

The study on the necessity of online safety education software development for research staff

Yuna Kwon¹, Young-Guk Kwon¹

¹ The Graduate School of Energy&Environment, Seoul National Univ. of Science and Technology, 232Gongneung-ro, Nowon-Gu, Seoul, 139-743, Rep. of Korea
{yuna7472@hanmail.net}

Abstract. The study analyzed 334 universities in year 2012 and 359 universities in year 2014 of inquiry result from laboratory safety management status by means of Laboratory Safety Act. The study result highlights that chemical engineering field used to have the greatest number of laboratories in year 2012, but it has transferred to biotech/microbial field in year 2014, causing difference in the number of laboratory by study fields. Second, 12 hour education in year 2014 has increased by over 50% at universities of any type when compared to that of year 2012. This phenomenon indicates that the laboratory safety education in universities for research staffs is being well established and settled. Last, the preference in software development of online education program for the research staff shows that there is a high preference in the development of "laboratory safety education program by study field" and "development of laboratory safety education program by education subjects (bachelor's degree, Master, doctorate)". Therefore, it is necessary to develop a software that includes safety education contents for education subjects (bachelor's degree, Master, doctorate) and their study fields.

Keywords: Online safety education, Software development, Laboratory safety & health, Safety management, Online education

1 Introduction

Due to the rapid development of ICT(Information & Communication Technology), there is a sudden increase in the use of internet based education on-site. Especially, the increase in the use of internet based e-learning provides an opportunity to review the routinely practiced educations. The demand of approaching industrial safety education in the method of ICT applied education is also increasing [1]. In-country laboratory accidents have been reported annually since the 1999 SNU nuclear engineering explosion accident. The main cause of accident is chemical materials, but the factors that cause accident are too broad. Therefore, education and management of laboratory accident precaution is highly necessary [2].

Therefore, in order to provide accident compensation and prevention of laboratory accident, government has established an enactment regarding composition of laboratory safety environment (A.K.A Laboratory safety act). Safety educations are

conducted as means of safety measure and research staffs are obligated to attend this safety education.

The educational contents enshrined in the legislation must include regulations related to composing safe laboratory environment, laboratory hazard related factors, safe research and development activity related factors, material safety data related factors, and laboratory safety management related factors.

Moreover, it clearly states that research staffs (undergraduate, graduate student) are obligated to attend periodic safety education of over 6 hours per half-year or 12 hours per year. However, the year 2010 inquiry highlights that the execution ratio of safety education in university, both online and collective education put together, fall short of under 45%, and the efficiency of safety education is also found to be inadequate [3]. Unlike other ordinary industrial sites, universities do not have a uniformed and standardized process, their research environment alters in accordance with the research staff's given projects [4], and that the safety education textbook is uniformed despite the types of handling substances and hazard factors of each laboratory vary. The education for research staffs being conducted until now used to be in the format of a collective education at the initial trial of laboratory safety act, but the method of education has developed into online education. However, the foundation of laboratory safety data of software and other data are not yet established. According to the study result of year 2009, 53,184 personnel attended the online education, and it has gradually increased to 82,131 personnel in year 2011. The number of research staffs who has attended online education has grown approximately 1.54 times (154%) in year 2011 compared to that of year 2009 [3]. In the latest study result of year 2014, 331,824 staffs have attended online education and this value is 6.2 times (623.9%) increase compare to that of year 2009, which indicate that the number of online participation is rapidly increasing [5]. Furthermore, the analyzed result of universities' safety education status illustrate that there are still inefficient education being conducted such as assembling and educating all research staff of different major fields, planning educational contents. Therefore, it is necessary to develop customized online educational contents that can prevent accident through composing educational contents suitable for each individual majors and utilize it in the real situations.

Therefore, the purpose of this study is to grasp the method and current situation of laboratory safety education, and provide suggestions for the necessity of data development program in order to activate online education.

2 Study method

The study analyzed university institute inquiry of Laboratory Safety Act's laboratory safety management status result. Current status of university institutes that have participated in the study is 334 institutes in year 2012 and 359 institutes in year 2014, as shown in <Table 1>

Table 1. University institute status by year n(%)

Classification	Year		Total
	2012	2014	
University	180(53.9)	197(54.9)	377(54.4)
2,3 year-course college	121(36.2)	127(35.4)	248(35.8)
Polytechnics	33(9.9)	35(9.7)	68(9.8)
Total	334(100.0)	359(100.0)	693(100.0)

3 Study result

3.1 (year)Difference in the number of laboratories by study field

The number of laboratories by study field is shown in the <Figure 1>. Chemical engineering field had the greatest number of laboratories in year 2012 with 27.89 labs, whereas biotech/microbial field had the greatest number of laboratories in year 2014 with 22.59 labs. The overall number of laboratories is decreasing in year 2014 when compared to that of year 2012.

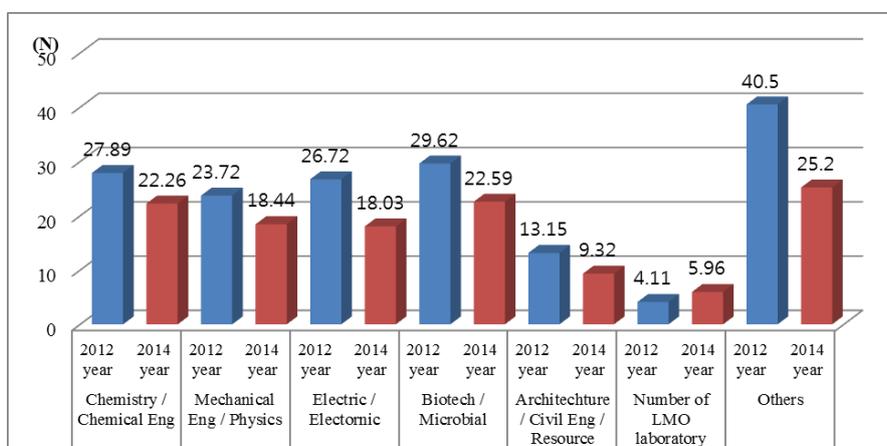


Fig 1. (year)Difference in the number of laboratories by study field

3.2 Regular education and training time of Research staff

The regular education and training time of research staff is indicated in <Table 2>. In year 2012, over 50% of 4 year-course university had the highest percentage in the

education time of over 12 hour category, whereas 2,3 year-course college and polytechnics had the highest percentage in the 'Not conducted' category. In year 2014, university institutes of all types show that over 12 hour education category has the highest percentage and 'Not conducted' category with the lowest percentage.

Table 2. The difference in regular education and training time of research staff by year n(%)

Year	university institute classification	Regular education and training time of research staff				Total
		over 12 hour	less than 12 hour	Not conducted	N/A	
2012	University	91(50.6)	35(19.4)	35(19.4)	19(10.6)	180(100.0)
	2,3year college	34(28.1)	23(19.0)	53(43.8)	11(9.1)	121(100.0)
	polytechnics	8(24.2)	6(18.2)	15(45.5)	4(12.1)	33(100.0)
	Total	133(39.8)	64(19.2)	103(30.8)	34(10.2)	334(100.0)
2014	University	133(67.5)	44(22.3)	17(8.6)	3(1.5)	197(100.0)
	2,3year college	57(44.9)	55(43.3)	14(11.0)	1(.8)	127(100.0)
	polytechnics	24(68.6)	7(20.0)	2(5.7)	2(5.7)	35(100.0)
	Total	214(59.6)	106(29.5)	33(9.2)	6(1.7)	359(100.0)

3.3 Disciplinary actions on not conducting laboratory safety education

For the disciplinary actions on not conducting laboratory safety education, limitative restriction are proceeded such as no particular disciplinary action taken in action or 'Restrict laboratory access' or 'Restrict research paper and qualification exam application'.

Table 3. Disciplinary actions on not conducting laboratory safety education n(%)

	Disciplinary actions on not conducting laboratory safety education						Total
	Personnel disadvantage	Restrict laboratory access	Restrict research paper and qualification exam application	No disciplinary action	Others	No response	
2012	2(.6)	41(12.3)	3(.9)	207(62.0)	48(14.4)	33(9.9)	334(100.0)
2014	9(2.5)	68(18.9)	3(.8)	208(57.9)	49(13.6)	22(6.1)	359(100.0)

3.4 Research staff educational method and number of participant

Multiple response analysis result of educational method for research staff shows that year 2012's collective education is 83.2% and online education is 16.8%, whereas year 2014's collective education is 63.9% and online education is 36.1%. This indicates the transitioning trend of educational method, from collective to online education.

In addition, comparing year 2012 and 2014, participation in both collective and online education has approximately doubled, and the number of online education participants has grown in year 2014 when compare to that of year 2012.

Table 4. Research staff educational method and number of participant n(%)

Year	Educational method	Number of participant		
		N	%	Mean±SD
2012	Collective	154	83.2	856.58±1868.19
	Online	31	16.8	1908.61±2859.72
2014	Collective	221	63.9	1673.08±2182.45
	Online	125	36.1	2654.59±3511.16

3.5 Preference in the development of online education program software

The multiple response analysis result of preference in development of online education program software is shown in <Table 5>. As shown in the table, both year 2012 and 2014 responded that the most important factor is the ‘development of laboratory safety education program of each study field’, and the preference in the ‘development of laboratory safety education program by each education subject’ has grown in year 2014.

Table 5. Preference in the development of online education program software n(%)

Preference in the development of online education program software	2012		2014	
	n	%	n	%
Development of laboratory safety education program by major	330	30.4	351	27.9
Development of laboratory safety education program by type of accident	285	26.2	289	23.0
Development of laboratory safety education program by type of university institute	151	13.9	156	12.4
Development of laboratory safety education program by education subject	135	12.4	270	21.5
Development of laboratory safety education program by type of laboratory	186	17.1	191	15.2
Total	1087	100.0	1257	100.0

4 Conclusion

The purpose of this study is to investigate preference in the development of online safety education program software, and the result is concluded as follows.

First, chemical engineering field used to have the greatest number of laboratories in year 2012, but it has transferred to biotech/microbial field in year 2014, causing difference in the number of laboratory by study field.

Second, education time of 12 hour or more for research staffs has grown over 50% in year 2014 when compared to that of 2012, and this represents that laboratory safety education is being well established and settled in the university institutes.

However, there are insufficient disciplinary actions taken when not conducting safety education, thus development and management of evaluation program is necessary.

Third, the percentage of online education in universities has increased when compared to that of collective education. The main purpose of this phenomenon is predicted to be the ineffectiveness of collective education due to location and time restriction, and convenience of online education such as easy access and management on attendance and other factors. The preference in the development of online education program software for the research staff indicates that there is a high preference in the development of "laboratory safety education program by study field" and "development of laboratory safety education program by subject for education (bachelor's degree, Master, doctorate)". Therefore, the study emphasizes that, in the future, it is necessary to develop an online education program that comprise characteristics of study fields and contents regarding education subject's laboratory safety management. The main purpose of laboratory safety education is to reflect the status of research sites and reinforce accident prevention and management capability. However, current laboratory safety education is conducted without reflecting research staffs' major or institutes' characteristic and is only based on the textbook lecture, being weighed more on knowledge based education than practical education. In order to compensate these problems, online education for research staff has been attempted for its advantages over collective education such as flexible lecture time, consistency of lecture information, and high quality of lecture contents. However, development of various laboratory safety education software that fits major and institute type is essential, thus numerous reviews and verification process should be conducted in order to be comprehensible for research staff and applicable to research activities. In this study, only a fragmentary research on the online safety education status and preference in the development of education program software has been conducted. However, in the future, it is essential to proceed with the study on the development procedure of education software in order to activate online safety education.

References

1. M.-S Jeong. :Efficiency measures of safety training through e- learning, Korea National Open University.,(2007)
2. Y.-s Lee. :A Study on Establishment of Objective and Scientific Research Laboratory Safety Policy through Survey on the Current Status. Ministry of Education and Science Technology(MEST)., Technical report (2013)
3. Y.-s Lee. : A Study of improvement plan for research laboratory safety policy through survey on the current status ,Ministry of Education and Science Technology(MEST)., Technical report (2011)
4. C.-G Ji, Hyuk Il Kwon. : A study on the Improvement of Safety in the Laboratory, Journal of Korea Safety Management & Science, vol.6, No.4 , pp47—59, Korea(2014)
5. M.- s Cho. : A study on current status of laboratory safety management for the establishment of laboratory safety policy, Ministry of Education and Science Technology(MEST), Technical report(2014)