

Orientating Attempts to Improve Students' Understandings of the Significance of Information and Communication Technology in Medical Sciences

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医療系専門科目としての「情報科学」IV — 医学・医療との関わりの理解向上を目的とする 国家試験出題傾向と現場意識の紹介 —

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Key words : informatics education, medical technologist, association of informatics and medicine, students' awareness, evaluating teaching skills

Information science is one of the designated subjects in the national licensing examination for medical technologist. Therefore it is set as a specialty subject in majority of the training schools. However, the students seem to be far from understanding the significance of information and communication technology in medicine with concrete images. To improve students' understandings and awareness of studying informatics, commentary presentation was given at the beginning of the term. This includes rudimentary condition of their knowledge, history of computer technology and application in laboratory medicine, knowledge requirements of licensing examination, and recognition of working medical technologists. As a result, positive self-evaluation on their understandings reached to 92% after the commentary, whereas 71% before the commentary. In addition, 67% of the students said that the real requirements were different from those they had estimated. An introduction of the survey results of recognition by actual working technologists was particularly received a good evaluation by the students. Such commentary would be also effective for improving students to understand the significance of their knowledge learnt in another subject that the relation with medicine seems to be unclear. It still remains as the issue that the students hardly associate what they studied in the class with their actual performance using computers and network systems.

Introduction

The modern medicine is supported by the advanced knowledge and technology even if a direct

relation is hard to be seen clearly. The information and communication technology (ICT) may be one of them. Today the network environment is counted as one of the social infrastructure as well as electric-

ity, water supply and telephone service. It is still in our memory that the Internet played an important role as a means of communication in confusion just after 2011 Tohoku earthquake and tsunami disasters.

In the field of medicine, network technology supports a medical service as a hospital information system such as information sharing and a mean of communication including electronic medical records and the medical ordering system as well as an accounting system. The Internet connects a hospital with another institution and enables to get second opinion from a distant place. It will be also helpful to support effective home medical care system. In laboratory medicine, computer has controlled auto-analyzers since the earlier period and been indispensable in clinical examination including image processing. On these bases, information science is one of the designated subjects in the national licensing examination for medical technologist. Therefore, it is set as a specialty subject in the training course, in addition to a literacy subject in general education.

On the other hand, students of recent generation should be familiar with using computer and network. They use the Internet to find references in classes from the primary school to the high school, smart phones or feature phones for peer communication. In concern with theoretical knowledge of mechanisms, Information Science is a compulsory subject in the high school curriculum. Additionally, most of colleges offer them a course on basic informatics and computer literacy in general education. In this way, students have enough opportunity to learn knowledge and technique on information science.

However, the rudimentary knowledge of the students is not enough to start a specialty class for laboratory medicine in our course¹⁾. Naturally all the students will agree that ICT is indispensable to the staff engaging in modern medicine, but it seems to be difficult for them to have clear image how ICT supports medicine and what they have to learn in the course. They do not have real feeling. Most students did not

realize that informatics is designated subject in the licensing examination until the course started. This might be a reason that they did not sincerely face to the basic class in the college and possibly felt just a simple repetition of what they had learnt in high school. In fact, general users will not have a trouble if they do not know the computer and network mechanism as a black box. Thus our students may be unconscious of being required the knowledge “inside” the computer and network technology.

The author previously reported the conditions of the students’ knowledge of ICT at the starting time of the class¹⁾, knowledge required in the licensing examination analyzed by a tendency of questions²⁾, knowledge and techniques recognized to be essential by working technologist in clinical laboratories³⁾. To improve the students’ recognition on the relation between ICT and medicine, and make them be conscious of the background of the study, the author gave them a commentary presentation on these findings. In this study, the changes in their self-evaluation of understandings and recognition what they have to learn were investigated.

Methods

Students : The students were 41 and 44 sophomores in 2012 (Class of 2015) and 2011 (Class of 2014) of the Department of Medical Technology, School of Health Sciences, Tohoku University, respectively. These students had got the credit of basic information science in “Subject Common across Campus” in their freshman year. The specialty subject was “Information Science in Medical Technology”. The sophomores in 2010 (Class of 2013) for comparison in term-end evaluation have the same background.

Questionnaire survey before commentary presentation : In the first class of the course, a questionnaire investigation was performed. This is the annual survey of students’ rudimentary knowledge and requests for study as previously reported¹⁾. The

students were noticed that this survey was a part of the studies on informatics education and asked for their cooperation. In this study since 2011, additional questions were asked ; (1) Why do you think you should learn informatics as a specialty subject in addition to general education? (2) How do you evaluate your acquisition of computer skills and knowledge got from primary school to college general education? (3) Do you think that you understand the association of the learning items in this subject with medicine and health sciences? As question (1), the students were asked for free description, while they were asked to classify into 4 rating scales in questions (2) and (3). In concerning question (3), the positive respondents were asked how they estimate the association, and the negative respondents were asked which point is unclear. All the respondents were asked how much knowledge and skills they suppose to be required for engaging clinical examination.

Commentary presentation : The commentary presentation was performed on the second class in the next week. First, the status of the students' knowledge as results of the first questionnaire was shown. Next, the history of computer and network technology was explained (Fig. 1A). Then the required knowledge derived from the tendency of questions asked in the licensing examinations over past 30 years²⁾, and essential knowledge and skills recognized by medical technologists working in clinical laboratories³⁾ were introduced (Fig. 1B). After the commentary, the second questionnaire survey was done to analyze the change in students' consciousness on association of informatics with medicine. The questions were as follows ; (1) When did you realize that informatics is a designated subject in licensing examination? (2) Did you understand or gain a deeper understanding how the learning items in this class associate with medicine and health sciences? (3) Is there any difference between the required knowledge and skills you had es-

timated and those introduced by this commentary? (4) Was this commentary helpful for you to understand the association of informatics with medicine and health sciences? In question (1), three choices were given : this class, after admission to university, before admission to university. In questions (2) and (4), the students were asked to classify into four ratings. With regard to question (3), they were asked to describe the details of difference.

Term-end evaluation : In School of Health Sciences, Tohoku University, a system of evaluating teaching skills of the faculty by students has been established in 2009⁴⁾. The perspectives were shared by teachers in annual faculty development program. As for one of 10 questions, "did you understand how the learning items of this subject or field associate with medicine and medical care?" The teaching skill is evaluated by classifying into 5 rating scales including neutral as well as positive and negative evaluation. The author employed those results for students' evaluation at the term-end, and compared the ratings before and after giving the commentary presentation.

Results and Discussion

According to the first survey at the beginning, majority of the students did not have confidence in their acquisition of computer skills and knowledge. As shown in Fig. 2, the rates of positive self-evaluation were 24% and 40% in 2012 and 2011, respectively. Although this rate changes by the year, the tendency is similar¹⁾. In respect of understanding how the informatics associate with medicine and health sciences, 3% and 68% of the students replied "understand" and "understand to a certain extent" in 2012, respectively. In 2011, positive evaluation was only "understand to a certain extent" and the value was 85% (Fig. 3). Thus most of the students seemed to bring themselves to have understood. However, they could not show concrete contents of their recognition. They described such as "re-

quired the knowledge to process the patients data”, “required the knowledge for data security” (Table 1), but not like knowledge of file format, protocol,

mechanism of firewall and others.

In contrast, the degree of positive self-evaluation was improved after commentary presentation on re-

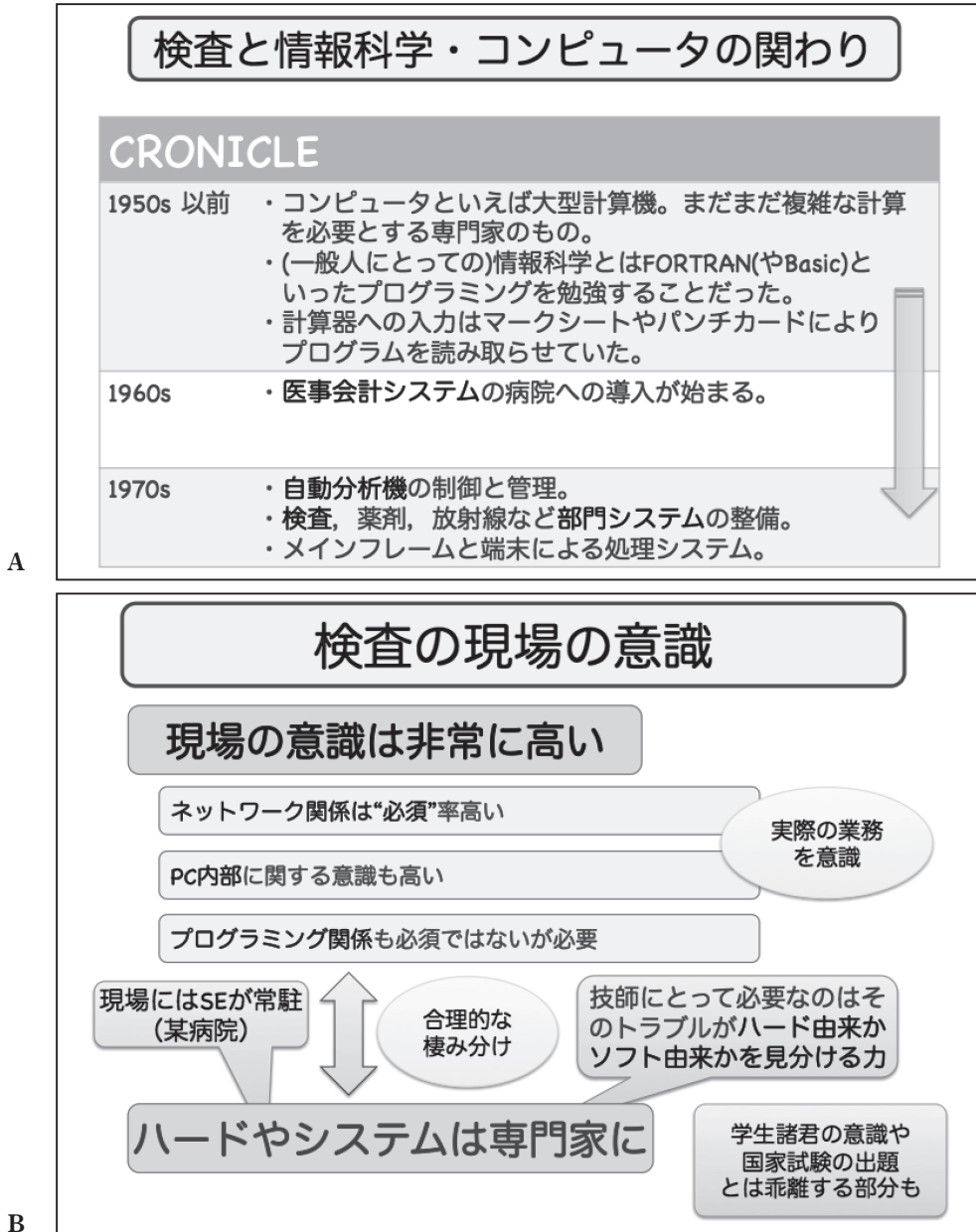


Figure 1. Charts shown in commentary presentation. (A) History of computer and network technology (part). (B) Perspectives of survey on working medical technologists. Real data were previously reported (Ref. 3)

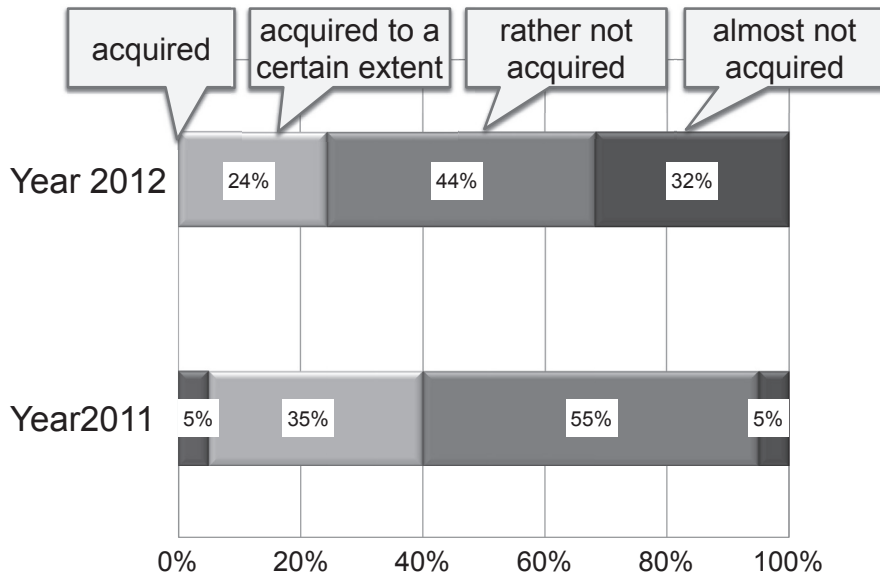


Figure 2. How do you evaluate your acquisition of computer skills and knowledge ?

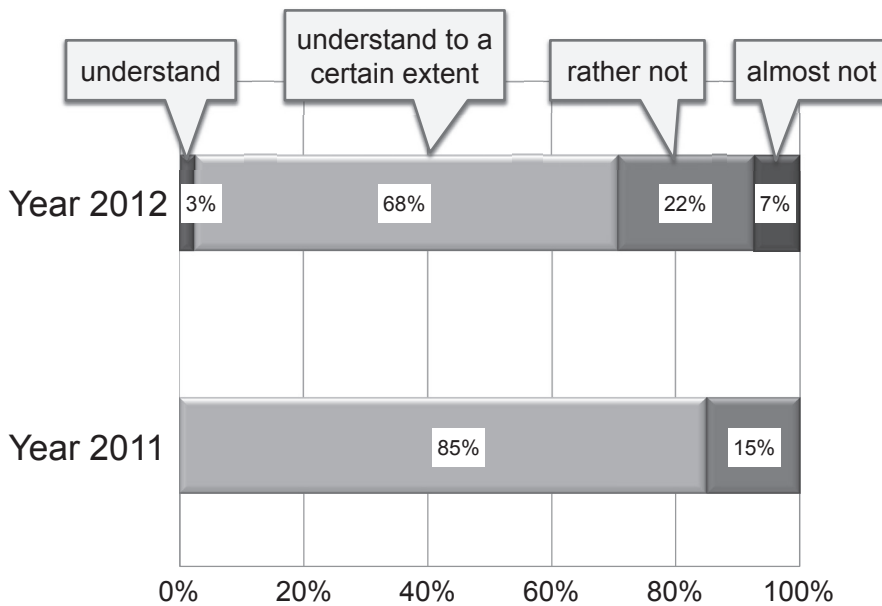


Figure 3. How do you evaluate your understanding association of the learning items in informatics with medicine and health sciences ? (Before commentary presentation)

Table 1. How do you estimate the association of ICT with medical and health sciences? Representative description by students before commentary presentation.

- In the current medicine, digital instruments has become popular both in clinical care and studies. It is necessary for a medical staff to understand the background and mechanism.
- It is necessary to share information among the staff, for speedy and relevant clinical examination and care.
- Statistical processing is essential for clinical examination, and computer is necessary for the purpose.
- Patients data will be processed by instruments.
- Patients data will be managed and processed by PC.
- We should learn network and information system used in the hospital, and should prevent a leak of the patients personal information.
- I understand informatics is necessary to handle patients information, but I cannot have a concrete image how it is concerned.

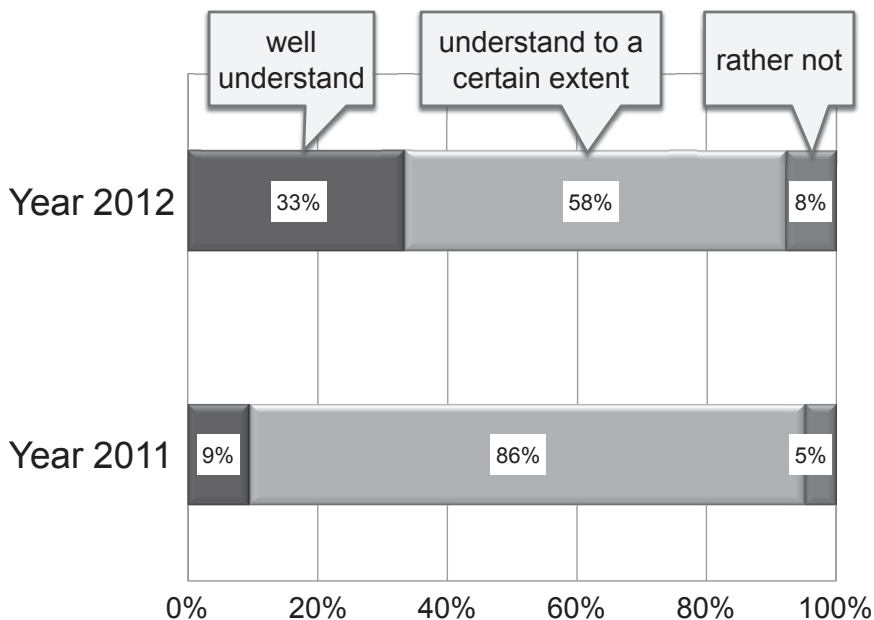


Figure 4. Did you understand or gain a deeper understanding how the learning items in informatics associate with medicine and health sciences? (After commentary presentation)

quired knowledge by licensing examination and recognition by working medical technologists (Fig. 4). In 2012, the students replied “understand” and “understand to a certain extent” both increased to 33% and 59%, respectively, where the rates in 2011 were 10% and 86%. Furthermore, it should be noted that over two thirds of the students had changed their recognition in details of content. Sixty-seven and 71% of the respondents in 2012 and 2011 replied that the required knowledge and skills introduced by

the commentary were different from those they had estimated (Fig. 5). According to the description summarized in Table 2, they realized that the knowledge of much higher level are required than they estimated, and impressed that even the outdated knowledge such as programming are recognized to be still essential by the technologists working in clinical laboratories: As mentioned above, users after 1990s can operate computers without programming by themselves. Furthermore, the laboratory

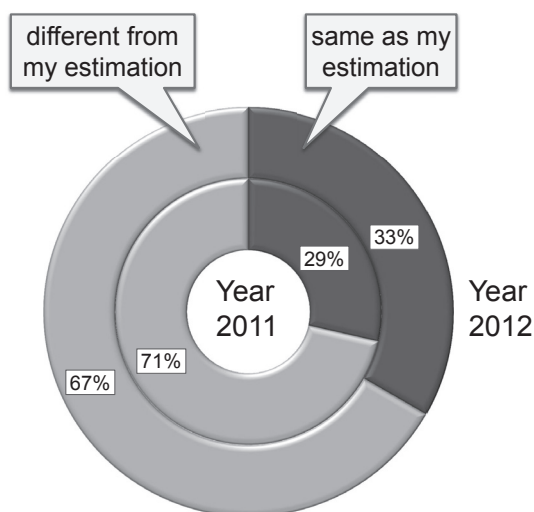


Figure 5. Is there any difference between the required knowledge and skills you had estimated and those introduced by this commentary ?

technologists demanded knowledge of statistical processing, skill for presentation and document processing. There should be a considerable impact on the students to realize that the knowledge of operating mechanism of computer and network is required as medical technologist. Some of them might have been thought that they should just be able to operate a personal computer. With regard to the contents of commentary presentation, 98% of the students gave positive evaluation in both of the years (data not shown). Particularly, the introduction of consciousness of working medical technolo-

gists received high evaluation. In addition, more than 80% of the students replied that they realized informatics as a designated subject in the licensing examination after admission to the university, and who knew it before the admission was only one in each year.

Figure 6 presented the change in evaluation of teaching skills of the faculty at the term-end. The rating score of question “did you understand how the leaning items of this subject and field associate with medicine and medical care?” was increased compared to the year 2010, the commentary presentation was not given. Even the rate of positive evaluation was similar, the evaluation score of “strongly agree” doubled in 2012 comparing to 2011. Although the change is not statistically significant ($p=0.18$ by Mann-Whitney’s U test), the reason of this doubling is not clear. The evaluation has been changed by the year and this can be within the change. Indeed, the total positive evaluation score is higher in 2011 than in 2012 (85% versus 76%). Another reason might be due to the confidence of the students. In 2012, the rate of the students with positive self-evaluation of their computer skills and knowledge is nearly half of those in 2011 (Fig. 1). This hypothesis could be supported by change in self-evaluation of understanding the significance of informatics in medicine before and after the commentary as shown in Figs. 2 and 3. Ratings after the commentary are higher in 2012 than in 2011 whereas positive evaluation is lower in 2012 before

Table 2. Difference between the required knowledge and skills the students had estimated and those introduced by the commentary. Representative description after commentary presentation.

- I realized that required knowledge for a medical technologist is in a wide variety and high levels.
- There is a gap between what I know or want to know and the knowledge required in licensing examination.
- I realized much computer skills and knowledge are needed in clinical laboratories than I estimated, and I got flustered.
- I realized the difference between the knowledge of information processing we want to learn and that required in clinical laboratories.
- We have to know the mechanism of the instruments, not only the operation method.
- Working medical technologists recognized the knowledge to be necessary, such as binary digits and character code, those I thought as unnecessary.
- I thought that informatics is necessary just for data management, but there are much application in medical field. I realized that medical technologist has to make presentation and ICT is essential for the purpose.

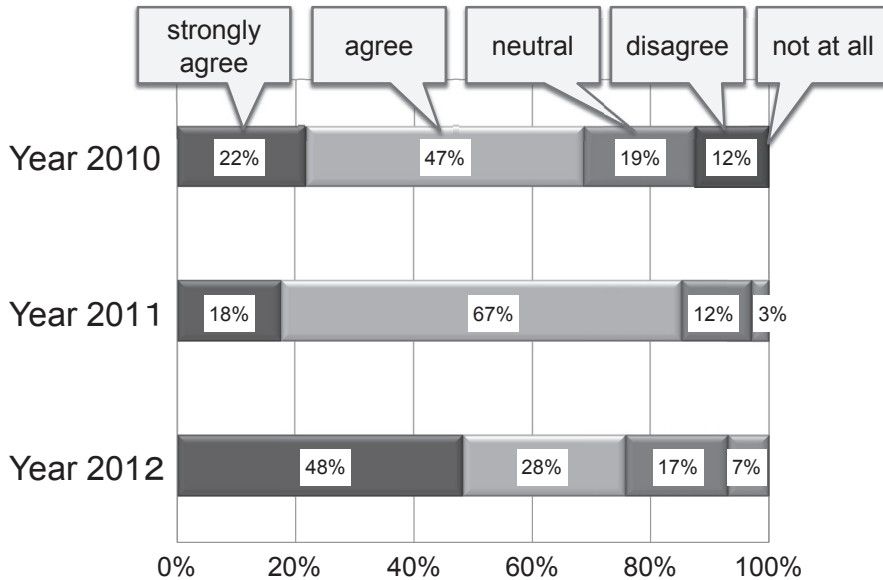


Figure 6. Change in evaluation of teaching skills of the faculty by students at the term-end. The commentary presentation was not given in 2010.

the commentary.

Information science will be counted among basic subjects in the sense that its association with clinical medicine cannot be clearly seen. However, it will be helpful to giving perspectives and what the students have to learn at the beginning of the class for understanding the association of the subject with medicine and health sciences. For all, the students are not able to link the knowledge they got to actual usage of computer and network with real feeling, and it should be an issue to be settled.

Conclusion

Most of students have vague understandings how information science associates with medicine and health sciences, but seemed to bring themselves to have understood. The commentary presentation was performed to improve their understandings at the beginning of the class. Showing the knowledge and skills they have to learn, and recognition of the working medical technologists brought their understandings deeper. More than two thirds of the stu-

dents realized that the required knowledge and skills were different from those they had estimated.

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