Table 5: Comparison of login frequency by month according to COVID-19 patient care status (N = 68)

	Cared for COVID-19 patients		Did not care for COVID-19 patient		*p*	*r*
	n	Mean	n	Mean		
Mar, 2020	14	64.36	54	58.85	.35	-0.11
Apr, 2020	21	66.67	47	79.85	.63	-0.06
May, 2020	23	34.48	45	43.09	.62	0.00
June, 2020	21	34.38	47	41.28	.98	0.00
July, 2020	15	21.40	53	14.40	.44	-0.09
Aug, 2020	16	20.44	52	19.67	.58	-0.07
Sept, 2020	14	27.07	54	26.17	.39	-0.11
Oct, 2020	16	42.38	52	46.71	.80	-0.03
Nov, 2020	19	35.74	49	33.14	.70	-0.05
Dec, 2020	23	33.30	45	37.24	.61	-0.06
Jan, 2021	27	28.96	41	45.78	.10	-0.20
Feb, 2021	21	15.00	47	21.43	.22	-0.15

Table 6: Comparison of login frequency by month according to COVID-19 patient care status (N = 45)

	Cared for COVID-19 patients		Did not care for COVID-19 patient		*p*	*r*
	n	Mean	n	Mean		
Mar, 2020	10	54.50	35	42.71	.26	-0.17
Apr, 2020	13	28.85	32	23.25	.32	-0.15
May, 2020	13	10.00	32	8.41	.80	-0.04
June, 2020	12	4.00	33	10.70	.49	-0.10
July, 2020	11	9.45	34	11.47	.76	-0.05
Aug, 2020	11	9.36	34	13.35	.44	-0.11
Sept, 2020	10	28.50	35	28.46	.63	-0.07
Oct, 2020	11	51.45	34	59.85	.48	-0.10
Nov, 2020	13	31.46	32	31.19	.83	-0.03
Dec, 2020	16	21.56	29	22.93	.97	-0.01
Jan, 2021	21	13.85	24	17.13	.57	-0.09
Feb, 2021	16	14.50	29	15.79	.97	-0.01

Table 7: Comparison of login frequency per month by distance learning experience (n = 23)

	Cared for COVID-19 patients		Did not care for COVID-19 patient		*p*	*r*
	n	Mean	n	Mean		
Mar, 2020	4	89.00	19	88.58	.91	0.19
Apr, 2020	8	128.13	15	200.60	.02	-0.48
May, 2020	10	66.30	13	128.46	.01	-0.56
June, 2020	9	74.89	14	113.36	.03	-0.45
July, 2020	4	28.00	19	39.16	.67	-0.09
Aug, 2020	5	44.80	18	31.61	.54	0.13
Sept, 2020	4	23.50	19	21.95	.67	0.09
Oct, 2020	5	22.40	18	21.89	.64	0.10
Nov, 2020	6	45.00	17	36.82	.29	0.23
Dec, 2020	7	60.14	16	63.19	.97	-0.01
Jan, 2021	7	72.14	16	88.75	.14	-0.32
Feb, 2021	5	16.60	18	30.50	.06	-0.40

3.5 Analysis of Open-ended Questions

Of the participants, 60.3% (n = 41) reported difficulties engaging in distance learning while performing clinical duties. Twenty participants answered that balancing clinical duties was an issue, e.g., "I was mentally and physically exhausted from working in the COVID ward, and sometimes found it difficult to find time to study after work." Time management was mentioned by 12 participants, such as "It was difficult to find the time." Excessive fatigue was mentioned by five participants, e.g., "I had to continue my studies without time to recover from daily fatigue." Maintaining motivation to learn was mentioned by two participants, e.g., "I sometimes felt it was difficult to maintain motivation." Balancing time with family was mentioned by two participants, such as "I neglected housework and childcare and caused trouble to my family." Securing a place to study was mentioned by two participants, e.g., "I need to secure a place where I can use a computer."

Regarding necessary support, 66.2% (n = 45) of the participants needed to learn online. Twelve participants needed help to secure study time and space. A specific statement was "I want an external approach to secure my own study time." Eleven participants stated a contact point where they could consult casually would be helpful. In addition, 11 participants suggested having a contact person they could ask for help, and that being able to exchange information with other learners would enable them to proceed without needing to ask a teacher for help. Learners desired more communication between themselves and with teachers, and more tutoring. Five participants wanted to learn progress management and eight wanted support when adjusting work schedules.

The participants' recommendations for implementing distance learning included “securing study time,” “explanations of distance learning in the workplace,” “devising study methods,” “securing study locations,” and “communication among learners.”

4 Discussion

We compared the monthly login frequencies of two cohorts (FY2019 and FY2020) for a self-paced distance learning course. The login frequency of the FY2020 cohort was higher in March, while the login frequency of the FY2019 cohort was higher in all other months. Login frequency was higher in most months for learners who had no prior distance learning experience. In the group with distance learning experience, caring for COVID-19 patients did not affect login frequency. In the group with the distance learning experience, care for COVID-19 patients had no effect on login frequency, while in the group without distance learning experience, the presence or absence of caring for COVID-19 patients affected login frequency.

4.1 Impact of the Number of COVID-19 Infected People on Learning Progress

As shown in Figure 3, the number of new cases of COVID-19 in Japan increased after April 2020, August 2020, and November 2020, reaching approximately. 8,000 in January 2021 [15]. Learner login frequency was lower in April 2020 than in April 2019 (Table 3). The number of logins from April to June was significantly lower for participants without prior distance learning experience who cared for COVID-19 patients (Table 7). This suggests that during the first wave of COVID-19 from April 2020 until COVID-19 hospitalizations decreased, some participants were not able to log into the course. In their responses to the open-ended questions, participants remarked on the difficulty of balancing working in the COVID-19 ward with distance learning. From these findings, we infer that implementation of COVID-19 patient care in hospitals and pandemic-imposed restrictions on healthcare workers’ behaviors made studying more difficult and decreased their motivation to learn due to physical and mental fatigue [16]. For adult learners, it is important to provide learning support that emphasizes learner autonomy [17]. However, it has been noted that many adults have not acquired the skills needed for autonomous learning and the ability to reflect on their learning [18].

In unforeseen situations, such as the COVID-19 pandemic, it is difficult for learners to exercise their autonomy. It is not possible to solve the problem at the discretion of the individual learner. Rather, it is necessary for educational institutions to actively intervene and support learners so that they do not drop out. Our study demonstrates the efficacy of investigating and analyzing learners’ work situations and CPE learning logs at an early stage. Based on our results, it we recommend specific support for CPE be provided while learners are performing their clinical duties, such as encouraging medical institutions to ensure adequate CPE learning time and to prepare documents that describe the time required and expectations for distance learning.

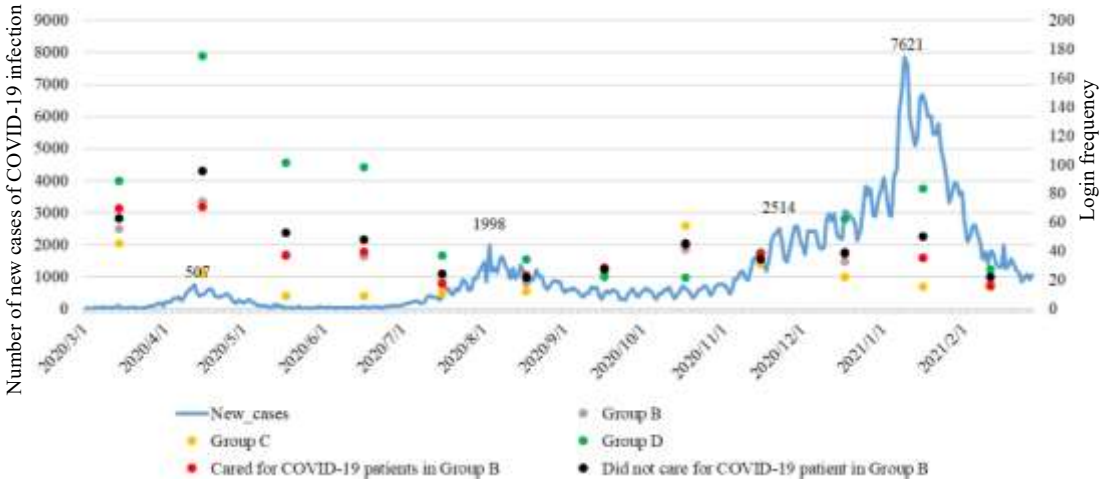

Figure 3: Number of new cases of COVID-19 infection, new deaths, and login frequency

4.2 Distance Learning Experience and the Impact of COVID-19

Previous research by the authors has shown that nurses' prior distance learning experience does not affect learning progress or performance [13]. However, the results of the current study showed that COVID-19 patient care reduced course login frequency in the group with no distance learning experience. In April and May 2020, when the number of COVID-19 patients increased, learners who cared for such patients logged in at a lower rate. In June, when the number of patients decreased, the number of logins remained low. The reason for the low number of logins in June may be that COVID patients require more than two weeks of recuperation before they can be discharged from the hospital, and patient care may have been affected in June. In contrast, the number of logins of learners who cared for COVID-19 patients increased after August 2020. The number of COVID-19 patients increased again in August and December. As shown in Figure 2, the number of moderately or severely ill patients also increased in December. It can be inferred from the data that learners were able to continue distance learning while caring for COVID-19 patients, suggesting it takes approximately six months to adapt to distance learning, even under severe conditions.

Caring for COVID-19 patients imposed a significant burden beyond nurses' normal workloads and usual best practices of care. Under stressful situations, such as those imposed by the COVID-19 pandemic, the usual support provided learners with no prior distance learning experience may be inadequate. Compared to the previous year, learners without prior distance learning experience had a higher login frequency as they adapted to a new learning process and proceeded cautiously at the beginning. However, learners without prior distance learning experience who had to simultaneously cope with COVID-19 and a new way of learning may not have been able to concentrate sufficiently on learning to self-regulate. In contrast, the number of logins of learners with distance learning experience increased from September to October 2020, when the number of COVID-19 patients decreased. It can be inferred from the data that these learners were able to self-adjust to distance learning through their prior experience and actively delay [19] their learning by self-assessing and balancing priorities of learning and work.

4.3 Limitations

The small number of participants may contribute to the small effect sizes observed. Login frequency is not necessarily an indicator of active learning, as a learner may be logged in, but inactive. Future studies would benefit from measuring login frequency against knowledge acquisition and the pace of progress through the course. In addition, the number of participants was too small to analyze the effects of different levels of care on login frequency referenced against the COVID-19 patient caseload. To better understand the mechanisms through which exhausted medical professionals can continue to learn amid the ongoing stressors of the COVID-19 pandemic, we plan to conduct surveys and consider specific learning supports applicable to distance learning.

5 Conclusions

In this study, we investigated the impact of COVID-19 care on CPE by assessing distance learning in situations that require time for organizational response. We found that learners who cared for COVID-19 patients had a relatively low number of logins. Learning (as indicated by login frequency) declined when learners who had no prior experience in distance learning were engaged in COVID-19 patient care. By contrast, even though they were caring for COVID-19 patients, after approximately six months of the distance learning experience, such participants were able to adapt to and manage their distance learning.

The results of this study indicate the need for educational institutions to understand the current situation and actively intervene so that learners who are engaged in CPE and coping with COVID-19 or analogous stressor can balance their studies and work. In addition, when learners who have no experience in distance learning are forced to cope with COVID-19, it is assumed that it will be difficult for them to continue CPE, and an extension of the study period may be beneficial. At the same time, it is important to check not only login frequency but also login time and to evaluate whether sufficient learning time can be secured.

Acknowledgment

This work was supported by JSPS KAKENHI (Grant Number: JP19K10782).

References

[1] Treatment of Discharge and Work Restrictions for Patients with Novel Coronavirus Infection under the Law Concerning Prevention of Infectious Diseases and Medical Care for Patients with Infectious Diseases. https://www.mhlw.go.jp/content/000745527.pdf (in Japanese).

[2] V.C. Cheng, S.C. Wong, J.H. Chen, C.C. Yip, V.W. Chuang, O.T. Tsang, V.W.M. Chuang, S. Sridhar, J.F.W. Chan, P.-L. Ho, and K.Y. Yuen, “Escalating infection control response to the rapidly evolving epidemiology of the coronavirus disease 2019 (COVID-19) due to SARS-CoV-2 in Hong Kong,” Infection Control & Hospital Epidemiology, vol. 41, no. 5, 2020, pp. 493–498.

[3] A.M. Dondorp, M. Hayat, D. Aryal, A. Beane, and M.J. Schultz, "Respiratory Support in COVID-19 Patients, with a Focus on Resource-Limited Settings," The American Journal of Tropical Medicine and Hygiene, vol. 102, no. 6, 2020, pp. 1191–1197.

[4] T. Lammers, A. M. Sofias, R. van der Meel, R. Schiffelers, G. Storm, F. Tacke, ... and J. M. Metselaar, "Dexamethasone Nanomedicines for COVID-19," Nature Nanotechnology, vol. 15, no. 8, 2020, pp. 622–624.

[5] E.K. McCreary, and D.C Angus, "Efficacy of Remdesivir in COVID-19," JAMA, vol. 324, no. 11, 2020, pp. 1041–1042.

[6] X. Elharrar, Y. Trigui, A.M. Dols, F. Touchon, S. Martinez, E. Prud'homme, and L. Papazian, "Use of Prone Positioning in Nonintubated Patients with COVID-19 and Hypoxemic Acute Respiratory Failure," JAMA, vol. 323, no. 22, 2020, pp. 2336–2338.

[7] M. Beaudoin, G. Kurtz, I. Jung, K. Suzuki, and B.L. Grabowski, Online Learner Competencies: Knowledge, Skills, and Attitudes for Successful Learning in Online Settings. IAP, 2013.

[8] J. Thurmond, S. Cross, D. Byers, D. Todd, J. Rogers, K. Reid, and E. Winstead, "A Descriptive Study Examining Undergraduate Student Experiences during the COVID-19 Pandemic," International Journal Nursing and Health Care Science, vol. 1, no. 8, 2021, pp. 2021–2041.

[9] G. Piccoli, R. Ahmad, and B. Ives, "Web-Based Virtual Learning Environments: A Research Framework and a Preliminary Assessment of Effectiveness in Basic IT Skill Training," MIS Quarterly, vol. 25, no.4, 2001, pp. 401–426.

[10] J. Davies, and M. Graff, "Performance in e-learning: Online Participation and Student Grades," British Journal of Educational Technology, vol. 36, no.4, 2005, pp. 657-663.

[11] J.L. Hung, and K. Zhang, "Revealing Online Learning Behaviors and Activity Patterns and Making Predictions with Data Mining Techniques in Online Teaching," MERLOT Journal of Online Learning and Teaching, vol. 4, no.4, 2008, pp. 426–437.

[12] M. Saqr, U. Fors, and M. Tedre, "How Learning Analytics Can Early Predict Underachieving Students in a Blended Medical Education Course," Medical Teacher, vol. 39, no.7, 2017, pp. 757–767.

[13] M.S. Yagi, R. Murakami, S. Tsuzuku, M. Suzuki, H. Nakano, and K. Suzuki, "Distance Learning for Nurses: Using Learning Analytics to Build a Learning Support Program," The Journal of Information and Systems in Education, vol. 19, no. 1, 2020, pp. 1–8.

[14] Ministry of Health, Labour and Welfare, "Content of Programs," https://www.mhlw.go.jp/file/06-Seisakujouhou-10800000-Iseikyoku/0000077911.pdf (in Japanese).

[15] World Health Organization. https://covid19.who.int/region/wpro/country/jp (in Japanese).

[16] F. Agyei, J. Bayuo, P. Baffour, and C. Laari, "Surviving to Thriving: A Meta-Ethnography of the Experiences of Healthcare Staff Caring for Persons with COVID-19," BMC Health Services Research, in review, 2021; doi:10.21203/rs.3.rs-139341/v1

[17] K.S. Kitchener, and P.M. King, "The Reflective Judgment Model: Transforming Assumptions Adult Knowing," Fostering Critical Reflection in Adulthood, J. Mezirow, Ed., Jossey-Bass Publishers, 1990, pp. 159–176.

[18] S.D. Brookfield, "Transformative Learning as Ideology Critique," Learning as Transformation: Critical Perspectives on a Theory in Progress, J. Mezirow, Ed., Jossey-Bass Publishers, 2000, pp. 125–146.

[19] J.N. Choi, and S.V. Moran, "Why Not Procrastinate? Development and Validation of a New Active Procrastination," The Journal of Social Psychology, vol. 149, no. 2, 2009, pp. 195–212.