



Original Article

Responses of Korean physical therapy students after practice with a virtual anatomical system in Japan

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Abstract. [Purpose] To investigate responses of Korean physical therapy students, receiving medical terminology education in physical therapy both in Korean and English, after practice with a virtual anatomical system. [Subjects and Methods] The participants were 25 physical therapy students from Konyang University in South Korea visiting the International University of Health and Welfare for training purposes. The virtual anatomy practice was conducted in English using 3 dimensional virtual anatomy software constructed using real cadaver photographs. A questionnaire about this practice and anatomy was completed after the practice. [Results] The results of the questionnaire showed a trend toward high scores for virtual anatomy practice. [Conclusion] The present virtual anatomy system was created using multi-directional photographs from a real cadaver; therefore, it can be used as an auxiliary means of education using cadavers.

Key words: Virtual anatomy, Korean physical therapy students, English medical terms

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INTRODUCTION

It is necessary to educate healthcare professionals, including physical therapists, in the anatomy of the human body. Generally, human anatomy is taught as a class studying the structure of the human body at the physical therapist training school. Traditional mediums such as books, computer graphic images, video images, computer software, and cadaver anatomy have been used for anatomical education. There are several problems with anatomy education using real cadavers for healthcare professionals' education in Japan. These problems¹⁻³⁾ include cadaver management, time constraints, legal restrictions at medical and dental schools, and burden placed on medical or dental school teachers due to the increase in healthcare professionals' training. The problem of cadaver shortage³⁾ has also been pointed out in healthcare professional schools in South Korea.

Kubo et al. reported that anatomy was a weak subject for physical therapy students in Japan⁴⁾. In order to resolve such problems, novel education methods using anatomical images have been used globally^{1, 5, 6)}. Virtual anatomical systems, produced using photographs of cadavers, have been applied for anatomical education at some universities^{1, 6, 7)}. One such virtual anatomy system (MeAV 3D Anatomie, Panasonic, Osaka, Japan)⁸⁾ was introduced at the International University of Health and Welfare and has been used in an isolated classroom. This system can be used on computers and small tablets. It is

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possible to study cadavers using this system from multi-layered and multi-directional views, from superficial to deep layers, and by changing the viewing angle on the display, via 3-dimensional (3D) images and glasses and a double display. The students can easily learn anatomical terms in both English and Japanese corresponding to the structure on the display. The usefulness of this virtual anatomical material for education of physical therapy students has already been reported⁷⁾ in Japan.

On the other hands, medical terminology education is conducted using both English and Korean in South Korea. However, there are no reports on the usefulness of such 3D anatomical education systems for Korean physical therapy students.

The purpose of this study was to evaluate the usefulness of virtual anatomical material as an educational tool by assessing Korean physical therapy students after virtual anatomy training.

SUBJECTS AND METHODS

The study included 25 students (5 males and 20 females) from the Physical Therapy Department of Konyang University in South Korea (23 in the 2nd year, 1 in the 3rd year, and 1 in the 4th year). They enrolled at the International University of Health and Welfare for education and training supported by the Student Exchange Support Program (Scholarship for Short-term Study in Japan) of the Japan Student Services Organization. The students have been receiving education in medical terminology related to physical therapy in Korean and English. They have already taken anatomical subjects at their university.

An ethics-related item, an explanation of the use of equipment, and notes on the practice were given to the students by a professor of anatomy. A practice was carried out in English for 90 minutes. Japanese was used with Korean interpretation. In the practice, a handout was distributed to each student. Skeletal muscles and peripheral nerves were listed on the handout in English, and he/she was given the task to find and study them according to the handout. The numbers of listed muscles were the following: 6 in the pectoral girdle/shoulder girdle, 4 in the arm, 11 in the forearm, 4 in the pelvic girdle, 14 in the thigh, and 11 in the leg. The numbers of listed peripheral nerves were: 5 in the brachial plexus and 6 in the lumbosacral plexus. All muscles were presented as the English terms with their origin, insertion, and innervation.

The modified questionnaire concerning the present practice and anatomy developed by Itokazu et al.⁷⁾ was translated into Korean and distributed, conducted, and collected for all students at once, after the practice.

The questionnaire of practice-related items included six items formulated by the Faculty Development Committee of International University of Health and Welfare. Five items were selected among the six items in this study. The practice items were: 1) understanding the purpose, method, and contents, 2) consideration of student's knowledge and competence, 3) interest in content, 4) explanation of compliance matters, 5) encourage opinions and questions. Evaluation was performed using the 5-level Likert scale as follows: 1 –agree, 2 –somewhat agree, 3 –neither, 4 –somewhat disagree, 5 –disagree. Scores were totaled after completion of the questionnaire.

Anatomy-related items were to be evaluated using the visual analog scale concerning 4 items created by Itokazu et al.⁷⁾ with reference to Kubo et al.^{9, 10)}. For the visual analog scale, a 100 mm straight horizontal line was used, which was orientated from left (worst) to right (best) ends. For the items “interest in human anatomy” and “inspired to learn”, the line was oriented according to intensity with “not at all” at the left end and “the most” at the right end of the line. Satisfaction level of practice was defined as “totally unsatisfied” at the left end and “most satisfied” at the right end of the line. Understanding of medical ethics was defined as “could not understand” on the left end and “understood well” on the right end of the line. Students were instructed to mark on a straight line and the distance (mm) from the left end to the point marked was measured and calculated.

Statistical processing was performed by classifying the Likert scale with 1 (agree) and 2 (somewhat agree) as positive, 3 as neither, and 4 (somewhat disagree) and 5 (disagree) as negative. The three items (positive, neither, and negative) were compared with the hypotheses for the probability observed by the chi-square goodness of fit test (Table 1).

Opinions and impressions about the virtual anatomy system were freely stated. Similar content was classified into four groups (interest, suggestion, satisfaction, and non-description) from the questionnaire and tabulated. “Interest” focused on comments about novelty and experience, “suggestion” on proposals for the system, “satisfaction” on satisfaction with the content, and “non-description” when nothing was written or when students wrote “nothing.” The responses for each category were summarized. Prior to the completion of the questionnaire by the students, agreement was obtained in writing after explaining the research purpose. There is no conflict of interest to report regarding this study.

RESULTS

In the practice-related items, positive was significantly higher than negative ($p < 0.05$) in all items 1 through 5, and positive represented a high proportion of responses. The average of the positive scores was more than 90% in 4 of 5 items; the remaining 1 item, encourage opinions and questions, was 88% (Table 1). The anatomy-related items, with average scores and standard deviations, were as follows: interest in human anatomy, $80.5 \pm 19.9\%$; inspired to learn, $81.3 \pm 14.7\%$; practice satisfaction, $88.8 \pm 11.1\%$; and understanding of medical ethics, $88.8 \pm 12.8\%$. Although the ranges were wide for these four items, all mean scores were over 80% (Table 2).

Sixteen students responded to opinions and impressions, including one answer classified as non-description.

Table 1. Results of questionnaire for practice-related items (%)

Contents	1	2	3	4	5	1+2	4+5
	Agree	Somewhat agree	Neither	Somewhat disagree	Disagree	Positive	Negative
I. Understanding the purpose, method, contents	72	24	0	0	4	96*	4*
II. Consideration of student's knowledge and competence	56	40	0	0	4	96*	4*
III. Interest in contents	68	24	4*	0	4	92*	4*
IV. Explanation of compliance matters	80	12	4*	4	0	92*	4*
V. Encourage opinions and questions	64	24	8*	4	0	88*	4*

Chi-square goodness of fit test, *p<0.05

Table 2. Result of questionnaire for anatomy-related items (%)

Contents	Mean ± SD	Range (Min–Max)
VI. Interest in human anatomy	80.5 ± 19.9	72 (28–100)
VII. Inspired to learn	81.3 ± 14.7	60 (40–100)
VIII. Practice satisfaction	88.8 ± 11.1	37 (63–100)
IX. Understanding of medical ethics	88.8 ± 12.8	50 (50–100)

SD: Standard Deviation

Table 3. Response type and their percentages (n=25)

Types	Percentage of students (%)
Satisfaction	8
Interest	36
Suggestion	16
Non description	40

“Non description” was the most frequent response at 40%; many of the available responses were classified as “interest” (Table 3). “Suggestion” represented 16% and “satisfaction” was 8%.

DISCUSSION

The Korean physical therapy students showed a trend toward giving high scores in practice-related items and anatomy-related items in this virtual anatomy practice. The novelty of the virtual anatomy system possibly had a high impact and the scores students gave for this practice were comparable to those given by Japanese students⁷. Compared with the research conducted by Itokazu et al. in Japan⁷, 0% of respondents responded as negative in all items of the exercise, while 4% of the Korean students responded negative. Two percent of students responded as neither among the Japanese students⁷ for the “encourage opinions and questions”, while Korean students responses were as follows: interest in contents, 4%; explanation of compliance matters, 4%; encourage opinions and questions, 8%.

The proportion of students who replied “neither” was slightly higher among Korean students than Japanese students. Korean students may have felt inconvenienced because the language at the exercise was not their mother language. In the anatomy-related items, Korean students had average scores of 80.5 to 88.8 for the four items. Han et al. reported¹¹) that 4,552 major subjects had an average score of 77.2 points of the lecture evaluation in Korean universities. Compared to this reported average, it is conceivable that the average of the practice evaluated here is high. Such a result potentially supports the usefulness of the virtual anatomical system.

On the other hand, the reason why “interest” was highest, with the exception of “non description,” seems to be influenced by the novelty of the virtual anatomical system. The 16% rate of “suggestion” is considered to indicate the need for improvement of the system in the future (Table 3).

There are some studies stating that satisfaction is high regarding anatomical education using cadavers. In Japan, Shimo¹³) reported that healthcare profession students are satisfied with participation in the cadaver anatomy practice. In South Korea, Son et al.¹⁴) reported that the intensity of comprehension in cadaver practice lasting 4 hours and 30 minutes showed a tendency toward high scores, from 75.4% to 89.6%, and the satisfaction level was as high at 96.5%. In the practice of

cadaver anatomy, the most frequent requirement from the students was increased education time. Actually, it is very difficult to increase practice time using cadavers. Therefore, preparation and review using other media is an important learning tool, and virtual anatomical systems will occupy a very important position among them.

There are several previous studies on virtual anatomy using other teaching materials. Lee et al. reported¹²⁾ that there was no difference between computer-based anatomical training and anatomical practice using real cadavers. The report showed that there was no significant difference in grades for writing and on real tests. Practice using a computer can be a replacement for real cadaver practice or as a partial alternative education method. Kudo et al.¹⁾ suggested that cadaver imaging teaching materials, devised as an alternative teaching material with the main objective of understanding three dimensional positional relationships, is useful in place of cadaver practice.

Virtual teaching materials appear to be useful and are highly-rated by students. Sim et al. reported³⁾ that there was no difference among the four mediums (color clay, actual heart, model of the heart, sketch with colored pencils of the front and back of the heart in the textbook) used for a heart class. In a study using a 3D model of the inner ear⁵⁾, average quiz scores were significantly higher in the intervention group than in the control group.

Korean physical therapy students are accustomed to touch operation of tablets and smart phones, as are Japanese students; therefore, they felt the materials used in the virtual anatomy program were familiar. Since the system used in the International University of Health and Welfare used the technical terms in English, it seems to be useful for Korean students who have studied English technical terms.

The limitations of the present study are as follows. It was used only one company's virtual anatomy system. The contents were confined to only specific muscles and nerves. It has not been verified whether the participants are representative of South Korea or not because they were from only one university in South Korea. The validity of the virtual anatomy teaching materials was not considered.

The present virtual anatomy system is created using multi-dimensional photographs of a real cadaver; therefore, it can be used as an auxiliary means of education using cadavers. It can be suggested strongly that such virtual education systems can be helpful for anatomy education as an alternative means for physical therapy students in many countries. A virtual anatomy system on the computer system is easier to access than a cadaver laboratory in many countries. Future prospects include use in postgraduate education and other healthcare professions' programs¹⁵⁾. Effectiveness can be further assessed by evaluating examination scores after virtual anatomical training.

REFERENCES

- 1) Kudou S, Fujii T, Asamoto K, et al.: Investigation on the effects of the lesson with "photographic teaching material of anatomy" in co-medical schools. *Keitai Kinou*, 2008, 6: 135–141 (in Japanese).
- 2) Kimura T, Matsuda W, Aimi Y, et al.: Visit to the human anatomical dissection course is effective for PT/OT students: efficacy and evaluation. *Keitai Kinou*, 2012, 11 24–32 (in Japanese).
- 3) Sim JH: The learning effects of instructional media on anatomy classes in a nursing college. *J Korean Biol Nurs Sci*, 2009, 11: 51–58 (in Korean).
- 4) Kubo A, Kuramoto-Ahuja T, Kobayashi K, et al.: An investigation into best and weak subjects at the first term in junior year of college. *Rehabilitaion Kyoiku Kenkyu*, 2015, 20: 46–47 (in Japanese).
- 5) Nicholson DT, Chalk C, Funnell WR, et al.: Can virtual reality improve anatomy education? A randomised controlled study of a computer-generated three-dimensional anatomical ear model. *Med Educ*, 2006, 40: 1081–1087. [[Medline](#)] [[CrossRef](#)]
- 6) Hilbelink AJ: The effectiveness and user perception of 3-dimensional digital human anatomy in an online undergraduate anatomy laboratory. University of South Florida, 2007.
- 7) Itokazu M, Kubo A, Taniguchi T, et al.: Enhancement omotivation of undergraduate paramedical students to study anatomy by a novel virtual anatomy training system. *Rigakuryoho Kagaku*, 2016, 31: 715–717 (in Japanese). [[CrossRef](#)]
- 8) Panasonic C: MeAV Anatomie 3D. <http://panasonic.biz/it/invc/meav-anatomie/> (Accessed Mar. 23, 2017) (in Japanese)
- 9) Kubo A, Kurosawa K, Maruyama H: Changes in QOL of undergraduate physical therapy students after the Great East Japan Earthquake: satisfaction with life and learning at the end of the junior year of college. *Rigakuryoho Kagaku*, 2014, 29: 1007–1009 (in Japanese). [[CrossRef](#)]
- 10) Kubo A, Kuramoto-Ahuja T, Kobayashi K, et al.: Influence of satisfaction with learning and living at the end of the junior and senior college years of PT students on the results of the national examination for physical therapists. *Rigakuryoho Kagaku*, 2015, 30: 115–117 (in Japanese). [[CrossRef](#)]
- 11) Han KS, Choi SH, Park JC: Problems in mandatory course evaluations. *Commun Stat Appl Methods*, 2011, 18: 35–45 (in Korean).
- 12) Lee WB, Kim KY, Baik SH: Learning effects of computer-aided anatomy laboratory. *Korean J Med Educ*, 1999, 11: 77–81 (in Korean). [[CrossRef](#)]
- 13) Shimo S, Fujita A, Kawate T, et al.: A study on the needs of practical training for rehabilitation students, using human anatomical specimens. *Bull Health Sci Univ*, 2016, 12: 67–75 (in Japanese).
- 14) Son I, Son M, Jeong GB: The effect of education in anatomy using cadavers to the paramedic students. *J Korea Contents Assoc*, 2013, 13: 341–347 (in Korean). [[CrossRef](#)]
- 15) Itokazu M, Taniguchi T, Kubo A: Practical use of a virtual system for teaching anatomy in postgraduate education. *Bull Int Univ Health Welf*, 2016, 21: 31–35 (in Japanese).