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Original Article

Effectiveness of an automated health information processing system developed to protect the educational environment of a medical university during the COVID-19 pandemic

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Abstract: [Purpose] This study aimed to reveal the effectiveness of an automated student health information processing system that was developed and implemented in the Department of Physical Therapy at the International University of Health and Welfare during the COVID-19 pandemic. [Participant(s) and Methods] Eleven faculty members and staff from six departments handling student health data completed a survey. The total time saved during the period of use was calculated based on the number of days the system was used and the daily processing time savings. Subjective improvements were evaluated in terms of time constraints, mental stress, and workload reduction (total score range: -22 to +22). [Results] The system was used for an average of 195.5 ± 66.7 days, reducing daily processing time by 115.0 ± 112.0 minutes. The total subjective improvement score for all items was 20 points or more. The average time reduction across departments was 595.6 ± 782.7 hours, totaling 3,573.5 hours. [Conclusions] Processing times significantly decreased across all departments, reducing faculty and staff burdens related to work hours, mental stress, and workloads. Accurate and rapid information processing provided additional time for educational enrichment and was considered a crucial tool for future infectious disease outbreaks.

Keywords: Pandemic, Educational Environment Protection, Health Information Processing

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I. INTRODUCTION

The novel coronavirus disease (COVID-19), which spread globally in 2020 causing extensive damage, was designated as an infectious disease equivalent to Category II in Japan on February 1, 2020 [1)]. Countries worldwide have since focused on preventing COVID-19 spread, vaccinating populations, and treating infected individuals. By May 8, 2023, when COVID-19 became a Class 5 infectious disease in Japan, infection prevention measures at educational institutions had become burdensome for professors and staff.

In Japan, the Cabinet Office and Ministry of Health, Labor, and Welfare implemented various medical-related measures nationally [2)]. The Ministry of Education, Culture, Sports, Science and Technology worked to protect the educational environment and prevent infection spread in institutions, including universities. Our university, which trains medical professionals, has been preventing COVID-19 spread following ministry guidelines. Given our focus on medical training, clinical training in hospitals is essential [3)]. Preventing infections in students beginning or during clinical training is crucial to protect patients. However, when students take classes at universities, crowded environments are often unavoidable.

Many departments, including Physical Therapy, have numerous practical training sessions requiring face-to-face meetings alongside classroom learning. Special measures by the Ministry allowed remote learning during the pandemic [4)]. However, practical classes have limitations online; therefore, our university conducted face-

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to-face classes early while preventing infection spread. Measures taken include reducing on-site personnel, health status checks, using alcohol disinfectants, wearing masks, avoiding the three Cs (closed spaces, crowded places, and close contact) [5], installing partitions, using hybrid formats, and adjusting corridor movement, seating arrangements, and class times.

Students were asked to check their health status before coming to university for symptoms [6] related to COVID-19, including temperature, and report them to their department via Google Forms [7]. The Department of Physical Therapy integrated student health information and adjusted it for online classes. Health information collected from students was processed before 9 a.m., and information on potentially infected students not attending face-to-face classes was shared with the department and faculty. Health information processing was conducted daily for approximately 400 students, from first to fourth-year. As some students reported multiple times, about 1,000 reports were collected each morning. As the pandemic continued, three to ten faculty members processed the information every morning.

Student health information from Google spreadsheets was converted to Excel 2019 for processing. The Department of Physical Therapy used Excel functions and macros to complete the process quickly. Other departments employed various practices for division of labor, processing content, and methods.

Health information needed to be processed quickly and accurately before classes, increasing faculty workload. The response method differed by department; in Physical Therapy, many faculty members were busy responding daily. To extract unwell students, one or two faculty members processed the health information. The extracted information was emailed to homeroom professors of each year. Two homeroom professors per year responded based on the information received. They contacted class professors via email, phone, or in person. They also responded to unwell students and those who hadn't reported their health status. The processing professor mainly handled non-reporters. Students arriving without reporting were required to record their temperature and symptoms in isolation. Information was shared within departments, and aggregated data was sent to the Student Affairs Division. Individual student health information was shared with faculty and staff for crisis management, with efforts to protect personal information.

This situation continued for about half a year, with workload and time constraints on professors accumulating. We considered automating repeated daily processing patterns (Robotic Process Automation [RPA]). While some steps were automated using Excel macros and functions, we implemented computer programming to automate the entire process.

The programming language used was Visual Basic Application (VBA). Windows 10 OS task scheduler function was used for automation. After automation, the information processor's role was to monitor the system's operation. The automated function started Excel and ran the VBA program at a specified time to process health information. Data collected from students via Google Forms was stored in Google Spreadsheet [8]. The data was downloaded, processed, and subjects requiring online classes were extracted using Power Query [9].

The extracted information was automatically emailed and shared with faculty and staff. The entire process was automated — from emailing non-reporting students to saving compiled data and reporting daily situations to the Student Affairs Office via Google Forms.

A dedicated desktop PC was used for programming. After full automation in the Physical Therapy Department, the system was introduced to other departments, implemented in six departments across two campuses. Measures were taken to suit each department's characteristics. One department switched from a paid application to this automated system.

The purpose of this study was to clarify the effectiveness of a system for automatically processing student health information, which was developed to enhance education in the Department of Physical Therapy during the COVID-19 pandemic and was operated at a medical university to protect the educational environment.

II. PARTICIPANTS AND METHODS

1. Participants

To verify the effectiveness of using an automated health information processing system in protecting the educational environment, we summarized the situation before and after the use of the system in the Department of Physical Therapy, which developed and first used the system. A signed paper questionnaire survey was conducted among the faculty and staff involved in processing students' health information in departments that used the automated health information processing system at our university. The system was introduced and used in some departments at two of our university's five campuses located in Otawara and Okawa.

The inclusion criteria for the survey were two faculty members from the Department of Physical Therapy who had been in charge of processing since the system was developed, and faculty members from the other five departments who had been in charge of processing before and after the introduction of the automated system, for a total of 11 people. Faculty members who provided support in terms of hardware and software were excluded. Faculty members who no longer needed to be involved in processing immediately after the automated processing system was implemented were also excluded from the survey.

2. Methods

We compared the changes in the number of faculty members involved in related work in the Department of Physical Therapy at our university before and after development and implementation of the automated health information processing system. The data before and after implementation were based on the results of the observations and collections made by the researchers during our work in the department.

The breakdown of the roles and numbers of people involved in processing each day before and after using the system was as follows: information processing technology, online class target selection and information distribution processing, and homeroom professor. On days when it was difficult for the homeroom professor to respond, other professors sometimes took over, but here we classify them as the number of homeroom professors.

In the questionnaire survey, the staff in charge of processing health information in each department were asked to provide the following information about the automated health information processing system they used: 1) number of days used by departments, 2) changes in processing time per day, 3) subjective changes in time constraints, 4) changes in mental stress after use, 5) workload, 6) affiliation, occupation, etc. The number of days of use was calculated from the date on which each department started using the system until March 17, 2023. One department continued to use the system after that, but the period after March 17 was not included in the calculation. The number of days of use was included during the long summer and winter holidays as reporting processing was required to determine the infection status of the students. The number of days from the start date to the end date of use was calculated for each department, and the number of days of use was calculated by multiplying by 5/7 to apply only to weekdays.

The change in processing time per day was calculated for all participants, and the change in time over the entire period of use was calculated by each department. Subjective changes after using the automated system were also obtained via the questionnaire survey. Subjective changes in time constraints, changes in mental stress after use, and workload were measured using a 5-point scale in which the scores and answer items were set as follows: 2 points, much lighter; 1 point, lighter; 0 points, no change; -1 point, slightly heavier than before use; -2 points, much heavier than before use, and the total score was calculated. The total score ranged from a minimum of -22 points to a maximum of +22 points. From the questionnaire results, the time reduction by department over the entire period of use and the total time reduction for all departments were calculated.

This study was approved by the Institutional Review Board of the International University of Health and Welfare (approval number: 23-Io-36).

When conducting the questionnaire survey, the purpose of the study was explained to the participants, and verbal and written consent to participate in the study was obtained.

III. RESULTS

In the Department of Physical Therapy, the breakdown of the number of people involved in processing on the day before and after using the automated processing system (before and after) was as follows: information processing technology (0−1 person, 0−1 person); selection of online class recipients and information distribution processing (1−2 people, 1−2 → 0 people; since the system was initially put into operation and partially automated, these people were surveyed as they were the people in charge, but after the digitalization of manual work and full automation of processing, the number of people was reduced to

0); homeroom professors (4−8 people, 0 people); and the total number of people (11 people, 1 person).

The mean and standard deviation of the number of days of use by department was 195.5 ± 66.7 (Table 1), and the change in processing time per day was a reduction of 115.0 ± 112.0 minutes.

The change in the time required for processing by the subject over the entire period of use was a decrease of 595.6 ± 782.7 hours. The total change in time required for processing by all subjects was a decrease of 3,573.5 hours (Table 1).

The changes in subjective improvement in response to time constraints, mental stress, and workload were 21/22, 20/22, and 20/22, respectively (Figure 1).

Table 1. Departmental Automation: Days in Use & Time Saved

Department	Used days	Reduced hours
A	206.4	536.6
B	292.9	36.6
C	132.1	264.3
D	215.7	2,157.1
E	217.9	363.1
F	107.9	215.7
Total	1,172.8	3,573.5
Mean ± SD	195.5 ± 66.7	595.6 ± 782.7

SD: Standard Deviation

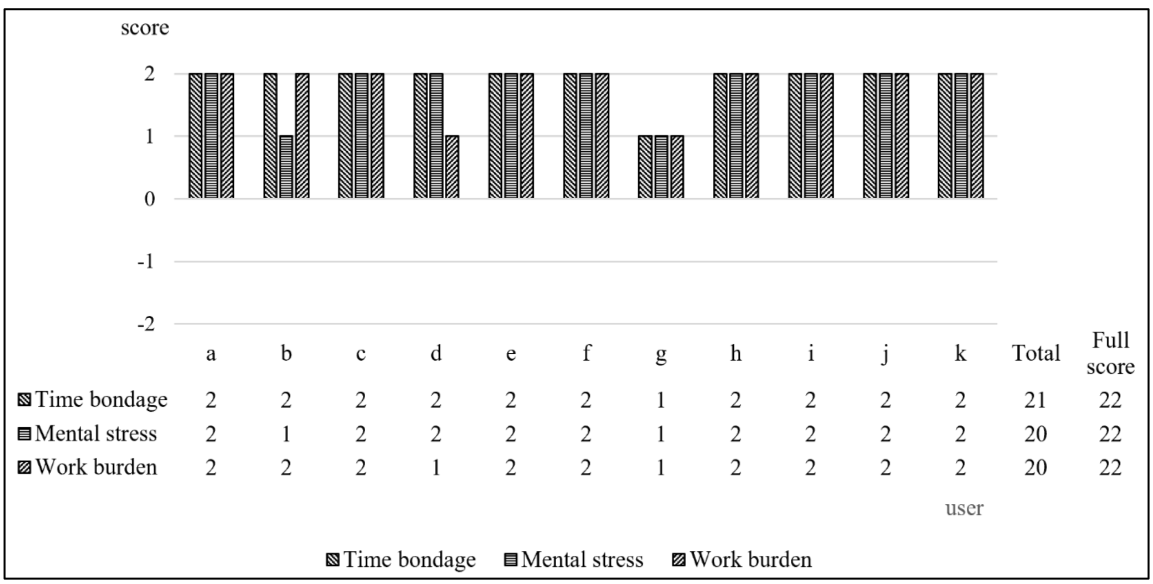

Figure 1. Reducing the subjective burden felt by each individual after using the RPA system

IV. DISCUSSION

This study verified the effectiveness of a system that automatically processes the health information of university students, which was developed and operated during the COVID-19 pandemic. To verify its effectiveness, we conducted a questionnaire survey of the faculty and staff in charge of health information processing. The content of the questionnaire survey concerned the improvement of work efficiency due to changes in the processing time of the faculty and staff in charge and the change in the subjective burden of work.

As a result, on average, the daily processing time was reduced by 115 minutes across the six departments that used the automated processing system, and during the 195.5 ± 66.7- days period of use. The reasons for the variation in the number of days of use were that the decision on the timing of introduction was left to each department and that it took time to customize the system to suit each department. Processing times across the six departments were reduced by an average of 595.6 ± 782.7 hours during each use period. The reason for the variation in the amount of time saved by each department was thought to be due to differences in the way each department utilized the system and the ability of the health information processing staff to use the software functions of the PCs. The processing time for the six departments was reduced by a total of 3,573.5 hours.

The scores for the constraints on the work hours of the faculty and staff in charge, mental stress, and workload ranged from -22 points to 22 points, and were 21/22, 20/22, and 20/22 points, respectively, making it clear that the subjective burden was also greatly reduced and almost eliminated (Table 2). These results suggest that the automated processing system has made a significant contribution to improving the work efficiency of faculty and staff.

In the Department of Physical Therapy, 11 staff members performed manual processing tasks. After the introduction of the automated processing system, eight staff members were completely freed from the processing tasks in the initial stage and the remaining two staff members were completely freed from the processing tasks after further optimization of the system. The time spent on processing tasks by the 11 faculty members in charge of the six departments, including these two staff members, was significantly reduced, as was the workload. Consequently, the work efficiency of the entire department was greatly improved, and faculty members were able to focus on more specialized tasks.

According to Kuroda et al.[10], university professors and researchers report working longer hours than corporate researchers do. According to the 2022 Ministry of Education, Culture, Sports, Science, and Technology's Survey on Teacher Working Conditions, many teachers work long hours at all educational levels, including elementary, junior high, and high school [11]. Given that the workload of teachers is high, the additional burden of new tasks, such as infection prevention measures, could lead to a quantitative and qualitative decline in the educational environment for both faculty and staff. This study confirmed the effectiveness of an automatic health information processing system at a medical university, which suggests the possibility of using it not only at universities as educational institutions but also at elementary, junior high, and high schools. Furthermore, we believe its use can be expanded to various organizational activities, such as large companies.

The workload will increase when measures to prevent the spread of infection are added to regular work, but by introducing an automated processing system such as this one, professors and staff will be able to handle the situation with less of a burden.

The results of this study will provide hints for conducting face-to-face classes at various educational institutions, including medical universities, not only during pandemics but also when infectious diseases spread. Although it is difficult to make international comparisons with respect to the protection of the medical education environment at our university when the infection spread, it is believed to have been one of the few excellent measures worldwide.

The use of the RPA system freed faculty and staff from most of their workload, providing an environment in which they can focus on their primary duties, which is important for several reasons. First, faculty and staff have more time and mental space to focus on their primary educational activities. Second, even if a faculty member in charge of processing health information is absent because of infection, classes can continue because health information is processed automatically without interruption.

In addition, it is essential to be able to quickly and accurately obtain processing results when busy. Even if processing is possible, if the results are obtained after some time has passed, they will not contribute significantly to infection prevention. For these reasons, it can be said that an automated health information processing system is very effective in maintaining an educational environment. Although there have been few reported cases of the introduction and use of RPA in the field of education at the elementary, junior high, high school, and university levels, we believe that this research demonstrates its potential as a tool that can significantly reduce the workload of professors.

In this study, computer programming was used to automate repetitive tasks out of necessity during the pandemic. However, this was possible because the university had people with programming skills. Although this could have been done by outsourcing to a specialist company, it is unclear whether the work would have been completed and put into operation if outsourced given issues such as securing sufficient time and budget, time required for procedures, and the selection of a company that could handle the task. Therefore, securing and developing human resources with computer programming skills is likely to be a useful means of protecting the educational environment, not only in the industrial sector but also in future school education.

As digital transformation in the education sector is gaining popularity, the RPA is expected to become increasingly important. Even if an analog task is digitized, if processing is a repetitive task performed manually, automation can help speed up and improve its accuracy. In Japan, programming education has become mandatory in elementary schools since 2020, and the Ministry of Education, Culture, Sports, Science, and Technology has promoted programming education in schools [12, 13]. Some universities provide programming education in physical therapist training schools; [14] however, it is believed that proactive programming education in the future will help improve the efficiency of work processing after entering society. In particular, with the recent development of artificial intelligence, it has become possible to program using various AI tools [15], thus saving coding time. We hope to see the expansion of the use of tools that can improve the educational environment by utilizing RPA, which uses advanced technologies. As a measure against infectious diseases, we have already passed the major peak of the COVID-19 threat; however, preparing for future pandemics will help minimize future damage and protect the medical and educational environments. As a good example, South Korea learned from the failure of its government's response to Middle East Respiratory Syndrome (MERS) in 2015 and made systematic preparations to prepare for an uncertain future. Consequently, the country has a history of responding internationally to the COVID- 19 pandemic with outstanding results [16]. One of the measures used was a strategy that utilized information technology. Considering this track record of such preparations, although this study is based on the results of a Japanese educational institution, it is believed that it can be used as a reference not only for Japan but also for other countries around the world.

As part of our preparations for the future spread of infectious diseases in educational institutions, we believe that the parallel implementation of face-to-face and online classes as implemented at our university, the utilization of health information used during this process, and RPA can be positioned as important means of protecting the educational environment in the event of the spread of a serious infectious disease in the future.

Research limitations

The limitations of the automated processing system mentioned in this study include the geographical characteristics of the campuses on which it is operated. Otawara City has a population of approximately 72,087 [17], while Okawa City has a population of 32,988 (as of 2020) [18], In the case of Otawara City, a high proportion of students commute to school by car. Further verification is required to determine the suitability of the system under various conditions, such as the nature of the infectious disease, geographical characteristics of educational institutions (e.g., universities), and characteristics of students' commuting methods.

The data on processing time from the questionnaire are not actual data but an estimate recalled by the individual; therefore, there are issues with accuracy. As faculty and staff members who were relieved of their duties after the automated processing system was adopted in each department were excluded from the study, the data presented do not actually reflect a greater reduction in processing time. Thus, there are issues with fully demonstrating the effectiveness of RPA. Another limitation of this study is that we did not investigate participants' opinions about other potential benefits of the automated system. The small sample size of survey participants (11 individuals) also presents a possible limitation.

PARTS OF THIS PAPER WERE PRESENTED AT THE FOLLOWING CONFERENCES:

1. Effectiveness of an automatic health information processing system developed for the purpose of maintaining a university educational environment during a coronavirus disaster. Journal of International University of Health and Welfare, 29(abstract issue), Sep. 2024（Japanese)
2. Changes in workload after utilizing Robotic Process Automation for student health information processing during the COVID-19 pandemic. The 36th International Meeting of Physical Therapy Science in Korea. Sep. 2024. https://doi.org/10.1589/jpts.36.Suppl.1_S1_1
3. Effects of using DX to reduce the workload for health information management of medical college students during the COVID-19 Pandemic. The 138th Meeting of the Society of Physical Therapy Science, Feb. 2024（Japanese)
4. A case study of the Department of Physical Therapy Automating (RPA) on the processing of student health check reports for COVID-19 spread prevention measures. The 12th Annual Conference of the International University of Health and Welfare Studies. 78, August 28, 2022（Japanese)

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REFERENCES

1) Medical Treatment Guideline Review Committee/Creation Group. Medical Treatment Guideline for Novel Coronavirus Disease (COVID-19), 2nd edition. https://www.mhlw.go.jp/content/000631552.pdf. (Accessed Nov. 9, 2024, Japanese)
2) Cabinet Office. Basic Policy for Countermeasures against COVID-19. In: COVID-19 Response Headquarters, editor. Cabinet Office Website, 2020. (Accessed Nov. 9, 2024, Japanese)
3) Director-General of the Medical Affairs Bureau, Ministry of Health, Labor, and Welfare. Guidelines for training institutions for physical and occupational therapists. http://www.japanpt.or.jp/upload/japanpt/obj/files/aboutpt/01_Guideline_181005.pdf. (Accessed Nov. 9, 2024, Japanese)
4) Ministry of Education, Culture, Sports, Science, and Technology. Higher Education Bureau, University Promotion Division. Regarding the handling of academic calendars and the use of distance learning, sending out Q&As, etc. (as of May 22). In: Ministry of Education, Culture, Sports, Science, and Technology, Higher Education Bureau, University Promotion Division, editor. 2020 (Japanese)
5) Cabinet Secretariat, Government Public Relations Office. Avoid the three Cs! https://www.gov-online.go.jp/prg/prg20638.html. (Accessed Nov. 9, 2024, Japanese)
6) Medical Treatment Guideline Review Committee/Creation Group. Medical Treatment Guideline for Novel Coronavirus Disease (COVID-19), 2nd edition. https://www.mhlw.go.jp/content/000631552.pdf. (Accessed Nov. 9, 2024, Japanese)
7) Google. Easily check insights with Google Forms. https://www.google.com/intl/ja_jp/forms/about/. (Accessed Nov. 9, 2024, Japanese)
8) Google. How to use Google Spreadsheets. https://support.google.com/docs/answer/6000292?hl=ja&co=GENIE.Platform%3DDesktop. (Accessed Nov. 9, 2024, Japanese)
9) What is Power Query? https://learn.microsoft.com/ja-jp/power-query/power-query-what-is-power-query. (Accessed Nov. 9, 2024, Japanese)
10) Reiko Kuroda, Takashi Kawamura, Toshiya Irokawa et al.: Survey on measures to combat overwork for university educators and researchers, and desirable measures to combat overwork in the future. https://www.zsisz.or.jp/investigation/17d0ce19460771611eaa948904198883a8a70381.pdf. (Accessed Nov. 9, 2024, Japanese)
11) Elementary and Secondary Education Bureau, Ministry of Education, Culture, Sports, Science, and Technology. Summary (preliminary figures) of the survey on teachers ' working conditions (2022). https://www.mext.go.jp/content/20230428-mxt_zaimu01-000029160_1.pdf. (Accessed Nov. 9, 2024, Japanese)
12) Promotion of Programming Education. Ministry of Education, Culture, Sports, Science, and Technology: https://www.mext.go.jp/content/20200608-mxt_jogai01-000003284_004.pdf. (Accessed Nov. 9, 2024, Japanese)
13) The elementary and secondary education bureau school digitization project teams Elementary School Programming Education Teaching Case Studies. https://www.mext.go.jp/a_menu/shotou/zyouhou/detail/mext_1375607.html. (Accessed Nov. 9, 2024, Japanese)
14) Ryu Sakamoto, Yutaka Fukunaga, Satoshi Onishi, et al.: Initiatives at a physical therapy school to encourage continued programming learning. Journal of the Japanese Society of Rehabilitation Education, 2021, 4: 148−153. (Japanese)
15) Camelors I. Generative AI tool that can be programmed. Website creation and app development made easy. https://magazine.sokudan.work/post/tips_173#index_FALpQU1d. (Accessed Nov. 9, 2024, Japanese)

16) Kyungah Cheon, Yishu Ling, Jiarong Hu, et al.: Current status and challenges of COVID 19 inf ection control in South Korea. RPSPP Discussion Paper, No. 39. RITSUMEIKAN: POLICY SCI ENCE & PUBLIC POLICY, April 2021. (Japanese)
17) Otawara City. Population. https://www.city.ohtawara.tochigi.jp/docs/2016020400018. (Accessed Nov. 9, 2024, Japanese)
18) Okawa City. Final results of the 2020 census. https://www.library.okawa.fukuoka.jp/s003/toukei/41 5/20161026111545.html.(Accessed Nov. 9, 2024, Japanese)