



Original article

# Impact of the COVID-19 Pandemic on Student Performance at a Department of Physical Therapy –Analysis of the Grades of Those Who Graduated in 2024 after Repeating a Year–

Hiroshi Murao<sup>1\*</sup>

<sup>1</sup> Kobe Gakuin University Graduate School of Rehabilitation

## Abstract

[Purpose]

To clarify the impact of changes in the educational environment due to the COVID-19 pandemic, such as switching to remote classes and not conducting regular examinations, on student performance at the Department of Physical Therapy, Kobe Gakuin University.

[Subjects and Methods]

We divided the students who had been admitted to the department between 2015 and 2019 into 4 groups: those who graduated without (group I: 134) and with (II: 14) repeating a year (repeat) during the pre-COVID-19 period, and those who graduated without (group III: 30) and with repeating a year (repeat) during the post-COVID-19 period (group IV: 8).

Then, we compared grade point averages calculated from grade points for specialized required subjects (GPAs-RS) and national physical therapist certification examination scores among the 4 groups.

[Results]

During semesters 1 and 2, the GPAs-RS of group IV were higher than or equal to those of group I. During semesters 3 and 4, the GPAs-RS of groups IV did not differ from those of group I. During semesters 5 and 6, the GPAs-RS of groups IV were lower than those of group I. Lastly, during semesters 7 and 8, the GPAs-RS and national certification examination scores of group IV did not differ from those of group I.

[Conclusion]

Changes in the educational environment due to the COVID-19 pandemic had a negative impact on some students at the Department of Physical Therapy, as their academic performance deteriorated, leading to repeat.

Submitted Jul. 4. 2024

Accepted Nov. 25. 2024

## \*Correspondence

Hiroshi Murao

Kobe Gakuin University Graduate School of Rehabilitation

E-mail:

[murao@reha.kobegakuin.ac.jp](mailto:murao@reha.kobegakuin.ac.jp)

## Keywords:

COVID-19

GPA

national certification examination score

## INTRODUCTION

Coronavirus disease 2019 (COVID-19)<sup>1)</sup> was first reported in December 2019, and the World Health Organiza-

tion (WHO) subsequently declared the COVID-19 pandemic. The causative virus of COVID-19 was unprecedented, and due to its high infectivity and diverse clinical

symptoms, it had a profound impact not only on Japanese people's social lives but also on Japan's economy. The impact of COVID-19 on the school lives and studies of Japanese students was also significant. The Ministry of Education, Culture, Sports, Science, and Technology recommended in its guidelines remote classes using the Internet (online classes) and learning tasks that could be performed at home<sup>2)</sup>.

To prevent the spread of COVID-19, Kobe Gakuin University decided to switch to online classes in principle from April 2020, and not to conduct regular examinations during the first semester from late July to early August 2020 and during the second semester from late January to early February 2021.

In a previous study to clarify the impact of switching to online classes and not conducting regular examinations on student performance at the Department of Physical Therapy, Kobe Gakuin University, the distributions of grades for subjects taken by students before and after the COVID-19 pandemic were significantly different, and grade point averages calculated from grade points for specialized required subjects (GPAs-RS) were significantly higher after the pandemic. However, as stated in this previous study, the high GPA-RS values should be interpreted with caution<sup>3)</sup>. Additionally, specialized required subjects delivered during the second year or semesters 3-4 were shown to be especially important to understand the subjects offered in the third year, i.e. semesters 5 and 6 in the curriculum used at the Department of Physical Therapy, Kobe Gakuin University, and were positively correlated with national physical therapist certification examination scores<sup>4)</sup>.

The 49 students admitted to this department in 2019 spent their sophomore year, which is crucial due to the nature of the curriculum, without regular examinations as a measure against the COVID-19 pandemic.

Among these 49 students, 30 graduated from the department in March 2023 without repeating a year (repeat). Thus, the rate of graduation without repeat was 61.2%. Considering that the rate for students admitted to the department in 2013-2014 was 79.3% in a previous study<sup>5)</sup>, the decrease in the rate must be attributed to the COVID-19 pandemic.

Kobe Gakuin University determined to resume regular examinations from 2021, when 1 year had passed since the pandemic. Accordingly, the Department of Physical Therapy also resumed to conduct regular examinations.

The purpose of this study was to clarify the impact of the COVID-19 pandemic on student performance at this department.

## SUBJECTS AND METHODS

We targeted 2 types of students: 172 admitted to the Department of Physical Therapy, Kobe Gakuin University, between 2015 and 2018 as the pre-COVID-19 period; and 49 admitted in 2019, who spent their sophomore year without regular examinations due to the COVID-19 pandemic.

From these students, we excluded 3 who were still in school at the time of the data analysis, 31 who dropped out after admission, 1 who was admitted in 2018 and was still a sophomore in 2020 due to repeat. We divided the included students into 4 groups: those who graduated without (group I: 134) and with (II: 14) repeat during the pre-COVID-19 period, and those who graduated without (group III: 30) with repeat during the post-COVID-19 period (IV: 8) (Fig. 1).

The curriculum was the same for all students admitted between 2015 and 2019, and there were 65 specialized required subjects evaluated.

We obtained the students' academic records through

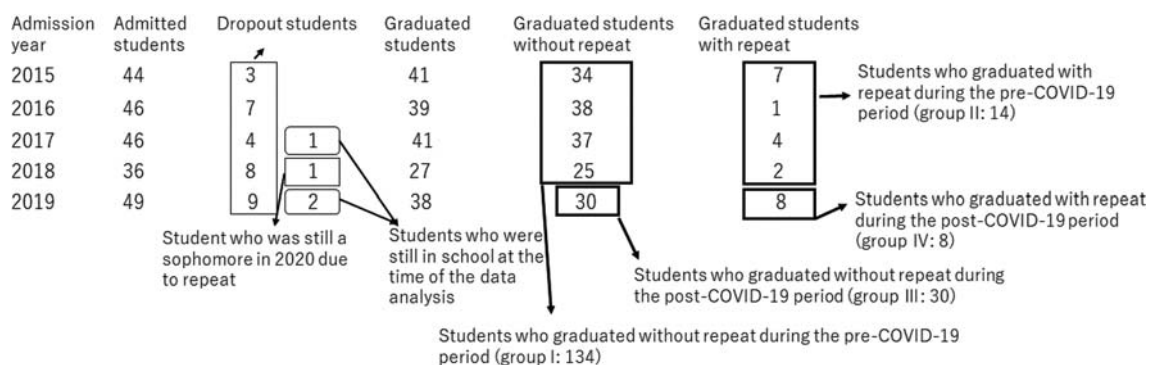


Fig. 1. Students divided into four groups



the Educational Affairs Center after following the given procedure. We scored their grades, S, A, B, C, D, and “/”, for the relevant subjects 4, 3, 2, 1, 0, and 0, respectively, as grade points. At the university, grading was performed based on the following criteria: S: a score of 90 or higher; A: 80 or higher and lower than 90; B: 70 or higher and lower than 80; C: 60 or higher and lower than 70; and D: lower than 60. We graded students not taking regular examinations, which were a requirement for the acquisition of credits, or not attending classes “/” (i.e., “unevaluable”). We calculated each student’s grade point average for the required subjects (GPA-RS) calculated from his/her grade point for each relevant subject using the following formula: ( $\sum$  grade point for each subject  $\times$  number of credits) / ( $\sum$  number of credits from each subject), and classified the obtained GPAs based on semesters.

For the subjects that were registered for twice or more by the students, we adopted the grades from the first registration. Among the grades of the students in groups I and II, we excluded those obtained in 2020 and 2021, considering that they may have been affected by the COVID-19 pandemic.

We calculated the students’ national certification examination scores by comparing their answers to the questions of the national examinations with the answers published by the Ministry of Health, Labour, and Welfare.

Then, we compared grade points for the specialized required subjects, GPAs-RS during each semester, and national certification examination scores among groups I, II, III, and IV.

As for the statistical analysis, we used the Kruskal-Wallis test to compare medians and the Shapiro-Wilk test to examine data normality represented by mean values first. Second, after confirming that the data were normal, we performed one-way analysis of variance. When the one-way analysis of variance showed differences among the 4 groups, we performed inter-group comparison using the Bonferroni method. When the Shapiro-Wilk test did not confirm data normality, we used the Kruskal-Wallis test. When the Kruskal-Wallis test showed differences among the 4 groups, we performed inter-group comparison after Bonferroni correction. We set the significance level at lower than 5%.

After obtaining approval from the Ethics Committee for Research Involving Humans at the Faculty of Rehabilitation, Kobe Gakuin University (approval number: SORIN

22-05), we provided the students with explanations, including the following considerations, through the website of this faculty: 1) the purpose and method of information use; 2) the content of the information used; 3) requirements for persons who use the information; 4) the name, institution, and contact address of the principal investigator; 5) term of information use; 6) disuse of information that allows the identification of subjects; and 7) the method to manage requests/claims from the subjects specified in 6) or their representatives. Students who did not contact to notify of their refusal were regarded as consenting to the study.

## RESULTS

There were differences among the 4 groups in the grade points for 3 of 8 subjects during semester 1, 7 of 9 subjects during semester 2, 10 of 10 subjects during semester 3, 10 of 12 subjects during semester 4, 13 of 14 subjects during semester 5, 6 of 7 subjects during semester 6, 2 of 2 subjects during semester 7, and 1 of 3 subjects during semester 8. When focusing on groups IV and I during semester 1, group IV’s grade point for 1 subject, Anatomy I, was significantly higher than that of group I, and there were no subjects for which the former’s values were significantly lower than the latter. During semester 2, group IV’s grade point for 1 subject, Anatomy II, was significantly higher than that of group I, whereas the former’s values for 2 subjects, Physiology and Clinical Psychology, were significantly lower than those of the latter. During semester 3, group IV’s grade points for 2 subjects, Neuroscience and Orthopaedics I were significantly higher than those of group I, whereas the former’s values for 2 subjects, Psychiatry I and The Study of Developmental Disability, were significantly lower than those of the latter. During semester 4, group IV’s grade points for 3 subjects, Practice in Kinesiology, Internal Medicine II, and Orthopaedics II, were significantly higher than those of group I, whereas the former’s values for 3 subjects, Psychiatry II, Practice of Measurement and Evaluation in Physical Therapy I, and Physiotherapy, were significantly lower than those of the latter. During semester 5, group IV’s grade point for 1 subject, Research Theory of Physical therapy, was significantly higher than that of group I, whereas the former’s values for 9 subjects, Emergency Medicine, Medical Safety Management, Rehabilitation Medicine, Practice of Measurement and Evaluation in

Table 1. The name of required subjects and grade point of required subjects

| semester | the name of required subjects (number of credits)                 | ① pre COVID-19 graduated students without | ② pre COVID-19 graduated students with | ③ post COVID-19 graduated students without | ④ post COVID-19 graduated students with | test name for statistical analysis | ①vs②  | ①vs③  | ①vs④  | ②vs③  | ②vs④  | ③vs④  |
|----------|---|---|--|--|---|------------------------------------|-------|-------|-------|-------|-------|-------|
| 1        | The Introductory Seminar for Physical Therapy (1)                 | 4(4-4) (n=134)                            | 4(4-4) (n=30)                          | 4(4-4) (n=8)                               | 4(4-4) (n=8)                            | Kruskal-Wallis test                | 1.00  |       |       |       |       |       |
|          | Psychology (2)  | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.05 | 1.00  | -0.05 | 1.00  | 0.09  | 1.00  |
|          | Biometry (2)  | 1(1-2) (n=134)                            | 1(1-2) (n=30)                          | 1(1-2) (n=8)                               | 1(1-2) (n=8)                            | Kruskal-Wallis test                | 0.06  | 1.00  | -0.05 | 1.00  | -0.01 | -0.05 |
|          | Chemistry (2)   | 1(1-2) (n=134)                            | 1(1-2) (n=30)                          | 1(1-2) (n=8)                               | 1(1-2) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.05 | 1.00  | 1.00  | -0.01 | -0.05 |
|          | Physics (2)   | 1(1-2) (n=134)                            | 1(1-2) (n=30)                          | 1(1-2) (n=8)                               | 1(1-2) (n=8)                            | Kruskal-Wallis test                | 0.64  | -0.01 | -0.05 | 1.00  | -0.01 | -0.01 |
|          | Introduction to Rehabilitation (2)                                | 2(1-3) (n=134)                            | 2(1-3) (n=30)                          | 2(1-3) (n=8)                               | 2(1-3) (n=8)                            | Kruskal-Wallis test                | 0.93  | -0.01 | -0.05 | -0.01 | -0.01 | -0.01 |
|          | Physical Therapy Concept (1)                                      | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | 0.23  | 0.09  | -0.01 | 0.68  | 1.00  | 1.00  |
|          | Communication (1)   | 1(1-2) (n=134)                            | 1(1-2) (n=30)                          | 1(1-2) (n=8)                               | 1(1-2) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
|          | Research (1)  | 1(1-2) (n=134)                            | 1(1-2) (n=30)                          | 1(1-2) (n=8)                               | 1(1-2) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
|          | Kinesiology (1)   | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.10  | 0.88  | 0.22  | -0.05 | 1.00  |
|          | Physiology (2)  | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
|          | Practice in Anatomy (2)   | 3(3-3) (n=134)                            | 3(3-3) (n=30)                          | 3(3-3) (n=8)                               | 3(3-3) (n=8)                            | Kruskal-Wallis test                | 0.07  | -0.05 | -0.01 | 1.00  | -0.01 | 0.16  |
|          | Human Development (2)   | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | 0.01  | -0.05 | 1.00  | -0.01 | 0.08  | 1.00  |
|          | Clinical Psychology (1)   | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.05 |
|          | Public Health (1)   | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.05 | 1.00  | 0.11  | 0.11  | 0.42  | 1.00  |
|          | Clinical Practice in Physical Therapy I (1)                       | 4(4-4) (n=134)                            | 4(4-4) (n=30)                          | 4(4-4) (n=8)                               | 4(4-4) (n=8)                            | Kruskal-Wallis test                | 0.62  | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
|          | Kinesiology II (1)  | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.01 | -0.01 | 0.20  | -0.01 | -0.01 |
|          | Practice in Physiology (2)  | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.05 | -0.01 | -0.01 | -0.01 | 0.63  |
|          | Neuroscience (1)  | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.05 | -0.01 | -0.01 | -0.01 | 1.00  |
| 3        | Internal Medicine I (1)   | 2(1-2) (n=134)                            | 2(1-2) (n=30)                          | 2(1-2) (n=8)                               | 2(1-2) (n=8)                            | Kruskal-Wallis test                | 0.41  | 0.30  | -0.01 | -0.01 | -0.01 | -0.01 |
|          | Internal Medicine II (1)  | 2(1-2) (n=134)                            | 2(1-2) (n=30)                          | 2(1-2) (n=8)                               | 2(1-2) (n=8)                            | Kruskal-Wallis test                | 0.24  | 0.10  | 0.25  | -0.01 | 0.06  | 0.34  |
|          | Psychiatry I (1)  | 2(1-2) (n=134)                            | 2(1-2) (n=30)                          | 2(1-2) (n=8)                               | 2(1-2) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
|          | Psychiatry II (1)   | 2(1-2) (n=134)                            | 2(1-2) (n=30)                          | 2(1-2) (n=8)                               | 2(1-2) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
|          | Pathology (1)   | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.20  | -0.01 | 0.70  | -0.01 | 0.35  |
|          | Physiology (2)  | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
|          | The Study of Developmental Disabilities (1)                       | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
|          | Measurement and Evaluation in Physical Therapy (2)                | 2(1-2) (n=134)                            | 2(1-2) (n=30)                          | 2(1-2) (n=8)                               | 2(1-2) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.05 | -0.01 | -0.01 | -0.01 | 0.22  |
|          | Practice in Kinesiology (1)                                       | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.12  | -0.01 | -0.01 | -0.01 | 1.00  |
|          | Internal Medicine II (2)  | 2(1-2) (n=134)                            | 2(1-2) (n=30)                          | 2(1-2) (n=8)                               | 2(1-2) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.05 | -0.01 | -0.01 | -0.01 | -0.01 |
|          | Physiology I (1)  | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.05 | -0.01 | -0.01 | -0.01 | -0.01 |
|          | Physiology II (1)   | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.05 | -0.01 | -0.01 | -0.01 | -0.01 |
|          | Clinical Neurology I (1)  | 2(1-2) (n=134)                            | 2(1-2) (n=30)                          | 2(1-2) (n=8)                               | 2(1-2) (n=8)                            | Kruskal-Wallis test                | 0.14  | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
|          | Clinical Neurology II (1)   | 2(1-2) (n=134)                            | 2(1-2) (n=30)                          | 2(1-2) (n=8)                               | 2(1-2) (n=8)                            | Kruskal-Wallis test                | 0.14  | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
|          | Practice of Management and Evaluation in Physical Therapy I (2)   | 3(3-3) (n=134)                            | 3(3-3) (n=30)                          | 3(3-3) (n=8)                               | 3(3-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.05 | 0.47  | -0.01 | 1.00  | 0.04  |
|          | Exercise Therapy (2)  | 3(3-3) (n=134)                            | 3(3-3) (n=30)                          | 3(3-3) (n=8)                               | 3(3-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.01 | 1.00  | 0.19  | 0.09  | 1.00  |
|          | Physiology (2)  | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.28  | -0.01 | -0.01 | 0.47  | 0.56  |
|          | The Study of Active Living (1)                                    | 2(1-2) (n=134)                            | 2(1-2) (n=30)                          | 2(1-2) (n=8)                               | 2(1-2) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.56  | -0.01 | -0.01 | -0.01 | -0.01 |
|          | The Study of Active Living (2)                                    | 2(1-2) (n=134)                            | 2(1-2) (n=30)                          | 2(1-2) (n=8)                               | 2(1-2) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.56  | -0.01 | -0.01 | -0.01 | -0.01 |
|          | Clinical Practice in Physical Therapy II (2)                      | 4(4-4) (n=134)                            | 4(4-4) (n=30)                          | 4(4-4) (n=8)                               | 4(4-4) (n=8)                            | Kruskal-Wallis test                | -0.01 | 1.00  | -0.01 | 1.00  | -0.01 | 1.00  |
|          | Emergency Medicine (1)  | 3(3-3) (n=134)                            | 3(3-3) (n=30)                          | 3(3-3) (n=8)                               | 3(3-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.01 | 1.00  | -0.01 | 1.00  | 0.20  |
|          | Internal Medicine II (2)  | 2(1-2) (n=134)                            | 2(1-2) (n=30)                          | 2(1-2) (n=8)                               | 2(1-2) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.05 | -0.01 | -0.01 | -0.01 | -0.01 |
|          | Rehabilitation Medicine (2)                                       | 2(1-2) (n=134)                            | 2(1-2) (n=30)                          | 2(1-2) (n=8)                               | 2(1-2) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.28  | -0.01 | 0.10  | 0.10  | -0.05 |
|          | Research Theory of Physical Therapy (2)                           | 4(4-4) (n=134)                            | 4(4-4) (n=30)                          | 4(4-4) (n=8)                               | 4(4-4) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.30  | -0.01 | -0.01 | -0.01 | 1.00  |
|          | Practice of Observation and Evaluation in Physical Therapy I (1)  | 3(3-3) (n=134)                            | 3(3-3) (n=30)                          | 3(3-3) (n=8)                               | 3(3-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.10  | -0.01 | -0.01 | -0.01 | 0.97  |
|          | Practice of Observation and Evaluation in Physical Therapy II (1) | 3(3-3) (n=134)                            | 3(3-3) (n=30)                          | 3(3-3) (n=8)                               | 3(3-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.10  | -0.01 | -0.01 | -0.01 | 0.97  |
| 5        | Practice in Exercise Therapy (1)                                  | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | -0.01 | 0.31  | 1.00  | 0.09  | 0.31  |
|          | Practice in Physiology (1)  | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.01  | 0.09  | 0.31  | 1.00  | 0.89  |
|          | Practice in Anatomy (1)   | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.25  | -0.01 | 1.00  | 0.19  | 1.00  |
|          | Physical Therapy in Neurology (1)                                 | 3(3-3) (n=134)                            | 3(3-3) (n=30)                          | 3(3-3) (n=8)                               | 3(3-3) (n=8)                            | Kruskal-Wallis test                | 0.09  | -0.01 | 0.23  | 1.00  | 1.00  | 1.00  |
|          | Physical Therapy in Bone and Joint Disorder (1)                   | 3(3-3) (n=134)                            | 3(3-3) (n=30)                          | 3(3-3) (n=8)                               | 3(3-3) (n=8)                            | Kruskal-Wallis test                | 0.18  | -0.01 | 0.19  | 1.00  | 1.00  | 1.00  |
|          | Physical Therapy in Respiratory and Circulatory Metabolism (1)    | 3(3-3) (n=134)                            | 3(3-3) (n=30)                          | 3(3-3) (n=8)                               | 3(3-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.47  | 1.00  | -0.01 | 0.11  | 0.18  |
|          | Physical Therapy Management (1)                                   | 3(3-3) (n=134)                            | 3(3-3) (n=30)                          | 3(3-3) (n=8)                               | 3(3-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.39  | -0.01 | -0.01 | 0.18  | -0.01 |
|          | Physical Therapy Management (2)                                   | 3(3-3) (n=134)                            | 3(3-3) (n=30)                          | 3(3-3) (n=8)                               | 3(3-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.39  | -0.01 | -0.01 | 0.18  | -0.01 |
|          | Physical Therapy Management (3)                                   | 3(3-3) (n=134)                            | 3(3-3) (n=30)                          | 3(3-3) (n=8)                               | 3(3-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.39  | -0.01 | -0.01 | 0.18  | -0.01 |
| 6        | Practice in Clinical Physical Therapy I (2)                       | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.34  | -0.05 | 0.09  | 1.00  | 1.00  |
|          | Practice in Clinical Physical Therapy II (2)                      | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.38  | -0.05 | -0.01 | 1.00  | 0.75  |
|          | Community Rehabilitation Theory (1)                               | 2(1-3) (n=134)                            | 2(1-3) (n=30)                          | 2(1-3) (n=8)                               | 2(1-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.56  | -0.05 | -0.01 | 1.00  | 0.56  |
|          | Community Rehabilitation Theory (2)                               | 2(1-3) (n=134)                            | 2(1-3) (n=30)                          | 2(1-3) (n=8)                               | 2(1-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 0.23  | -0.01 | -0.05 | 1.00  | 1.00  |
|          | Clinical Practice in Physical Therapy III (3)                     | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | 0.51  | 0.25  | -0.01 | -0.05 | 1.00  | 1.00  |
| 7        | Clinical Practice in Physical Therapy III (3)                     | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 1.00  | -0.01 | 1.00  | 0.39  | 1.00  |
|          | Integrated Study in Physical Therapy I (3)                        | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | -0.01 | 1.00  | -0.01 | 0.13  | 0.53  | 1.00  |
| 8        | Integrated Study in Physical Therapy I (2)                        | 2(2-3) (n=134)                            | 2(2-3) (n=30)                          | 2(2-3) (n=8)                               | 2(2-3) (n=8)                            | Kruskal-Wallis test                | 0.11  | -0.05 | -0.01 | -0.01 | -0.18 | 0.40  |
|          | Physical Therapy Research II (2)                                  | 4(3-4) (n=134)                            | 4(3-4) (n=30)                          | 4(3-4) (n=8)                               | 4(3-4) (n=8)                            | Kruskal-Wallis test                | 0.06  | -0.01 | -0.01 | -0.01 | 0.18  | 1.00  |

Table 2. Comparison of GPAs for required subjects and national examination score in four groups

| semester                   | group I (①)        | group II (②)      | group III (③)     | group IV (④)     | test name for statistical analysis | ①vs②  | ①vs③  | ①vs④  | ②vs③  | ②vs④  | ③vs④  | p-value |
|----------------------------|--------------------|-------------------|-------------------|------------------|------------------------------------|-------|-------|-------|-------|-------|-------|---------|
| 1                          | 2.45±0.38 (n=134)  | 1.95±0.28 (n=14)  | 2.70±0.34 (n=30)  | 2.77±0.32 (n=8)  | Kruskal-Wallis test                | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | 1.00    |
| 2                          | 2.49±0.41 (n=134)  | 1.87±0.35 (n=14)  | 2.73±0.40 (n=30)  | 2.43±0.35 (n=8)  | one way analysis                   | -0.01 | -0.05 | 1.00  | -0.01 | -0.05 | -0.05 | 0.44    |
| 3                          | 2.30±0.47 (n=134)  | 1.40±0.33 (n=14)  | 3.18±0.48 (n=30)  | 2.58±0.64 (n=8)  | Kruskal-Wallis test                | -0.01 | -0.01 | 0.94  | -0.01 | -0.01 | -0.01 | 0.27    |
| 4                          | 2.63±0.42 (n=134)  | 2.00±0.36 (n=14)  | 2.87±0.34 (n=30)  | 2.40±0.38 (n=8)  | one way analysis                   | -0.01 | -0.05 | 0.89  | -0.01 | 0.62  | -0.05 | <0.05   |
| 5                          | 2.80±0.39 (n=109)  | 2.44±0.38 (n=11)  | 2.67±0.26 (n=30)  | 2.06±0.50 (n=8)  | one way analysis                   | -0.01 | 0.17  | 0.54  | -0.01 | 1.00  | -0.05 | <0.05   |
| 6                          | 2.83±0.48 (n=109)  | 2.43±0.35 (n=11)  | 2.38±0.59 (n=30)  | 1.93±0.64 (n=8)  | one way analysis                   | -0.01 | 0.06  | -0.01 | -0.01 | 1.00  | 0.21  | 0.19    |
| 7                          | 2.30±0.63 (n=72)   | 1.89±0.55 (n=9)   | 1.52±0.64 (n=30)  | 1.81±0.59 (n=8)  | Kruskal-Wallis test                | -0.01 | 1.00  | -0.01 | 0.39  | 0.18  | 1.00  | 1.00    |
| 8                          | 3.13±0.37 (n=72)   | 2.81±0.48 (n=9)   | 3.38±0.51 (n=30)  | 2.88±0.80 (n=8)  | Kruskal-Wallis test                | -0.01 | 1.00  | -0.05 | 1.00  | -0.05 | 1.00  | 0.17    |
| national examination score | 198.5±15.7 (n=130) | 194.8±19.0 (n=14) | 210.9±15.6 (n=30) | 210.6±21.3 (n=7) | one way analysis                   | -0.01 | 1.00  | -0.01 | 0.35  | -0.01 | 0.12  | 1.00    |

Values are expressed as mean ± SD vs:versus



Physical Therapy II, Practice of Objective Structured Clinical Examination, Practice in Exercise Therapy, Physical Therapy in Bone and Joint Disorder, Physical Therapy in Pediatrics, and Physical Therapy in Respiratory and Circulatory Metabolism, were significantly lower than those of the latter. During semester 6, there were no subjects for which group IV's values were significantly higher than those of group I, but the former's values for 4 subjects, Practice in Physical Therapy I, Practice in Physical Therapy II, Community Rehabilitation Theory, and Practice in Community Rehabilitation Theory, were significantly lower than those of the latter. During semester 7, there were no subjects revealing significant differences between the 2 groups. Lastly, during semester 8, group IV's grade point for 1 subject, The Theory of Collaboration between Medical and Welfare Professionals, was significantly higher than that of group I (Table 1).

As for GPAs-RS, there were differences among the 4 groups during semesters 1, 2, 3, 4, 5, 6, 7 and 8. Between groups IV and I, the former's values were significantly higher during semester 1, and significantly lower during semesters 5 and 6. There were differences among the 4 groups in national certification examination scores, but there was no difference between group IV and I. However, when focusing on groups IV and II, the former's GPA-RS and national certification examination scores were significantly higher or equal to those of the latter during semesters 1-8. When focusing on groups IV and III, the GPAs-RS during semesters 4 and 5 were significantly lower in the former (Table 2).

Assuming that all 8 students in group IV graduated without repeat, the rate of graduation without repeat among students admitted to the Department of Physical Therapy, Kobe Gakuin University, in 2019 was 77.5%.

## DISCUSSION

Semesters 1 and 2 were a 1-year period spent by students in group III, IV not under the influence of COVID-19; they attended face-to-face classes, and took regular examinations. this period, group IV's GPAs-RS were not lower than those of group I. but group IV's GPAs-RS were higher than those of group II. In the previous study involving students at the Department of Physical Therapy, Kobe Gakuin University, the GPAs-RS of students who graduated with repeat were lower than those of students who graduated without repeating semester 1 or 2<sup>6</sup>). Based

on this, students in group IV had the academic ability to graduate without repeat if they had been under the conditions with face-to-face classes and regular examinations.

In contrast, semesters 3 and 4 were a 1-year period spent by students in group III, IV under the influence of COVID-19; they attended only online classes, and did not take regular examinations. During this period, group IV's GPAs-RS were not higher than those of group I. In the previous study involving students at the Department of Physical Therapy, Kobe Gakuin University, the GPAs-RS of students who graduated without repeat were significantly higher during semesters 3 and 4 than their values before the COVID-19 pandemic<sup>3</sup>). This suggests that without face-to-face classes and regular examinations, the academic performance of students in group III may have deteriorated. In addition, the finding that the GPAs-RS of group IV were lower than those of group III during semester 4 suggests that students in the former require regular examinations to stimulate their learning motivation. Semesters 5 and 6 were a 1-year period spent by students in group III, IV attending face-to-face classes and taking regular examinations after being affected by COVID-19 for the previous year. This period, group IV's GPAs-RS were lower than those of group I. The Ministry of Education, Culture, Sports, Science, and Technology reported that online classes are difficult for students to ask questions to teachers and understand the contents<sup>7</sup>). Kadota et al. and Honda et al. reported that face-to-face classes are more successful than online classes<sup>8,9</sup>). Based on these reports and the results of the present study, it is likely that students in group IV, who had online classes and no regular examinations during semesters 3 and 4, advanced to their third year with an insufficient acquisition of the knowledge that should have been gained during these semesters. Furthermore, the subjects that these students took during semesters 5 and 6 were conducted in face-to-face classes, and their grades were evaluated through regular examinations. The students who advanced to their third year with an insufficient acquisition of the knowledge that should have been gained during semesters 3 and 4 may have been unable to cope with the regular examinations conducted during semesters 5 and 6, and their performance may have deteriorated, resulting in repeat.

It has also been reported that the required specialized courses offered in semesters 5 and 6 at this university

have a positive correlation with national examination scores<sup>4</sup>), and we consider this to be an important year.

Semesters 7 and 8 were a 1-year period when students in group IV attended face-to-face classes and took regular examinations after repeat, and also took the national physical therapist certification examination. During this period, there were no differences in GPAs-RS or national certification examination scores between them and students in group I. It seems that students in group IV maintained their motivation during the repeated year, and after advancing to their fourth year, they were able to achieve the same level of performance as students in group I because they studied under the conditions with face-to-face classes and regular examinations. Additionally, by taking the national physical therapist certification examination just prior to graduation while maintaining their academic performance, they were also able to pass it.

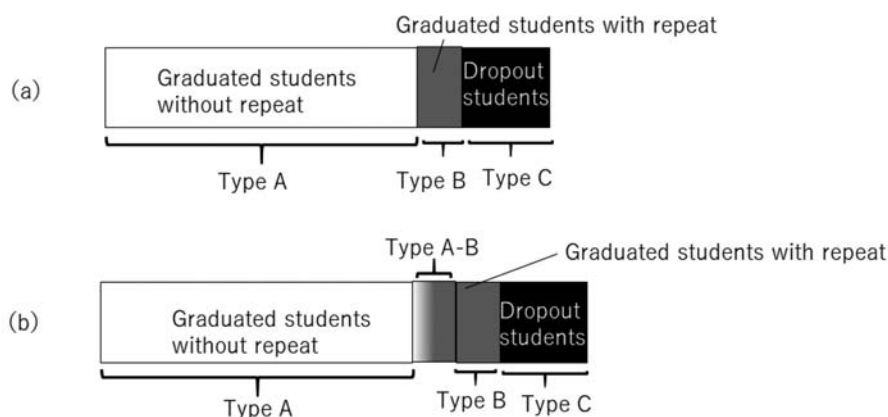
The outcomes of students admitted to the Department of Physical Therapy, Kobe Gakuin University, can be classified into 3 types: graduation without repeat (Type A), graduation with repeat (Type B), and dropping out (Type C) (Fig. 2a). While there are students whose outcomes do not change no matter what learning environment is provided, there are also students who might end up repeating a year due to changes in the learning environment (Type A-B) (Fig. 2b).

In medical settings, there have been some reports on medical sequelae related to physical and mental health after COVID-19 infection<sup>10,11</sup>). The changes in student per-

formance observed in the present study may be considered a long-term effect (sequela) experienced by educational institutions, which were forced to alter their environments due to the COVID-19 pandemic.

## STUDY LIMITATIONS

The curriculum and the names of specialized required subjects were the same, but the faculty members who taught some subjects varied among the 4 groups. Due to the operation of the Department of Physical Therapy, Kobe Gakuin University, it is not possible to provide data with all faculty members being the same, and we consider this to be one of the limitations of this study. While the results revealed that changes in the educational environment affected grades, we did not assess individual students' physical condition, motivation, or other factors. This is also a limitation of the study. Although we chose the national physical therapist certification examination as an evaluation item, the difficulty level varies among years, making simple comparisons risky. In some university entrance examinations, the adjusted median method<sup>12</sup>) is used to adjust scores so that students with the same academic performance who take examinations of different difficulty levels do not suffer from unfairness. However, to use the median adjustment method, the mean and standard deviation of the scores calculated from all the examinees who took the examinations are required. In this study, it is not possible to adjust national certification examination scores using this method because the Ministry



(a) Classification of students based on their outcomes

(b) Classification of students including those whose outcomes change depending on educational methods and environments

Type A: Students who graduate without repeat, regardless of educational methods

Type B: Students who graduate with repeat, regardless of educational methods

Type C: Students who drop out, regardless of educational methods

Type A-B: Students whose outcomes (with/without repeat) change depending on educational methods and environments

Fig. 2. Classification of students



of Health, Labour, and Welfare does not publish these statistics. This is also one of the limitations of this study. Moreover, the results of the study are from a single university and department, and cannot be generalized to other universities or departments, and it is unclear whether similar results would be obtained. This is another limitation of the study.

## Funding and conflict of interest

No funding. The authors declare no conflicts of interest.

## References

- 1) World Health Organization: Coronavirus disease (COVID-19) pandemic. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019> (2023. 08. 07)
- 2) Ministry of Education, Culture, Sports, Science and Technology: Guidelines for Responding to New Coronavirus Infections at Universities and Other Institutions. [https://www.mext.go.jp/content/20200605-mxt\\_kouhou01-000004520\\_5.pdf](https://www.mext.go.jp/content/20200605-mxt_kouhou01-000004520_5.pdf): 2020:5 (2023. 08. 07)
- 3) Takenaka T, Murao H: Changes in Grades of Pre-Graduation Students due to the Spread of COVID-19-Report from One Private University Physical Therapy Department. *J Asia Reha Sci* 5(2): 11-19, 2022
- 4) Murao H, Iwai N: Relationship between score in the national examination for physical therapists and grade point average (GPA) every semester -analysis of relationship between scores in the national examination for physical therapist and GPA estimated with requested subjects that have positive correlation statistically (GPA-RSPC). *Rehabil Kyoiku Kenkyu* 22: 248-252, 2017
- 5) Takenaka T, Murao H: Predictability of Student Withdrawal Based on Academic Performance during the First Year at the Department of Physical Therapy, Faculty of Rehabilitation, Kobe Gakuin University-Comparing General Educational, Required Specialized, and Elective Specialized Courses. *Rehabil Kyoiku Kenkyu* 27: 74-79, 2021
- 6) Murao H, Iwai N: Performance characteristics of graduated students with repeat in Department of Physical Therapy – Prospective study in four class students learning with same curriculum – . *Rehabil Kyoiku Kenkyu* 25: 266-271, 2019
- 7) Ministry of Education, Culture, Sports, Science and Technology: Survey on school life of students and others affected by new coronavirus infection (results). [https://www.mext.go.jp/content/20210525-mxt\\_kouhou01-000004520\\_1.pdf](https://www.mext.go.jp/content/20210525-mxt_kouhou01-000004520_1.pdf) (2024. 06. 30)
- 8) Kadota Y, Morino K, Motoyama K, et al.: Impact of remote and face-to-face lecture on the grade point average using telecommunication big data. *J Acad Comput Netw (Web)* 26: 79-86, 2022
- 9) Honda K, Yamada T, Kobayashi J, et al.: Adaptation and effectiveness of remote learning. *Adm* 28: 213-234, 2022
- 10) Bellan M, Soddu D, Balbo PE, et al.: Respiratory and psychophysical sequelae among patients with COVID-19 four months after hospital discharge. *JAMA Netw Open* 4: 1-12, 2021
- 11) Hameed F, Palatulan E, Jaywant A, et al.: Outcomes of a COVID-19 recovery program for patients hospitalized with SARS-CoV-2 infection in New York City: A prospective cohort study. *PM&R* 13: 609-617, 2021
- 12) Kikuchi K, Nakaune N: Evaluation of score adjustment using the adjusted median method. *J Jpn Assoc Res Test* 17: 1-7, 2021