**Original Article** 



# Evaluation of drug information literacy gained through elearning to prepare students for practical pharmacy experience

## Naoto Nakagawa<sup>1</sup>\*, Keita Odanaka<sup>1</sup>, Hiroshi Ohara<sup>1</sup>, Shigeki Kisara<sup>1</sup>

<sup>1</sup> School of Pharmaceutical Sciences, Ohu University, Koriyama, Fukushima, Japan.

Correspondence: Naoto Nakagawa, School of Pharmaceutical Sciences, Ohu University, Koriyama, Fukushima, Japan. n-nakagawa@pha.ohu-u.ac.jp

#### ABSTRACT

Pharmacists are the only medical professionals who can support pharmacotherapies by searching for, collecting, processing, and communicating appropriate drug information to patients and medical staff. Thus, drug information literacy (defined as appropriate understanding, interpretation, analysis, and restatement/expression of drug information) is essential. We created an e-learning program to train pharmacy students in drug information literacy before beginning their practical experience training. Students could complete the program at home in their free time. We then evaluated the program's educational outcomes in terms of attitudinal change. A cloud-based e-learning system was used in the study. We targeted fifth-year pharmacy students who were preparing for practical experience training. We investigated whether the e-learning program actively enhanced drug information literacy among students by administering a questionnaire to test students' drug information literacy before and after the e-learning program. Twenty-one students were enrolled in the study. The e-learning program significantly enhanced pharmacy students' drug information literacy (p = 0.008) and made them more confident when speaking to physicians or nurses (p = 0.031). Seven out of thirteen respondents (54%) used the acquired literacy in their practical experience training. The e-learning program was able to foster drug information literacy, and pharmacy students were able to apply the literacy during their practical experience.

Keywords: Drug information literacy, E-learning, Pharmacy practice experience training, Pharmacy students

## Introduction

Information retrieval, evaluation, and application skills represent a significant component of the core skill set all pharmacists must possess [1]. Drug information on pharmaceutical products has become increasingly easy to obtain through the Internet. However, the accuracy of the information is questionable. Taking this into consideration, pharmacists must be able to provide accurate drug information to patients and medical staff.

Access this article online				
Website: www.japer.in	E-ISSN: 2249-3379			

How to cite this article: Nakagawa N, Odanaka K, Ohara H, Kisara S. Evaluation of drug information literacy gained through e-learning to prepare students for practical pharmacy experience. J Adv Pharm Educ Res. 2021;11(4):111-5. https://doi.org/10.51847/VIxD33BtyR

That is, pharmacists must possess drug information literacy (DIL)—defined as appropriate understanding, interpretation, analysis, and restatement/expression of drug information. As pharmaceutical products and standard pharmacotherapies are continuously updated, it is increasingly important that pharmacists be able to correctly examine and interpret drug information to accurately administer appropriate pharmacotherapies to patients and other medical staff.

We previously elucidated that Japanese pharmacists are less likely than American pharmacists to make a habit of critically reading clinical trial literature [2]. One of the reasons is that Japanese pharmacists did not learn how to critically examine clinical trial literature when they were students. The Drug Information committee of the Japan Pharmaceutical Association also reported that Japanese pharmacists need to improve their DIL for the evaluation of pharmacotherapies [3].

Recently, e-learning programs have been globally utilized online [4-6]. Here, e-learning is defined as learning conducted through

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms. an Internet process [7]. A review article reported that e-learning in pharmacy education effectively increases knowledge and is a highly acceptable instructional format for pharmacists and pharmacy students. However, there is limited evidence that elearning effectively improves skills or professional practice. Moreover, there is no evidence of long-term learning outcomes [8]. In this study, therefore, we seek to examine behavioral changes-specifically, the transfer of learning to the workplace-brought about through a DIL-focused e-learning program. Attitudinal change as a result of e-learning is one of the best strategies to create this transfer to the workplace [9, 10]. Therefore, we created an e-learning program to train pharmacy students in DIL. The program targeted P5 students (fifth year) before they began their practical pharmacy experience training (PPE). The e-learning program we created allowed students to learn at home in their free time. We then evaluated the program's educational outcomes in terms of attitudinal changes among the students.

# Materials and Methods

This study targeted P5 students (fifth year) who had prepared for their PPE. In Japan, pharmacists receive six years of training, and students received five months of practical clinical training in their fifth year. The e-learning program in this study was conducted from January 23 to February 25, 2019. It took place before the students began their PPE. The program was not required for P5 students.

#### E-learning content

The e-learning platform used in this study was a cloud-based elearning system called "ManaBeat" (SSTT Co. Ltd., https://satt.jp). **Table 1** shows the content of the program. Topic videos and report assignments were uploaded on the platform. Students were required to finish a content component before the next became available on the platform. Content units 1 and 2 included videos on understanding evidence hierarchy and using the web and Google Scholar to search for therapeutic guidelines. Students were then asked to apply these skills in content unit 3. Faculty members added comments and corrections to students' report files and gave feedback to them online. After that, students watched a final video regarding using the web for medical terminology and Google Translation in unit 4. Finally, in unit 5, they were asked to apply skills based on content units 1, 2, and 4.

Table 1. Content of the e-learning program				
Content	Method	Concept		
1. How to identify Japanese primary literature	Watching a topic video (7 min 55 s)	Understand evidence hierarchy		
2. How to find Japanese primary literature	Watching a topic video $(7 \min 44 s)$	Using Google Scholar and searching the web for therapeutic guidelines		
3. Report assignment 1	Report correction	Performance evaluation through an assignment based on content units 1 and 2.		
4. How to read English primary literature	Watching a topic video $(7 \min 43 s)$	Using Google Translation and searching the web for medical terminology		
5. Report assignment 2	Report correction	Performance evaluation through an assignment based on content units 1, 2, and 4.		

Topic videos and report assignments were uploaded on the platform "ManaBeat." Students were required to finish a content unit before the next became available.

## Outcomes

The primary outcome of the study was whether the e-learning program actively enhanced the P5 students' DIL. The outcome was evaluated using questionnaires regarding DIL before and after the e-learning program. Figure 1 shows the questionnaire schedule. The questions were as follows: "Q1. Do you understand the meaning of DIL?," "Q2. How important do you think drug information is in your practical training?," "Q3. Do you find the primary source of drug information useful if you come across something you don't know about medications or pharmacotherapies in your practical training?," "Q4. Would you like to find and respond to primary literature if you come across something you don't know about medications pharmacotherapies in your practical training?," and "Q5. Can you reasonably answer questions about medications from physicians and nurses in your practical training?" Each question was answered on a Likert scale from 1 to 4.



Figure 1. Questionnaire schedule for the e-learning program

A secondary outcome was how P5 students who took the program utilized their DIL skills during their PPE. A second survey was performed after they finished their PPE. The survey included the following questions: "Q1. Did you utilize your skills during the practical training period?" and "Q2. Which practice training did you utilize your skills, community pharmacies or hospital?"

#### Statistics

The sample size for the study was calculated with G\*Power software, version 3.1. The calculation was carried out by assuming the use of matched-pairs Wilcoxon signed-rank test (2-tails, effect size = 0.5, alpha = 0.05, 80% power). G\*Power suggested we would need 35 participants.

Categorical data were analyzed with the Chi-square test and Fisher's exact test. The Wilcoxon signed-rank test was carried

out to compare data between students who responded to the preand post-questionnaires for the primary outcome. P values of less than 0.05 were statistically significant. All statistical analyses were performed with EZR ("Easy R") (Saitama Medical Center, Jichi Medical University, Saitama, Japan), which is a graphical user interface for the programming language, R (The R Foundation for Statistical Computing). More precisely, it is a modified version of R commander, designed to add statistical functions that are frequently used in biostatistics [11].

#### Ethical considerations

This study was approved by the ethics committee of Ohu University (No. 283). Written informed consent was obtained from those students who were willing to participate in this study.

All methods were performed following the relevant guidelines and regulations.

## Results and Discussion

Table 2 shows the demographic backgrounds of the participants. The total number of participating students was 21, of which 10 were female and 11 were male. Because 66 students were in P5, 31.8% of P5 students participated in the study. There were no significant differences in terms of GPAs and average score ratio on the Drug Information section on external exams, adjusted by a national average between female and male students (GPA; p = 0.662, external exam score ratios; p = 0.868).

Table 2. Demographic backgrounds of participants				
	Female	Male	p-value	
Number	11	10	-	
GPA (1-4)	3.4 +/- 0.4	3.3 +/- 0.4	0.662	
Average score ratio of Drug Information section on external exams (Adjusted by national average)	1.08 +/- 0.18	1.07 +/- 0.24	0.868	

Figure 2 shows the results of the questionnaires for the primary outcome. There were significant differences between the preand post-learning questionnaires regarding Q1 (p = 0.008) and



Q5. (p = 0.031). In contrast, there were no significant differences regarding Q2 (p = 0.371), Q3 (p = 0.572), and Q4 (p = 0.129).



Q2. How important do you think drug information is in your practical training?

Q3. Do you find the primary source of drug information useful if you come across something you do not know about medications or pharmacotherapies in your practical training?

Q4. Would you like to find and respond to primary literature if you come across something you do not know about medications or pharmacotherapies in your practical training?

Q5. Can you reasonably answer questions about medications from physicians and nurses in your practical training?

Figure 2. Results of the questionnaire for the primary outcome

Figure 3 shows the results of the questionnaires for the secondary outcome. Seven of the 13 students (54%) who responded used the DIL skills they had acquired, and they applied the skills more often in hospital training than in community

pharmacy training. Table 3 summarizes the free descriptions given by students who took part in the program.



**Figure 3.** Results of the second survey after pharmacy practice training (n = 13)

Note: Regarding Q2, four of seven students who participated
responded, "Community pharmacy" and "Hospital."

This study aimed to elucidate whether the e-learning program actively enhances DIL among P5 students. The program significantly enhanced pharmacy students' understanding of DIL, and they became more confident in terms of answering questions from physicians or nurses. Seven of the 13 students (54%) who responded to the post-PPE questionnaire (secondary outcome) said that they utilized DIL in their PPE sites. Therefore, the elearning program to foster DIL was successful. Nonetheless, Table 3 shows the reasons why some students did not use DIL. For the most part, the students stated that they did not encounter an opportunity to use DIL at their PPE sites. We would evaluate these reasons as doubtful because pharmacy students do not have enough knowledge regarding a variety of pharmacotherapies most of the time. Otherwise, as the Drug Information committee in the Japan Pharmaceutical Association reported previously [3], Japanese pharmacists need to improve their DIL to be able to evaluate pharmacotherapies, which suggests some preceptors might not ask students to search for evidence using DIL.

Table 3. Free descriptions from students who took the e-learning program (n = 13)				
Sito	Using Drug Information Literacy Skills			
5.10	Yes	No		
	The Minds Guideline Library helped us find out about unknown treatments			
	for children. I realized that acquiring the reliability of information sources			
	such as primary literature to find information with a high level of evidence			
	will be useful skills in the future.			
Community	Study session about diseases, slide making			
	During understanding prescriptions, I often had opportunities to look up			
	treatment guidelines for medications for which I do not know exactly why	# Because there was no scene to utilize the skill during the		
	they were prescribed. Because I took the course, I immediately knew where	training.		
	and how to look up, so my work was smooth.	-		
	The Minds Guideline Library helped us find treatment guidelines for	# I didn't have the opportunity to use my skills.		
	pulmonary embolism and lung cancer. I also searched for cardiovascular			
	events in Febuxostat and Allopurinol using Google Scholar.	# Practice sites were busy, and I had no time to use my skills. I		
	Case presentation	did not encounter the required scene.		
	I had a lot of challenges to encounter special illnesses than when I was			
	practicing at a community pharmacy, and I also filled unusual (unfamiliar)	# I didn't have the opportunity to be aware of the primary		
Hospital	prescriptions. So, I had many opportunities to look up treatment guidelines	literature or read English literature during practical training.		
	and to utilize them. In addition, I had many opportunities to talk about the			
	evidence of therapeutic drugs with a preceptor. I was glad I took the course.			
	I searched for guidelines and used them to compare standard treatments for			
	each disease with actual treatments.			
	I used it during DI training			
	Chemotherapy guidance to a patient with cancer			

Legris *et al.* reported that a web-based training program on medication use in chronic kidney disease patients elucidated an improvement in participating pharmacists' knowledge and skills [12]. In particular, skill scores were increased by 24% compared with the control group. This study was evaluated as a high-quality study in the review article [8]. Therefore, we can partly support this report with the results of the current study.

The e-learning program was opened to P5 students for about one month from January 23 to February 25 in 2019. Ten of the 21 participating students started their PPE just after finishing the elearning program. However, eight started PPE three months later, and the other three started it six months later because of practice site issues. Therefore, we assume that students who started their PPE several months after finishing the e-learning program may forget how to apply the DIL during their PPE, which would suggest that the e-learning program in this study did not show a long-term effect.

A review article summarized the advantages and disadvantages of e-learning [13]. The advantages include learner-centered content, in which learners choose the content, sequence, and pace of learning based on their experience and personal learning objectives. The content is also more accessible (learner decides on location and timing) and interactive than traditional large group classes. Further, there is improved interaction with teachers and other learners. In contrast, the disadvantages were summarized as a loss of personal learner-teacher interaction, the requirement for self-motivation to timetable and complete learning, and loss of the social context of the learning experience in the absence of peers. In this study, faculty members often interacted with participants who handed in their reports through e-mail feedback. Therefore, we determined that the loss of personal learner-teacher interaction was minimal. However, since the e-learning program required self-motivation to timetable and complete learning, a few students dropped out, which implies that it may be necessary to remind participants to complete the program.

This study had some limitations with the first one being the small number of students who participated in the e-learning program. Only 21 participated, which was less than the sample size of 35. This e-learning program was not required and was without credits. That would be the reason for the small number of participants. Because the program proved useful in terms of fostering DIL in the study, the next strategy is to include the program as a selective course with credits in the future. Second, this study did not compare with a control group. To increase the quality of the study, a control group should be set next time.

### Conclusion

This study aimed to elucidate whether an e-learning program actively could enhance DIL among P5 students in Japan. In conclusion, the program was able to foster DIL, and pharmacy students were able to apply DIL during their PPE.

Acknowledgments: We owe a very important debt to Prof. Hayasaka, who provided technical help and encouragement.

#### Conflict of interest: None

Financial support: This work was supported by the Research Funding Granted by Ohu University President under Grant 2019.

Ethics statement: This study was approved by the ethics committee of Ohu University (No. 283). Written informed consent was obtained from those students who were willing to participate in this study. All methods were performed following the relevant guidelines and regulations.

## References

 Malone PM, Malone MJ, Park SK. Drug Information Education and Training. Drug Information, A guide for pharmacists. Sixth ed. McGraw-Hill Companies, Inc.; 2018:1153-1170:chap 27.

- Nakagawa N, Murai Y, Obara T, Ohara H, Kurita S, Lai L. Comparative Study of Pharmacists' Perceptions of Clinical Literature Accessibility between Japan and USA –A questionnaire survey between Miyagi prefecture and the State of Florida. Jpn J Drug Inform. 2018;19(4):180-7.
- The Pharmaceutical Affairs Information Center will be peeled off to improve the member's drug information literacy. J Jpn Pharm Assoc. 2014;66(10):1423-30.
- Bond SE, Crowther SP, Adhikari S, Chubaty AJ, Yu P, Borchard JP, et al. Evaluating the Effect of a Web-Based E-Learning Tool for Health Professional Education on Clinical Vancomycin Use: Comparative Study. JMIR Med Educ. 2018;4(1):e5. doi:10.2196/mededu.7719
- Bredesen IM, Bjøro K, Gunningberg L, Hofoss D. EGect of elearning program on risk assessment and pressure ulcer classification - a randomized study. Nurse Education Today. 2016;40:191-7. doi:10.1016/j.nedt.2016.03.008.
- Isaacs AN, Nisly S, Walton A. Student-generated e-learning for clinical education. Clin Teach. 2017;14(2):129-33. doi:10.1111/tct.12526.
- Drayton SJ, Weeda ER, Avery LM, Penland B, Knight J. Impact of a co-curricular, e-learning activity on pharmacy student knowledge of laboratory values. Curr Pharm Teach Learn. 2019;11(1):87-93. doi:10.1016/j.cptl.2018.10.001.
- Salter SM, Karia A, Sanfilippo FM, Clifford RM. Effectiveness of E-learning in pharmacy education. Am J Pharm Educ. 2014;78(4):83. doi:10.5688/ajpe78483
- Sinclair PM, Kable A, Levett-Jones T, Booth D. The effectiveness of Internet-based e-learning on clinician behaviour and patient outcomes: A systematic review. Int J Nurs Stud. 2016;57:70-81. doi:10.1016/j.ijnurstu.2016.01.011.
- Aoshima S, Kuwabara H, Yamamoto M. Behavioral change of pharmacists by online evidence-based medicine-style education programs. J Gen Fam Med. 2017;18(6):393-7. doi:10.1002/jgf2.110.
- Kanda Y. Investigation of the freely available easy-to-use software 'EZR' for medical statistics. Bone Marrow Transplant. 2013;48(3):452-8. doi:10.1038/bmt.2012.244
- Legris MÈ, Séguin NC, Desforges K, Sauvé P, Lord A, Bell R, et al. Pharmacist Web-based training program on medication use in chronic kidney disease patients: impact on knowledge, skills, and satisfaction. J Contin Educ Health Prof. 2011;31(3):140-50. doi:10.1002/chp.20119
- Maxwell S, Mucklow J. E-Learning initiatives to support prescribing. Br J Clin Pharmacol. 2012;74(4):621-31. doi:10.1111/j.1365-2125.2012.04300.x