02	0.84	3.45	1.37	-0.43	162.00	0.22
4	I do not finish assignments when I do not have enough time due to assignments in other subjects.	2.83	1.06	2.73	1.01	0.10	221.00	0.03
5	I do not finish assignments when I	3.05	1.31	3.00	1.34	0.05	225.00	0.02

don't have time for club activities, lessons, cram school, or other commitments.

n=53, 5-point Likert scale

†p<.100

As a result of comparing the students' attitudes toward "doing the assignment but not finishing it," there was a significant tendency toward the not-submitted group on the p<.100 criterion for item (2)-2.

We compared the differences in attitudes of the submitted group and the un-submitted group regarding the non-implementation of assignments based on their responses to the third question (When they did not carry out the assignments) of the questionnaire survey. The results are shown in Table 5.

Table 5. Differences in attitudes when assignments are not completed

(3) When they did not carry out the assignments	Submitted		Not Submitted		$M_1 - M_2$	$U$	$r$
	$M_1$	$SD_1$	$M_2$	$SD_2$			
1 I do not do assignments when I forget that I have them.	2.90	1.28	2.73	1.10	0.17	217.00	0.04
2 I do not do assignments when they do not count toward my grade.	3.48	0.97	3.00	0.89	0.48	165.50	0.21
3 I do not do assignments when I feel that they are not necessary for my learning.	3.64	1.03	3.00	0.77	0.64	143.00*	0.28
4 I do not do assignments when I feel that doing them is a hassle.	3.83	0.88	3.18	0.98	0.65	150.50†	0.26
5 I do not do assignments when I do not understand the purpose, meaning, or intent of doing them.	3.71	0.94	3.36	0.92	0.35	182.50	0.15

n=53, 5-point Likert scale

\*p<.050, †p<.100

As a result of comparing the students' attitudes toward not carrying out assignments, there was a significant difference in the submitted group based on p<.050 in item (3)-3. Furthermore, in item (3)-4, there was a significant trend toward the submission group at the p<.100 criterion.

### 4.3. Categorization of Learner Characteristics of Assignment Implementation

There was no significant difference between the submitted group and the un-submitted group when the difference in the attitude toward the assignments was examined by comparing the mean values. Therefore, we conducted a factor analysis to examine the factors that influence students' performance of the assignments. The questionnaire items were categorized into two types: items related to factors for performing the assignments and items related to factors for not

performing the assignments, and factor analysis was conducted on each of the two types of items to identify factors that influence the performance of the assignments.

First, to examine the students' motivation to perform the assignments, factor extraction using the principal factor method and exploratory factor analysis using ProMax rotation were conducted on (1) of the questionnaire. The results are shown in Table 6.

Table 6. Students' attitudes toward performing the assignment

Questionnaire		factor		
		I	II	III
(1)-5	I do assignments because I like learning about the subject assigned.	0.94	0.02	0.01
(1)-6	I do assignments because I enjoy learning about the subject assigned.	0.94	-0.03	0.03
(1)-4	I do assignments because I know the purpose of doing them.	0.16	0.8	-0.02
(1)-3	I do assignments because it is necessary for me to do so to understand and master the course content.	-0.14	0.62	-0.04
(1)-7	I do assignments well in advance of the deadline.	0.05	0.54	-0.18
(1)-1	I do assignments because I believe that I should do the assignments at school.	-0.11	0.54	0.32
(1)-2	I do assignments because I believe that turning them in is related to my grades.	0.05	-0.11	0.8
Cronbach's alpha		0.94	0.69	-
factor correlation		<u>I</u>		
		<u>II</u>	0.16	
		<u>III</u>	0.03	0.31

n=53, Kaiser-Mayer-Olkin's measure: .57, Bartlett's test:  $\chi^2=129.13$ .

Factor extraction by principal factor method, ProMax rotation

The results of the factor analysis showed that the motivation to perform the assignments was categorized into three factors. The factor I consisted of (1)-5 and (1)-6, Factor II consisted of (1)-4, (1)-3, (1)-1, and (1)-7, and Factor III consisted of (1)-2. There was also a weak inter-factor correlation between factors II and III.

Next, to examine students' motivation to not perform the assignments, factor extraction using the principal factor method and exploratory factor analysis using ProMax rotation were conducted on (2) and (3) of the questionnaire. Also, all items were reversed because the questionnaire items were written in such a way as to ask for negative items. The results are shown in Table 7.

Table 7. Students' attitudes toward not performing the assignment

Questionnaire		factor			
		I	II	III	IV
(3)-5	I do not do assignments when I do not understand the purpose, meaning, or intent of	0.86	0.13	-0.06	-0.10

doing them. (R)

(3)-3	I do not do assignments when I feel that they are not necessary for my learning. (R)	0.73	0.08	0.06	-0.06
(3)-4	I do not do assignments when I feel that doing them is a hassle. (R)	0.50	-0.23	0.03	0.30
(2)-5	I do not finish assignments when I don't have time for club activities, lessons, cram school, or other commitments. (R)	-0.04	1.01	-0.05	0.00
(2)-4	I do not finish assignments when I do not have enough time due to assignments in other subjects. (R)	0.13	0.49	-0.01	-0.01
(2)-2	I do not finish assignments when I feel that I cannot solve the problems. (R)	-0.15	0.05	0.85	0.00
(2)-3	I do not finish assignments when I do not know what to refer to when doing my assignments. (R)	0.15	-0.11	0.67	-0.17
(3)-1	I do not do assignments when I forget that I have them. (R)	-0.10	0.00	-0.16	0.62
(3)-2	I do not do assignments when they do not count toward my grade. (R)	0.08	-0.02	-0.06	0.58
(2)-1	I do not finish assignments when I feel that they are too much. (R)	0.09	0.21	0.22	0.48
Cronbach's alpha		0.73	0.67	0.63	0.59
		I			
factor correlation		II			
		0.30			
		III			
		0.16	0.35		
		IV			
		0.37	0.41	0.49	

n=53, Kaiser-Mayer-Olkin's measure: .55, Bartlett's test:  $\chi^2=146.47$ .

Factor extraction by principal factor method, ProMax rotation (R): Reverse items

The results of the factor analysis showed that the motivation to perform the assignments was categorized into four factors. The factor I consisted of (3)-5, (3)-3, and (3)-4, Factor II consisted of (2)-4 and (2)-5, Factor III consisted of (2)-2 and (2)-3, and Factor IV consisted of (2)-1, (3)-1 and (3)-2. Also, weak inter-factor correlations were found between Factor I and Factor II, Factor I and Factor IV, and Factor II and Factor III, while moderate inter-factor correlations were found between Factor II and Factor IV, and Factor III and Factor IV, respectively.

## 5. Discussion

The above results suggest that the students in the submitted group feel more obligated to submit assignments than the students in the un-submitted group for the subjects of this study. In addition, it is thought that students are aware that they should perform and submit the assignments that are given to them regardless of the effect of performing the assignments on

their academic performance or the ease of performing the assignments. Therefore, it is possible that "submitting the assignment" itself is the purpose of the assignment.

Furthermore, on the one hand, the results of the factor analysis for the questionnaire (1) suggest the following factors for the student's implementation of the assignment.

- Students understand the purpose and need for the assignment
- Students' interest in the subject matter is high
- Students know that the assignment will be graded

On the other hand, the factor analysis results for questionnaires (2) and (3) suggest the following factors that prevent students from performing the assignments.

- Lack of time to complete the assignment
- The assignment is too difficult for students

These suggest that five factors affect students' performance of the assignments. The following five ways of supporting students to promote the implementation of their assignments can be identified from the above five factors.

- Specify the purpose of doing assignments
- Conduct the class in a way that attracts interest
- Clarify the relationship to grades
- Allow sufficient time for submission / Give time estimates
- Adjust the difficulty level based on the student's grade

Among these, "Specify the purpose of doing assignments" is particularly effective because it is consistent with the students' attitudes in the submission group, and it is easy for professors to provide support.

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