Relationship between Learning Engagement and Learning Outcomes in Online Education during the COVID-19 Pandemic: A semi-structured interview

Noboru Miyoshi[*], Qiujing Pan[**], Takuya Kimura[***], and Takahiko Nakaseko[****]

Abstract. The coronavirus pandemic has instituted mandatory online education across Japan and many parts of the world. Using a semi-structured interview, we collected and analyzed students' reactions to online education across high-rank, mid-rank, and low-rank universities in Japan to determine learning outcomes among undergraduates with different pre-existing learning engagements. Our analysis revealed that online education proved effective on students with pre-existing learning engagement outside of class, which in compliance with prior research, only students at high-rank universities were found to possess. Therefore, we inferred that the implementation of online education has been successful at high-rank universities but not at others. This study refutes that the gap in learning outcomes between different university levels occurring as a result of the mandatory shift in the online education is a legitimate phenomenon. This study would serve as a new perspective and evidence for future discussions on equity in higher education.

Keywords: COVID-19 pandemic, online education, learning outcome, learning engagement, interview-study, Japan

1 Introduction

In 2020, the spread of COVID-19 all over the world caused a decline in traditional face-to-face teaching

[*] Associate Professor, Office of Admissions and Graduate School of Humanities and Social Sciences, Hiroshima University, Japan, e-mail: miyoshi-noboru@hiroshima-u.ac.jp
[**] Assistant Professor, Department of Business Administration and IRer/Learning Education Development Center, Yamanashi Gakuin University, Japan, e-mail: panqiujing1988@gmail.com
[***] Professor, Faculty of Human-Environment Studies, Kyushu University, and Academic Research Division, National Center for University Entrance Examination (Cross-Appointment), Japan, e-mail: kimura.takuya.329@m.kyushu-u.ac.jp
[****] Lecturer, Center for Fundamental Education, Kyushu Sangyo University, Japan, e-mail: nakaseko@ip.kyusan-u.ac.jp

and learning and led to an upsurge in virtual communication and online education. During the pandemic, not only Japanese universities but also other universities in different countries around the world introduced online education as an emergency measure to curtail the adverse effect of the pandemic on education. According to a recent UNESCO report (2020), more than 1.9 billion students—children and youth—from 190 countries are being forced to transit from face-to-face learning to online learning to prevent the spread of the COVID-19 pandemic. Although virtual communication and online education are not new mode of teaching and learning in many universities around the world, the sudden transition took both faculty members and students unaware. While many faculty personnel have been trained and have used online teaching to some extent, the possibility that those who are not active in these areas may not adapt to this mode of teaching is obvious (Vizoso et al., 2018). Moreover, online education has impacted negatively on students for various reasons, including the lack of infrastructure for such advanced learning and low-quality instruction, as well as students' dissatisfaction with its poor content delivery any time soon (Bresó et al., 2020). Given the spread of the pandemic, this sudden global shift to online learning will not stop any time soon and would open a whole new set of challenges (Robinson & Ikeda, 2020). Therefore, universities will need to carefully consider how to evaluate and implement quality assurance on student learning outcomes. any time soon

Although the importance of quality assurance in online education is well understood, the first step in its implementation is to understand whether students are acquiring the appropriate level of knowledge and skills. Online education leaves the teacher's supervision and guidance on site, so it is the student's own learning behaviors and habits that are critical to their learning effectiveness. In this study, we explored the relationship between learning engagement and learning outcomes in online education. A qualitative approach of semi-structural interviews with six students in different levels (high-rank, medium-rank, low-rank) universities was applied.

2 Literature review

2.1 Concepts about learning engagement

A number of scholars have defined learning engagement. Some of these definitions are reviewed here. Krause (2005) defined learning engagement as activities and time students devote to learning at the university. Similarly, Kuh (2009) defined learning engagement as the amount of physical and psychological energy that the student devotes to the academic activities. Thus, a highly learning-engaged student is one who, for example, devotes considerable energy to studying, spends much time on campus, participates actively in student organizations, and interacts frequently with faculty members and other students. Similar to Kuh (2009), Bond (2020) defined engagement as "the energy and effort that students employ within their learning community, observable via any number of behavioral, cognitive, or attentive indicators across a continuum" (p. 3). In the opinion of Wong and Chong (2018),

online learning engagement is a unique collection of active and collaborative learning, participation in enriching learning activities, communication with learners and faculty members, involvement in educational experiences, and feeling supported. It is these definitions that this research is premised upon (Lawson & Lawson, 2013). According to Fredricks et al. (2004), learning engagement can be divided into academic, behavioral, cognitive, and emotional components. The academic and behavioral components include behaviors such as completing homework assignments and attending classes; the cognitive component refers to mental states such as a commitment to academic and educational goals; the emotional component refers to a sense of belonging to the university.

2.2 Discourses on the relationship between learning engagement and learning outcomes in traditional education

Multiple studies have explored the relationship between learning engagement and learning outcomes in traditional education. Most of these previous studies found a link between students' learning engagement and their learning outcomes (Pascarella & Terenzini, 2005; Gunuc, 2014; Rodriguez-Triana et al., 2020). Studies by Reschly and Christenson (2006) and Kuh et al. (2008) showed that learning engagement both inside and outside the classroom boosts academic performance, while Appleton et al. (2006) found that they also lead to the acquisition of a wide range of knowledge and skills. Furthermore, the lack of learning engagement inside and outside the classroom has adverse effects such as withdrawal from school and reduced students' acquisition of knowledge and skills in the third year of university (Drennan et al., 2014). However, these studies did not reveal which learning engagement inside or outside of class is specifically associated with learning outcomes.

In Japan, research conducted so far has focused solely on the face-to-face mode of education. A pioneering study in this area by Benesse (1998), found that university satisfaction depends upon students' learning engagement. Another study by Murasawa (2003) revealed that pre-university experiences and learning efforts, especially during school, significantly impacted knowledge and skill development, and that university education initiatives oriented towards student needs also have an effect. Kuzuki (2006) pointed out that learning outcomes concern what students learn rather than the kind of education provided. In relation to the latter, studies by Yamada (2007, 2008) determined the effects of the academic environment at universities by dividing learning outcomes into cognitive and emotional categories. The research by Ogata (2008), similar to Yamada's, showed that learning engagement influenced general-purpose skill formation. For academic knowledge formation, other variables such as the nature of learning outcomes exerted a significant influence. This tendency is stronger when learning outcomes are considered in the form of grades. A separate analysis by Morozumi (2009), which was conducted on a departmental basis, showed that in many departments, effort spent on class-related learning led to the acquisition of knowledge and skills. Similarly, Fujimura (2013) used within-grade correlations to examine if learning outcomes had to do with the characteristics of departmental faculty.

For a particular university, it was found that 10% of the total variance was accounted for by the difference in faculties. According to the analysis of the hierarchical linear model, learning outcomes were influenced by students' classroom experience and learning engagement in the class-related study. One study by Mizokami (2008a), for instance, found that students who felt classroom instruction was effective developed learning habits, such as class participation and self-study. The study emphasized the need for students to pursue learning habits inside and outside the classroom for overall knowledge and skills acquisition. Mizokami (2008b) also revealed that engaging in learning activities inside and outside the classroom plays a role in university satisfaction. Mizokami et al. (2009) further developed this research by dividing extracurricular learning into two categories: class-related and non-class-related (including English conversation, reading, etc.). The research showed that students in possession of both of these were more likely to acquire knowledge and skills by participating moderately in class, thereby demonstrating the importance of extracurricular learning. A study by Miyoshi (2015) revealed that knowledge and skills were acquired through enthusiastic learning engagements in extracurricular activities rather than passive attendance. However, in a study by Tanimura (2010), which looked at differences among medicine and other health-related fields, serious classroom learning, such as participating in classes and experiments, had a positive effect on acquiring health-related outcomes but a negative effect on acquiring general ones. It concluded that time spent in classes itself was not effective. Furthermore, a study by Yamada and Mori (2010) inferred that general-purpose skills were obtained as a result of "total learning," which included regular lessons and extracurricular activities. Echoing Yoshimoto (2007), the study noted that while it is important to engage in class-related learning within the regular curriculum, it is also necessary to incorporate students' self-growth, such as part-time jobs and club activities, within the framework of evaluation, and provide an environment that supports it. The study also emphasized the need to consider educational designs that incorporate these findings. More recent studies by Kaneko (2013), Miyoshi (2013), Yamada (2015), Torii (2021), and Yamada and Kimura (2021) have similarly established the relationship between extracurricular learning engagement and learning outcomes. Yamada's research concluded that time spent in learning (inside and outside of class), active learning experience, and faculty involvement determined learning outcomes in both Japan and South Korea. Miyoshi's analysis, which was conducted from a perspective similar to the one by Appleton et al. (2006) predicted that students who did not acquire appropriate levels of knowledge and skills in the first year of the university could not acquire these by the time of graduation.

2.3 Discourses on the relationship between learning engagement and learning outcomes of online education

Some scholars have categorized the learning engagement in online education and re-examined its relationship with learning outcomes. According to Redmond et al. (2018), learning engagement can be divided into social, cognitive, behavioral, collaborative, and emotional components. You (2016) found

that in the absence of learning engagement, online education does not lead to the acquisition of knowledge and skills. Similarly, Soffer and Cohen (2019) stated that greater access to course learning materials led to better knowledge acquisition.

Previous studies that are related to the present study were conducted on face-to-face education before COVID-19. Fraysier et al. (2020) reported that student learning engagement is a significant factor in improving student achievement. Tualaulelei et al. (2021) introduced students' engagement as a motive for their potential and to maximize their learning opportunities. Aristovnik et al.(2020) found that approximately 40% of students reported an increase in their workload when lectures were only available online. Most of the students noted that it is difficult to stay focused during online classes and felt their study performance had declined. Interestingly, studies comparing students' performance before and during the COVID-19 lockdown found either no significant difference (Bawa, 2020) or a significant improvement in test scores compared with previous years, regardless of the exam formats and teaching methods involved (Gonzalez et al., 2020). On the other hand, previous studies revealed that the benefits of online education are not as much as face-to-face learning. Abbasi et al. (2020) found that 86% of respondents felt that online teaching has little significance on students' learning outcomes. Furthermore, according to Redmond et al. (2018) and Soffer and Cohen (2019), these were only aimed at nontraditional students (working adults) as noted by Chen et al., (2010) and Thompson et al., (2013). Shao (2021) identified the number of students who speak up in online education to be very small compared to those who speak up in face-to-face education. While variation already existed in learning engagement inside and outside of class depending on the university's deviation values score, online education during COVID-19, likely made it starker. For instance, face-to-face education implied the physical presence of the professor and other students as opposed to online education during the COVID-19, where autonomous learning habits, such as preparation and review at home, became necessary with the professor on the other side of the computer screen and only the virtual presence of peers in class. Moreover, in face-to-face education, students were able to utilize spaces such as the library, and they could study while being stimulated by the presence of their peers. However, under online education, in principle, students cannot come to the university and need to work autonomously on preparation and review at home. In this context, it is essential to address what aspects of learning engagement, among their social, cognitive, behavioral, collaborative, and emotional components, as identified by Redmond et al. (2018), lead to the acquisition of knowledge and skills.

2.4 Research on the gap among universities by rank in relation to their learning engagement and learning outcomes

Ulrich Teichler advocated that compared with high-rank universities, the changes in the teaching model caused by COVID-19 have a greater impact on general higher education institutions in term of educational effectiveness (Pan, 2021). In 2020, the Ministry of Education, Culture, Sports, Science and

Technology (MEXT) published a list of universities that used less than 50% of the total number of face-to-face lecture method in their second-semester lecture programs by university rank and type (Okuba, 2020), and pressure is now being exerted on universities to reintroduce face-to-face lecture courses to ensure the quality of teaching and learning. In this context, exploring how to conduct quality assurance of online education is an important topic, both for policymakers and university administrators However, studies have not been conducted on the gap among universities by rank in relation to their learning engagement and learning outcomes.

2.5 Limitation of literature review and research questions

Based on the reviewed literature, we have elucidated the relationship between learning engagement and learning outcomes in online education. Moreover, we have established variations in learning engagement inside and outside of class depending on the university's deviation values. However, questions on the relationship between learning engagement and learning outcomes in online education for full-time undergraduate students still remain.

In view of the research gaps, our research questions are as follows:

1. Does online education mode exacerbates educational outcomes for students at different academic levels in different universities?
2. What aspects of learning engagement lead to the acquisition of knowledge and skills in online education?

3 Theoretical framework and research method

3.1 Theoretical framework

Table 1. Classification of learning engagement in online education

Social Engagement	Building community
	Creating a sense of belonging
	Developing relationships
Cognitive Engagement	Thinking critically
	Developing cross-disciplinary understandings
	Developing deep discipline understandings
Behavioral Engagement	Identifying opportunities and challenges
	Upholding online learning norms
	Supporting and encouraging peers
Collaborative Engagement	Learning with peers
	Relating to faculty members
	Connecting to institutional opportunities
Emotional Engagement	Recognising motivations

Source: Redmond et al., 2018

In this study, we adopted the framework developed by Redmond et al. (2018) to determine students' learning engagement in online education. Questions related to the latter were based on categories established by Redmond et al. (2018) as mentioned earlier. These questions were organized into social, cognitive, behavioral, collaborative, and emotional components (see Table 1). The following analysis and discussion present the content of the interviews, and these have been coded based on categories established by Redmond et al. (2018).

3.2 Research method

In this study, requests were made through faculty members to 10 universities selected from 788 universities across Japan in the MEXT's "Universities, Junior Colleges and Colleges of Technology" to participate in this study. We conducted a semi-structured interview survey via Zoom from June to September 2021 with undergraduate students enrolled in online education at six universities (two national universities and four private universities). The undergraduate students willingly agreed to participate in the study. In total, six people were interviewed for approximately one hour per person. These students were asked by their faculties to introduce their average academic performance at each university. A profile of the interviewees is shown in Table 2.

Table 2. Profile of the interviewees

Interviewees	Gender	Grade	University Rank	Faculty
A	F	3	High rank university	Faculty of Education
B	M	2	High rank university	Faculty of Science
C	F	2	Middle rank university	Faculty of Commerce
D	M	2	Middle rank university	Faculty of Humanities
E	M	2	Low rank university	Faculty of Literature
F	F	2	Low rank university	Faculty of International Management

Note: Universities are categorized as follows according to their deviation score (T score)s (a national norm-referenced person-indexed score) as calculated by Benesse Corporation: high-rank university = deviation score (T score) of 60 or higher, middle-rank university = deviation score (T score) above 35 and below 60, and low-rank university = deviation score (T score) below 35.

Prior to the interview, participants were informed that they are not required to answer questions they did not want to. Moreover, participants agreed to allow the interview to be audio recorded and allow the data to be used anonymously in project outputs such as academic journal articles, books, conference presentations, research applications, and policy briefings. In conducting the interview, we first asked for participants' personal information (name, gender, age, university/disciplinary faculty, current academic year) as well as their learning engagement and subsequent learning outcomes in online education. After the interview, we transcribed the data obtained from the interview using MAXQDA V.

2020 software (VERBI GmbH, Berlin, Germany). Afterward, data analysis was performed using the content analysis approach in accordance with the following Braun and Clarke (2006) six steps:(1) familiarization, (2) generating codes, (3) searching for themes, (4) reviewing codes, and (5) defining themes, (6) producing a report.

4 Results of learning engagement and outcomes by university rank

> Student A: Before COVID-19, I had been preparing for and reviewing lessons by myself. Afterward, I enrolled in the third-year seminar for my graduation thesis and found a research topic to start working on. As I already had a habit of studying independently, online education due to the pandemic did not pose a problem to me. In class, we had the opportunity to work in groups using Zoom's breakout rooms. However, I do feel that my sense of being a student at my university has declined due to the inability to visit the university in person. With respect to the acquisition of knowledge and skills, I spent a lot more time creating reports and PowerPoint presentations during COVID-19 and learned a lot about these through dedicated study.

> Student B: Before COVID-19, preparing before class and reviewing my lesson with friends after class inspired me to do the same myself during COVID-19. Many classes involved quizzes; therefore, I had to prepare beforehand. If I don't understand something, I study online with others taking the same class. Besides, the professor informally answers questions after class. In online education, I was able to participate in classes at my convenience, while also being able to take a variety of classes. As a result, I have learnt to look at things critically and from different perspectives. Not being able to see friends or professors around helped me speak up in a more focused manner.

Both students A and B are at high-rank universities and were observed to have developed independent learning engagement even during COVID-19, and comparing students' performance before and during COVID-19, we found no significant difference (Bawa, 2020). Before the pandemic, it had already been established that students at higher rank universities possess higher learning engagement (Kuzuki, 2007a, 2007b) and during the pandemic, students' learning engagement was a significant factor in improving their achievement (Fraysier et al., 2020). However, the present study confirms that students from high-rank universities had higher learning engagement. This is especially clear from the interview with student A who enrolled in her thesis seminar in her third year, found a research topic, and initiated a literature search by herself. She pursues group work using breakout rooms in class, which demonstrates collaborative learning engagement. Because students' social engagement reduced due to their inability to visit the campus, collaborative learning engagement became more important. Similarly, it was established from earlier studies that better learning engagement both inside

and outside of class increased students' mastery of knowledge and skills (Linda, 2016; Morozumi, 2009; Yamada, 2010). Regardless, it seems that such students know the joy of learning and are well aware that proficient knowledge and skills can be gained as a result of these efforts. The student in this category also sought opportunities to study with friends using various methods, such as breakout room, even in an environment where going to university is restricted due to COVID-19. This study suggests the same holds true for online education during COVID-19 as well. Although it is difficult for students to go to university due to COVID-19, the impact would be small because they are able to study independently. In the case of student B, although he is no longer able to study with his friends in person, seeing them study on their own before COVID-19 motivated his independent learning efforts during COVID-19. These interviews further demonstrated students' collaborative learning engagement, such as getting together online to go over points of uncertainty, as well as cognitive engagement, such as asking questions to the professor or thinking critically from multiple perspectives. In summary, the interviews with students A and B from high-rank universities revealed that, generally speaking, they demonstrated collaborative and cognitive learning engagement in their online education during COVID-19. Consequently, the students acquired knowledge about reports and PowerPoint presentations. In the studies conducted before COVID-19, Salanova et al. (2010) and Serrano and Andreu (2016) established a connection between the academic, behavioral, and emotional components of learning engagement and learning outcomes. However, under online education during COVID-19, students could no longer attend classes on campus, and as a result, they appear to have lost their sense of belonging, and their connection to the university weakened. Because they can study independently, it is possible that their sense of belongingness to university diminished due to COVID-19. However, it can be said that not all students are able to study independently during COVID-19. Students who can study independently are a minority in high-rank universities, and students C and D, discussed below, makeup the majority in universities.

> Student C: Before COVID-19, I only studied in my class sometimes. When we switched to online education as a result of COVID-19, I could no longer concentrate because there was no student or professor in class on campus. My motivation has decreased, and I feel less like a university student. Before the COVID-19, we do group work in class, but now fewer students speak up in online classes. I did learn how to use Zoom as a result of online education, but I couldn't focus on learning anything else. I feel that I learned more in face-to-face education before COVID-19.

> Student D: Before COVID-19, I sometimes prepared for and reviewed my lessons, but now I can no longer visit the campus, and it has become more difficult to regularly focus on my studies. As a rule, the cameras are off in class except for the professor; so there is less stimulation or motivation in learning from others around me. Since we switched to online education as a result of COVID-19, I have been learning less, and I often can't concentrate while studying at home. I

feel I have acquired lesser knowledge and skills in online education.

Both C and D are students at mid-rank universities and compared to students A and B at high-rank universities, they seem to have a weaker attitude toward independent learning, and there is little significance on students' learning outcomes (Abbasi et al., 2020). Student C stated that, because there are no students or professors on campus, she has difficulty staying motivated, thereby exhibiting a lack of emotional learning engagement. In previous research, Aristovnik et al. (2020) stated that students find it harder to concentrate during online classes. This may be, especially, true for students from mid-rank universities in the case of Japan. As observed earlier, regardless of whether students or professors were face to face, students C from high-rank universities was able on concentrate in her studies, while this student C from mid-rank was unable to concentrate on learning without someone's support. Therefore, online education, which requires more independent learning, may not be suitable for such students. Moreover, it suggests the importance for faculties to create opportunities to work together with other students and to encourage independent learning in online education. This can also be confirmed from the following interview of student C. She also has trouble with collaborative learning engagement, such as being stimulated by friends in class. Basically, Japanese students feel embarrassed expressing their opinions in public; So they do not speak up or ask questions. Thus, online education is even more so. In online education, students' camera is turned off in consideration of their internet capacity problem; however, the faculty encourages students to turn on the camera when talking. Also, in online education, it is necessary to create a grading system that reflects students' opinions and questions in class, as well as an environment in which it is easy for students to speak up. As a result, it is not only easier for students to convey their opinions, but it will also encourage other students to speak up, which will make it easier for them to experience collaborative learning. Finally, student C noted that her social engagement has declined by not visiting the university campus. This was the same for students A and B from high-rank universities, whom we earlier discussed. However, they may not have developed independent learning and their inability to attend university may cause them to further lose their sense of belonging. Also, it is difficult to go to university due to COVID-19, which means that students cannot meet their friends through club activities and so on, and were unable to build relationships. This situation has continued since 2020, and it is not strange to wonder why students who cannot do independent learning like student C and student D entered university. Moreover, like student C, student D did not exhibit collaborative learning engagement. In summary, the interviews with students C and D revealed to have reduced collaborative, emotional, and social learning engagement in online education as compared to students A and B. Moreover, in a previous study, student learning engagement is a significant factor in improving student achievement (Fraysier et al., 2020); however, students C and D from mid-rank universities did not feel that they had mastered new knowledge and skills, with the exception of student C mastering the use of Zoom. Therefore, if mid-rank universities continue online education even after COVID-19, such universities need to think about how to encourage

student learning engagement. Moreover, it will lead to gaining knowledge and skills through online education like high-rank universities. However, from the following interviews with students E and F, it can be seen that students from low-rank universities have not been more engaged in online education, and as a result, have not been able to gain student learning outcomes as well.

> Student E: Before COVID-19, although I usually focused in class, I didn't do any out-of-class preparation or review. After we switched to at-home online classes due to COVID-19, I often do other stuff during my classes. I can't concentrate anymore, and I have altogether stopped studying outside the class. As most classes are on-demand, there is also no opportunity to study with others around me, and I can't interact directly with the professor. I don't even feel like I'm a university student anymore. As a result, I've acquired absolutely no knowledge or skills through online education.

> Student F: I never study outside class. Students around me don't study either; so I don't study with them or show them my notes. The labor market for new graduates emphasizes academic credentials, and because I'm attending a low-rank university, I feel like there's no point if I study hard. As a result, I have no motivation to learn, and I don't ask the professor any questions. I've acquired absolutely no knowledge or skills through online education.

Both E and F are students from low-rank universities, and the interviews reveal that they engaged in no independent learning either before or during COVID-19. Also, it is clear these students are not studying more than students C and D from mid-rank universities. This is consistent with the study by Kuzuki (2007b) who found that before COVID-19, students at low-rank universities were less likely to have learning engagement outside of class. The interview with student E in this study showed that he had lost his focus and was no longer studying after online classes. In previous research, Aristovnik et al. (2020) mentioned that students find it difficult to stay focused during online classes, which could be true not only for students from mid-rank universities but also for students from low-rank universities. Aristovnik et al. (2020) reported an increase in students' workload when lectures were only available online, and Miyoshi (2021) found that self-learning outside class during the COVID-19 pandemic is longer than before. However, it should also be noted that students from low-rank universities did not learning engagement before COVID-19. Therefore, regardless of face-to-face education or online education, it can be said that these students have not gained learning engagement in the first place. In such universities, it is important to think about how students develop learning engagement before deciding to take face-to-face education or online education. Student E also states that many classes are on-demand with no scope for collaborative learning engagement, and because he has lost his sense of identity as a university student, he exhibits no social engagement either. Student F's interview reveals that in addition to lacking collaborative and social learning engagement, she lacks emotional

engagement as well. At the university of this student E, it was decided as a university policy to proceed with classes as an on-demand during COVID-19. While on-demand classes have the advantage that students can a take class at their own convenience, compared to other online education, however, on-demand classes tend to be one-way. The faculty give a one-way lecture, while the students just listen. Therefore, it is not surprising that many students lose collaborative learning engagement with friends and a sense of belonging to the university where on-demand classes are implemented as a university policy. Also, as can be seen from the interview with student F, it seems that it is becoming difficult to maintain motivation for learning. It is believed that this is because students have been unable to attend university for a long time due to COVID-19 and should stay at home. Student F further mentioned the characteristics of the Japanese labor market with its focus on academic credentials, which is connected to students at low-rank universities having given up on learning. In a previous study, it was clarified that job opportunities at large companies are different by university rank. Looking at the research trend, it is empirically verified that it is students from high-rank universities who are employed by large companies. The reason why large companies select students based on their university rank is to minimize the cost of on-the-job-training as a signal (Arrow, 1974; Spence, 1974). In other words, the career after graduation is determined by the university in which a students graduated. For this reason, student F from low-rank universities give up on studying during university. This is a structural problem of the relationship between the labor market and universities. Under these circumstances, of course, students do not study during university. Regarding this matter, it is important for the labor market to review the employment system, including students' effort during university. In summary, the interviews with students E and F from low-rank universities revealed that, like students C and D, they did not demonstrate collaborative, emotional, and social learning engagement in online education. Therefore, the significance of online education is not as good as in-person learning not only for students from mid-rank universities but also students from low-rank universities (Abbasi et al., 2020). The only difference is, while students C and D appeared to make an effort from time to time, students E and F did not, resulting in no acquisition of knowledge or skills through online education. While pre-COVID-19 studies by Linda (2016), Morozumi (2009), and Yamada (2010) found that students did not acquire the appropriate level of knowledge and skills without learning engagement both inside and outside the classroom, this study demonstrates that in online education during COVID-19, students did not exhibit collaborative, emotional, and social learning engagement. To sum up, while it is difficult for students to interact physically with faculty and fellow students on campus, we found variation in students' learning engagement inside and outside of class depending on the university rank, which in turn led to variation in the acquisition of knowledge and skills. After COVID-19, online education may become one of the new education styles at high-rank universities where students' learning engagement is guaranteed. However, it is necessary to review online education at mid-rank universities and low-rank universities. Even when introducing online education, it is important for these universities to consider how to encourage students' learning engagement.

5 Conclusion

In this study, we explored the relationship between students' learning engagement and learning outcomes in online education during COVID-19. Our analysis revealed that under online education, there is variation in students' learning engagement inside and outside of class depending on the university's deviation values, which in turn leads to variation in students' acquisition of learning outcomes. In other words, under online education, students at high-rank universities exhibited better learning engagement and actually acquired knowledge and skills, while students at middle and low-rank universities did not exhibit collaborative, emotional, or social learning engagement, and showed no learning outcomes as a result. The results imply that while online education is effective for students at high-rank universities, who usually exhibit good learning engagement inside and outside the classroom, it needs to be reconsidered for medium and low-rank university students who do not.

However, the findings of this study showed such a phenomenon, it does not mean that it should be legitimized. This is a point that this study would like to highlight. Moreover, because students are typically not allowed on campus or in class in online education, and the professor is on the other side of the computer screen, the students (at high, medium, and low-rank universities) do not feel the presence of others and might lose self-identification as a university student ought to. We cannot predict when the COVID-19 pandemic will stop. Therefore, we cannot deny that online education would not be the norm in the post- COVID-19. If online education is to continue to be a major mode of teaching and learning in universities, the gap in learning outcomes due to learning engagement, which is already caused by high and low deviation values, will become more pronounced. These issues of how to reduce the severity of the disparity due to the implementation of online education are what the universities should consider and focus on. As we think about how to tackle these problems, perhaps we can start with the following: exploring and developing effective online self-study systems that use the presence or absence of pre-study and revision before class as an indicator for assessing performance; exploring and improving student support methods and tools that can assist in the delivery of online education; ensuring smooth learning and access to learning outcomes for students who are unable to adapt to real-life education by strengthening the support provided to them.

5.1 Strength, limitations, and future studies

Our study contributes to exploring the relationship between student engagement and learning outcomes in online education during COVID-19. It also identifies, through the example of Japan, the detrimental effects of the shift from the traditional face-to-face to an online mode of education, especially for the academically disadvantaged, and points out the unjustifiable nature of this phenomenon. Based on this, it is hoped that the findings of this paper would provide a different reference perspective for thinking about and promoting equity in education.

Despite the strength of this study, there are still some notable limitations. First, the limitations of this research included the limited number of participants covering all different level universities in Japan and do not fully represent the opinions of students from different majors. Future studies should include more participants from different universities and different majors such as STEM. Second, the limitation of this study is its target group consisting entirely of students in Japan. In regard to future work, studying the comparable effects of online education on international students might give rise to different conclusions. As on-demand classes can be reviewed repeatedly, international students concerned about their language skills may find them useful. Third, the subject of our interviews and analyses was undergraduate students. Future work analyzing graduate students instead could reveal an even greater variation in learning engagement based on university deviation values. Because academic credentials are critical for employment in Japan, graduates are often seen to "launder" academic credentials by enrolling at a university with a higher deviation value. Additionally, graduate students are expected to find research topics on their own, while exhibiting proactive learning habits. We hope, future research addresses these limitations to obtain more comprehensive results.

Acknowledgments: This work was supported by RIHE Open-call research, Grant Number B03001, "An Empirical Study on the Effect of Class Experiences via Online Education on the Undergraduate Student's Learning Outcomes in the COVID-19 Crisis (Research Representative: Noboru Miyoshi)".

References

Abbasi, S., Ayoob, T., Malik, A., & Memon, S.I., (2020). Perceptions of students regarding e-learning during COVID-19 at a private medical college. *Pakistan Journal of Medical Sciences 36*, S57-S61

Appleton, J.J., Christenson, S.L., Kim, D., & Reschly, A.L. (2006). Measuring cognitive and psychological engagement: Validation of the Student Engagement Instrument. *Journal of School Psychology, 44*(5), 427-445. https://doi.org/10.1016/j.jsp.2006.04.002

Aristovnik, A., Keržič, D., Ravšelj, D., Tomaževič, N., & Umek, L. (2020). Impacts of the COVID-19 pandemic on life of higher education students: A global perspective. *Sustainability* 2020, 12, 8438.

Arrow, H. (1974). Higher Education as a Filter. In Lumsden, K.G. (Ed.), *Efficiency in Universities: The La Paz Papers* (pp.51-74). Amsterdam: Elsevier Scientific Publishing Company.

Bawa, P. (2020). Learning in the age of SARS-COV-2: A quantitative study of learners' performance in the age of emergency remote teaching. *Computers &Education 1*, 100016. 10.1016/j.caeo.2020.100016.

Benesse. (1998). *University satisfaction and problems of university education*. Tokyo: Benesse

Educational Research and Development Institute. (in Japanese)

Bond, M. (2020). Facilitating student engagement through the flipped classroom approach in K-12: A systematic review. *Computers & Education*, 151, 103819. https://doi.org/10.1016/j.compedu.2020.103819

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Bresó, E., Schaufeli, W.B., & Salanova, M. (2020). Can a self-efficacy-based intervention decrease burnout, increase engagement, and enhance performance: A quasi-experimental study. *Higher Education, 61*(4), 339-355. https://doi.org/10.1007/s10734-010-9334-6

Chen, P.D., Lambert, A.D., & Guidry, K.R. (2010). Engaging online learners: The impact of web-based learning technology on college student engagement. *Computers and Education, 54*(4), 1222-1232. https://doi.org/10.1016/j.compedu.2009.11.008

Drennan, J., O'Reilly, S., O'Connor, M., O'Driscoll, C., Patterson, V., Purser, L., & Murray, J. (2014). The Irish survey of student engagement. In H. Coates, & A. McCormick (Eds.), *Engaging university students* (pp. 109-125). Singapore: Springer. https://doi.org/10.1007/978-981-4585-63-7_8

Fraysier, K., Reschly, A., & Appleton, J. (2020). Predicting Postsecondary Enrollment With Secondary Student Engagement Data. *Journal of Psychoeducational Assessment*, *38*(7), 882-899. https://doi. org/10.1177/0734282920903168

Fredricks, J.A., Blumenfeld, P.C., & Paris, A.H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59-109. https://doi.org/10.3102/00346543074001059

Fujimura, M. (2013). The structure of learning outcome and learning time in Japanese students: Cross-sectional and longitudinal analyses. *University Review, 44*, 1-17 (in Japanese). https://ir.lib.hiroshima-u.ac.jp/ja/list/HU_journals/AN00136225/--/44/item/36505

Gonzalez, T., de la Rubia, M.A., Hincz, K.P., Comas-Lopez, M., Subirats, L., Fort, S., & Sacha, G.M. (2020). Influence of COVID-19 confinement on students' performance in higher education. *PLoS ONE*, 15, e0239490.

Gunuc, S. (2014). The relationships between student engagement and their academic achievement. *International Journal on New Trends in Education and their Implications, 5*(4), 216-231.

Kaneko, M. (2013). *Rebuilding university education: Towards a university that makes students grow*. Tamagawa University Press. (in Japanese)

Krause, K. (2005). Serious thoughts about dropping out in first year: Trends, patterns and implications for higher education. *Studies in learning, evaluation. Innovation and Development, 2*(3), 55-68.

Kuh, G.D., Cruce, T.M., Shoup, R., Kinzie, J., & Gonyea, R.M. (2008). Unmasking the effects of student engagement on first-year college grades and persistence. *Journal of Higher Education, 79*(5), 540-563. https://doi.org/10.1080/00221546.2008.11772116

Kuh, G.D. (2009). The national survey of student learning engagement: Conceptual and empirical foundations. *New Directions for Institutional Research 141*, 5-20. https://doi.org/10.1002/ir.283

Kuzuki, K. (2006). Potential and limits of curriculum evaluation by enrolled students. *Journal of Higher Education, 9*, 161-180. (in Japanese)

Kuzuki, K. (2007a). Engagement of low rank university students. In H. Yamada, & K. Kuzuki (Eds.), *Engagement of contemporary university students* (pp. 57-68). Higher Education Research Series, *90.* (in Japanese)

Kuzuki, K. (2007b). The orientation of low rank university students towards learning. *Journal of the Liberal and General Education Society of Japan*, *29*(2), 87-92. (in Japanese)

Lawson, M.A., & Lawson, H.A. (2013). New conceptual frameworks for student engagement research, policy, and practice. *Review of Educational Research, 83*(3), 432-479. https://doi.org/10.3102/0034654313480891

Linda, L. (2016). Exploring discipline differences in student engagement in one institute. *Higher Education Research and Development, 35*(4), 772-786

Miyoshi, N. (2013). An empirical study of undergraduate students learning outcomes: Verification in terms of achievement types. *University Management Policy Research*, *4*, 91-105. (in Japanese) http://ump.p.u-tokyo.ac.jp/en/resource/06-miyoshi%20No.4.pdf

Miyoshi, N. (2015). Undergraduate's study time, study motivation and learning outcomes. *Journal of the Liberal and General Education Society of Japan*, *37*(1), 105-113. (in Japanese) https://ci.nii.ac.jp/naid/40020514716

Miyoshi, N. (2021). Undergraduate student self-learning outside of class time: From the data of before and in COVID-19 pandemic. IDE, 39-42. (in Japanese)

Mizokami, S. (2008a). The relationship between types of learning in and out of class and the acquisition of generic skills. In Y. Hada (Ed.), *An international research comparison of the quality of university students: The perspective of securing and raising the quality of education* (pp. 2-11). Tokyo, Japan: Society for the Promotion of Science Grant-in-Aid for Scientific Research Basic Research (B) Research Results Report. (in Japanese)

Mizokami, S. (2008b). The relationship between types of learning in and out of class and changes in abilities and knowledge, and the satisfaction of university education ― In anticipation of implementation of the credit system. In R. Yamada (Ed.), *Educational evaluation of students in higher education in transition* (pp. 121-141). Tokyo: Toshindo. (in Japanese)

Mizokami, S., Nakama, R., Yamada, T., & Mori, A. (2009). The effect of differences in learning types (in-class and out of-class learning) on acquirement of knowledge and skills. *Journal of the Liberal and General Education Society of Japan*, *31*(1), 112-119. (in Japanese)

Morozumi, A. (2009). University-to-university comparison of student engagement―Focus on lesson effectiveness. *Bulletin of the University of Tokyo Graduate School of Education*, *49*, 191-206. (in Japanese)

Murasawa, M. (2003). The effect of university education on the formation of students' competence. In A. Arimoto (Ed.), *Curriculum reform at universities* (pp.75-89). Tamagawa University Press. (in Japanese)

Ogata, N. (2008). Student engagement and the outcomes of university education. *Journal of Higher Education*, *11*, 45-64. (in Japanese)

Okuba, A. (2020). Japan universities baffled by gov't policy to name schools with fewer non-online classes. *Mainichi Shimbun.* https://mainichi.jp/english/articles/20201103/p2a/00m/0na/015000c

Pan, Q. (2021). Challenges and Innovations of Higher Education Teaching Models in the "Post-epidemic Era": An Interview with Professor Ulrich Teichler. *Fudan Education Forum, 6*, 10-16.

Pascarella, P., & Terenzini, P. (2005). *How college affects students: A third decade of research*. San Francisco: Jossey-Bass.

Redmond, P., Heffernan, A., Abawi, L., Brown, A., & Henderson, R. (2018). An online engagement framework for higher education. *Online Learning, 22*(1), 183-204. https://doi.org/10.24059/olj.v22i1.1175

Reschly, A.L., & Christenson, S.L. (2006). Prediction of dropout among students with mild disabilities: A case for the inclusion of student engagement variables. *Remedial and Special Education, 27*(5), 276-292. https://doi.org/10.1177/07419325060270050301

Robinson, D., & Ikeda, T. (2020). Is online education the future of the university? *Nagoya University Journal of Higher Education*, *2*, 147-159. (in Japanese)

Rodríguez-Triana, María & Prieto, Luis & Holzer, Adrian & Gillet, Denis. (2020). Instruction, Student Engagement, and Learning Outcomes: A Case Study Using Anonymous Social Media in a Face-to-Face Classroom. *IEEE Transactions on Learning Technologies.* 1-1. 10.1109/TLT.2020.2995557.

Salanova, M., Schaufeli, W.B., Martinez, I., & Breso, E. (2010). How obstacles and facilitators predict academic performance: The mediating role of study burnout and engagement. *Anxiety, Stress, and Coping, 23*(1), 53-70. https://doi.org/10.1080/10615800802609965

Serrano, C., & Andreu, Y. (2016). Perceived emotional intelligence, subjective well-being, perceived stress, engagement and academic achievement of adolescents. *Journal of Psychodidactics, 21*(2), 357-374.

Shao, D. (2021). Active learning in online classes. *Bulletin of Nagoya University of Foreign Studies, 8*, 163-177. (in Japanese)

Soffer, T., & Cohen, A. (2019). Students' engagement characterstics predict success and completion of online courses. *Journal of Computer Assisted Learning, 35*(3), 378-389. https://doi.org/10.1111/jcal.12340

Spence, M. (1974). *Market signaling.* Columbia: Columbia University Press.

Tanimura, H. (2010). College students study time and learning outcomes. *University Management Policy Research*, *1*, 71-84. (in Japanese)

http://ump.p.u-tokyo.ac.jp/journal/2010-1/pdf/2010_hidehirotanimura.pdf

Thompson, N., Miller, N., & Pomykal Franz, D. (2013). Comparing online and face-to-face learning experiences for non-traditional students. A case study of three online teacher education candidates. *Quarterly Review of Distance Education, 14*(4), 233-251.

Torii, A. (2021). *Aspects of university IR and learning and education reform: Learning from the experience of a changing university*. Tamagawa University Press. (in Japanese)

Tualaulelei, E., Burke, K., Fanshawe, M., & Cameron, C. (2021). Mapping pedagogical touchpoints: Exploring online student engagement and course design. Active Learning in Higher Education. https://doi.org/10.1177/1469787421990847

UNESCO (2020). COVID-19 Education Response. Retrieved from https://en.unesco.org/covid19/educationresponse/globalcoalition

Vizoso, C., Rodríguez, C., & Arias-Gundín, O. (2018). Coping, academic engagement and performance in university students. *Higher Education Research and Development, 37*(7), 1515-1529. https://doi.org/10.1080/07294360.2018.1504006

Wong, A., & Chong, S. (2018). Modelling adult learners' online engagement behaviour: proxy measures and its application. *Journal of Computers in Education*, *5*(3), 132-145.

Yamada, H. (2010). Student engagement and attitudes at regional universities－The transformation of learning brought about by the transformation of universities into schools. *Hijiyama Journal of Higher Education*, *3*, 37-48. (in Japanese)

Yamada, R. (2007). *An international comparative study on the development of student educational evaluation in higher education in transition*. Japan: Society for the Promotion of Science Grant-in-Aid for Scientific Research (B) Research Results Report.

Yamada, R. (2008). Enrichment of students' emotional engagement and educational outcomes: Analysis of CSS and JCSS results. *University Review*, *40*, 181-198. (in Japanese)

Yamada, R. (2015). Learning and engagement of Japanese and Korean university students: Analysis of a survey of Japanese and Korean university students. *University Review*, *47*, 121-136. (in Japanese)

Yamada, R., & Kimura, T. (Eds.)(2021). *Visualization of learning outcomes and internal quality assurance: Challenges for Japanese IR*. Tamagawa University Press. (in Japanese)

Yamada, T., & Mori, T. (2010). Role of regular- and extra-curricula on generic skills of university students from the students' viewpoints. *Japan Journal of Educational Technology*, *34*(1), 13-21. (in Japanese)

Yoshimoto, K. (2007). Evaluation of educational outcome through graduates. *Research on Academic Degrees and University Evaluation*, *5*, 77-107. (in Japanese) https://www.niad.ac.jp/ICSFiles/afieldfile/2007/04/24/no9_16_yoshimoto_no5_05.pdf

You, J.W. (2016). Identifying significant indicators using LMS data to predict course achievement in online learning. *Internet and Higher Education, 29*, 23-30. https://doi.org/10.1016/j.iheduc.2015.11.003