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RESEARCH ARTICLE

A Study on the Awareness and Need for Connected-Convergence Education among College Students in Health-Related Fields

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Background: In modern society, rapid changes in the medical environment have required medical staff to access various information and be competent in active and effective problem-solving through collegial interactions. In line with these changes, universities are aiming to connect education. This study aimed to provide basic data of connected-convergence education by survey the awareness and needs of college students in health-related fields.

Methods: This study included 122 college students from the health field. A survey regarding "the awareness and need of connected-convergence education" was conducted and general characteristics of the participants were collected from June to July 2022.

Results: The awareness of connected-convergence education was low at 19.7%, but the intention to participate was high at 74.6%. Subject requirements were 18.0% for medical psychology, 13.5% for communication and counseling, 13.5% for medical artificial intelligence technology convergence, and 10.4% for sports health management. In the group showing high satisfaction with the major curriculum, the demand for connected education was also high. For efficient operation, it was investigated that it was necessary to secure specialized training courses, recognition of liberal arts credits, the right to register for courses equal to those of major students, and secure dedicated classrooms.

Conclusion: Although the awareness and experience of connected-convergence education among the participants were low, the intention to participate was high. As such a plan to revitalize the university curriculum was required. It is timely to discuss the nurturing of convergence-type talents and multidisciplinary thinking skills. It is meaningful to provide basic data necessary for connected-convergence education in health-related fields at university. Universities should strive to enhance job competency in the health field by providing connected-convergence education based on student demands.

Key Words: Education, Health, Needs assessment, Special education

Introduction

1. Background

In modern society, the elderly population, single-person households, and patients with chronic diseases are increasing. People have increased interests in healthcare, disease treatment, and well-being for the improvement of their quality of life. To manage one patient, integrated management of oral, systemic, and mental disorders is required. Public health personnel should manage patients with consideration for patient characteristics. Importantly, knowledge in other disciplines, creative thinking, and problem-solving skills are required[1]. Furthermore, rapid changes in the medical environment, such as the fourth industrial revolution, have resulted in many innovations, such as the use of big data and medical digitization.

Today's medical staff must be skilled in accessing various information and be competent in active and effe-

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ctive problem-solving through collegial interaction[2]. In line with these needs, universities are aiming to provide education that enhances thinking skills in connection with other majors to nurture competitive talents[3]. The purpose of connected-connected learning is to improve thinking abilities and problem- solving skills among students to address various problems. Hence, the trend of connected education is spreading[4,5].

Connected-convergence education can enhance the cooperative problem-solving ability of learners to address problems experienced in the medical field[4]. In particular, health students need the ability to think about medical issues from various perspectives and manage patients comprehensively. In the future, integrated management capabilities involving different aspects of health including oral health, psychological health, and social health will become increasingly critical. Therefore, connected-convergence education is needed to improve patient management competency among health students[6].

In engineering education, such connected-convergence education is expanding. Conversely, in health-related education, the focus is still on single major learning due to national exams for license acquisition. Although some universities are trying to provide interdisciplinary education linking medicine, nursing, and social welfare, the efforts to date have been insufficient[7]. Research on connected-convergence education related to dental hygiene is also insufficient. In the era of super-aging, connected-convergence thinking is needed to care for the elderly who experience systemic diseases, loss of economic power, and psychological changes. Overall, connected-convergence education is insufficient and it is difficult to evaluate its effect on the performance and operation method of each university[8].

2. Objectives

This study aimed to provide basic data necessary for health-related connected-convergence education by examining the awareness and needs of college students in health-related fields.

Materials and Methods

1. Ethics statement

This study was approved for review by the Institutional Review Board (IRB) of Konyang University according to IRB regulations (NO. KYU-2022-04-24).

2. Study design

The study was conducted between June to July 2022. The study's objectives and ethical considerations were explained to the candidates and consent for participation was obtained. The research recruitment notice was uploaded to K University's online bulletin board and departmental bulletin board. The online survey was conducted using a QR code. The study population consisted of students in health programs including nursing, dental hygiene, physical therapy, occupational therapy, clinical pathology, optical optics, emergency rescue, radiology, and hospital management. Non-health students or those who refused to participate were excluded from the study.

3. Sample size

The sample size was calculated using G-power program ver. 3.1.9.2. Convergence education awareness, demand, and general characteristic variables were reflected in the calculation. The calculation confirmed that 121 participants were required for each group. Accordingly, the study was conducted with 122 participants.

4. Intervention

The survey consisted of 26 questions, including 7 questions on the awareness of connected-convergence education, 13 questions on the requirement for connected-convergence education, and 6 questions on general characteristics (department, grade, sex, age, practice experience, and credits).

Recognition and demand items were measured on a 5-point Likert scale. As for the research tool, the research contents of Baek[9] were modified for the purpose of this study. The selected courses were among the universities' selections for innovation projects. The homepage data of 28 universities that are implementing convergence education were investigated.

5. Statistical analyses

Participants' general characteristics and their awareness, and need for connected-convergence education were analyzed with descriptive statistics. Variables, such as "needs for connected-convergence education" and "satisfaction with the curriculum" were analyzed using the chi-square test (nonparametric analysis). The statistical significance level was set to 0.05. Analyses were performed using PASW Statistics, version 18.0 (IBM Corp., Armonk, NY, USA).

Table 1. General Characteristics of the Participants

Division		Value
Sex	Male	21 (17.2)
	Female	101 (82.8)
Age (y)	20～22	81 (66.4)
	≥23	41 (33.6)
Grade	1	18 (14.7)
	2	40 (32.8)
	3	36 (29.5)
	4	28 (23.0)
Department	Nursing	29 (23.8)
	Dental hygiene	23 (18.8)
	Physical/occupational therapy	15 (12.3)
	Clinical pathology	19 (15.6)
	Emergency rescue	15 (12.3)
	Hospital management	10 (8.2)
	Radiology/optics	11 (9.0)
Clinical practice	Yes	58 (47.5)
	No	64 (52.5)
Awareness	Yes	24 (19.7)
	No	98 (80.3)
Grade point average	2.5～2.9	7 (5.7)
	3.0～3.4	37 (30.4)
	3.5～3.9	52 (42.6)
	≥4.0	26 (21.3)
Education experience	Teaching	1 (0.8)
	Connected major	2 (1.6)
	Convergence major	0 (0)
	Double major	1 (0.8)
	Not applicable	119 (96.8)

Values are presented as number (%).

Table 2. Students' Intentionto Participate in Connected-Convergence Education

Willingness to participate	Value
Yes	91 (74.6)
No	31 (25.4)

Values are presented as number (%).

Results

1. Participants' general characteristics

Of the 122 participants, 17.2% were male and 82.8% were female. Students in the second year of university accounted for 32.8%. Moreover, 47.5% had on-the-job experiences. Students in nursing accounted for 23.8%, dental hygiene 18.8%, and clinical pathology 15.6%. Regarding the grade point average (GPA), 42.6% of students had a GPA of 3.5～3.9. As for the students' awareness of connected-convergence education, 19.7% knew and 80.3% did not know. A total of 96.8% of participants had no educational experience outside of their major (Table 1).

2. Intention to participate in connected-convergence education

Table 2 shows that 74.6% of students wanted to participate in interdisciplinary and connected-convergence education. Of the students who wished to complete linked and convergence education, most requested medical psychology (18.0%). This was followed by students in communication and counseling, medical artificial intelligence (AI) technology convergence (13.5%), sports health management (10.4%), medical industry including medical device licensing, etc. (7.2%), and aged care (6.9%) (Table 3). Rega-

Table 3. Students' Desired Subjectsto Study through Connected-Convergence Education

Subject	Value
Medical psychology	57 (18.0)
Communication consultation	43 (13.5)
Medical AI technology convergence	43 (13.5)
Sports health management	33 (10.4)
Health social welfare	23 (7.2)
Medical industry	23 (7.2)
Elderly health care	22 (6.9)
Public health insurance	18 (5.7)
Well-dying	14 (4.4)
Beauty health care	14 (4.4)
Health convergence science	14 (4.4)
Public health IT convergence	8 (2.5)
Well-aging	6 (1.9)

Values are presented as number (%).
AI:artificial intelligence.

rding the subjects from other departments that students wish to study, exercise rehabilitation ranked the highest at psychiatry (35.3%), first aid (34.1%), exercise rehabilitation (33.5%), hospital service (29.5%) and documentation (20.8%) (Table 4).

Table 4. Elective Subjects in Other Departments

Subject	Value
Geriatric nursing	37 (17.7)
Swallowing rehabilitation	29 (13.9)
Understanding people with disabilities	27 (12.9)
Child development	46 (22.0)
Exercise rehabilitation	70 (33.5)
hospital marketing	29 (15.1)
Hospital financial management	22 (11.5)
Hospital computer practice	31 (16.2)
Create a document	40 (20.8)
Department of Medical Tourism	25 (13.0)
Health administration	45 (23.4)
Medical information management	51 (26.4)
Hospital management	34 (17.6)
Psychiatry	73 (35.3)
Rehabilitation psychology	43 (20.8)
Cognitive rehabilitation	20 (9.7)
Clinical decision making	26 (12.5)
Communication	45 (21.7)
Medical ethics	29 (10.7)
First aid	92 (34.1)
Infection control	55 (20.4)
Immunology	30 (11.1)
Disease prevention	47 (17.4)
Biomechanics	17 (6.3)
Big data medical statistics	37 (19.2)
Management for Medical device	14 (7.3)

Values are presented as number (%).

3. The need for connected-convergence education and satisfaction with the curriculum

As a result of analyzing the "needs for connected-convergence education" and "satisfaction with the current curriculum" in 3 groups (satisfied, average, and dissatisfied), the group with the highest satisfaction for the current curriculum showed a high demand for connected-convergence education at 69.7% ($p < 0.05$) (Table 5).

4. Operational strategies to facilitate connected-convergence education

The need for specialized education to facilitate connected-convergence education operationally was as high as 30.3%. As for the completion system, the need to recognize liberal arts credits was high at 38.5%. As for the operation method, 50.8% of students had the same right to apply for courses equivalent to their major. Regarding the plan to expand operation, securing a dedicated lecture room was the most important factor at 25.4%. Participation in the second year was the highest at 59.0%. The number of subjects completed was 60.7% for 2 subjects, and 38.5% for 2 credits As for the educational method, 60.3% preferred face-to-face lectures and 56.6% preferred lectures+practical classes (Table 6).

Discussion

1. Key results

In this study, students with low and high awareness of connected-convergence education both recognized the need for further expansion of connected-convergence education. In particular, there was a demand for subjects, such as medical psychology, communication counseling, and medical AI technology. Notably, the students' need for

Table 5. The Need for Connected-Convergence Education and Satisfaction with the Curriculum

Division		Needs to connected-convergence			
		High	Moderate	Low	p-value
Major Satisfaction	High	53 (69.7)	16 (21.1)	7 (9.2)	.001
	Moderate	18 (75.0)	4 (16.7)	2 (8.3)	
	Low	4 (18.2)	4 (18.2)	14 (63.6)	

Values are presented as number (%).
$p < 0.01$ by χ^2.

Table 6. Operational Strategies to Facilitate Connected-Convergence Education

Division		Value
Directions	Expansion of course	35 (28.7)
	Specialized of convergence education	37 (30.3)
	Lectures by level	27 (22.1)
	Expansion of basic education	23 (18.9)
Operational methods	Consistency of curriculum	26 (21.3)
	Consistency of lecture time	34 (27.9)
	Course selecting standards	62 (50.8)
Participation grade	1 grade	34 (27.9)
	2 grade	72 (59.0)
	3 grade	15 (12.3)
	4 grade	1 (0.8)
Number of subjects	1	20 (16.4)
	2	74 (60.7)
	3	20 (16.4)
	4	6 (4.9)
	5	2 (1.6)
Teaching methods	Face-to-face lectures at university	74 (60.6)
	Face-to-face lectures with other universities	14 (11.4)
	Online lectures during and outside university	34 (27.9)
Operational System	Increase of available credits	30 (24.6)
	Apply major credit	45 (36.9)
	Apply liberal arts credit	47 (38.5)
Expansion of education	Exclusive for lecture room	31 (25.4)
	Expansion of information sharing	29 (23.8)
	Scholarship assistance	27 (22.1)
Desired credit	1 credit	5 (4.1)
	2 credit	47 (38.5)
	3 credit	23 (18.9)
	4 credit	27 (22.1)
	5 credit	8 (6.6)
	6 credit	10 (8.2)
	7 credit	2 (1.6)
Instructional preferences	lecture	39 (32.0)
	Problem-focused learning class	7 (5.7)
	Discussion class	7 (5.7)
	Lecture + practice class	69 (56.6)

Values are presented as number (%).

connected-convergence education was higher. Among the connected-convergence education subjects provided by other universities, students wanted to study exercise rehabilitation, psychiatry, hospital service, documentation, and first aid. There was no significant difference between departments, such as dental hygiene, in the desired subjects for connected-convergence education. A mutual convergence approach between subjects from different departments may be necessary to strengthen major competencies in addition to major subjects. The need for connected-convergence education among college students for future career readiness is growing. At a time when there are not many studies on health-related or connected-convergence education, this study may contribute significantly to the field. The findings from this study suggest that there is the demand for connected-convergence education and that a plan should be developed to facilitate its implementation.

2. Results interpretation and comparison with previous studies

Students' awareness of connected-convergence education was low at 19.7%. Conversely, the intention to participate was high at 74.6%. Jeon[10] reported that the student educational experience was 15.4%, cognition was 22.1%, and necessity was 85.5%. These results were similar to the findings of this study. Since the university's connected-convergence education is insufficient, it is necessary to establish the concept and purpose of connected-convergence education suitable for the characteristics of the university by analyzing the perception and situation with the aim of implementation. connected-convergence education in college should aim to create new knowledge, skills and values in combination with existing learning[11]. Some universities are implementing education in collaboration with industries through innovation and prime projects. For example, the University Innovation Project and PRIME projects within Korea's educational advancement project for the internalization of human resources needed by society[12].

However, connected-convergence education does not apply to all students. To date, limited college-centered engineering connected education has been implemented, therefore, improvement is needed[13]. The preferred subjects for inclusion in connected-convergence convergence education were identified by the participants as medical psychology, communication counseling, and AI technology in medical science. Of note, college students' course selection is affected by employment standards. Realistically, it is useful to align careers with demands and apti-

tude and interest[14]. In an aging society, the number of people who need complex services in various fields, such as health, medical care, and welfare, is increasing. For this reason, it is necessary to solve problems through the cooperation of experts in various professions and interprofessional collaborations should start at the university[15].

For the operation of connected-converged education, specialized connected-convergence education is required. In particular, the recognition of liberal arts credits is viewed as necessary by the participants. The operation method is to secure the right to apply for the same course as the major. Moreover, securing a dedicated classroom was also considered important. Other proposed operational details included participation from the second year of university, include 2 connected-convergence courses, and 2 credits per course. According to Anh and Lee's study[16], 'establishment and operation of a dedicated organization' and 'dedicated lecture room and practice room' were identified as factors of top priority, while 'curriculum specialization', 'scholarship support for related majors', 'promotion of related majors', 'dedicated teaching assistant assignment' were considered secondary factors. Based on these results, a revitalization plan was proposed for prioritizing the educational need for university-linked majors.

3. Limitations

This study is limited by its sample population of only K-University students. Hence, the generalization of the results may not be applicable. In future research studies, the research target should be expanded. A proposed university education plan to enhance competency is also necessary. This may be developed using a survey that examines the necessity of connected-convergence education in the medical field. To increase students' awareness of connected-convergence education and promote connected-convergence education in the health and medical field, more research should be done in the future, especially research that considers the characteristics of each department and different universities.

4. Generalizability

The awareness of connected-convergence education was low at 19.7%. Conversely, the intention to participate was high at 74.6%. In the group with high satisfaction for the major curriculum, the demand for connected-convergence education was also high. For efficient operation, it is necessary to secure specialized training courses, enhance recognition of liberal arts credits, ensure the right to register for courses equal to those of major students, and secure dedicated classrooms. To adapt to rapid changes in the medical environment and manage patients in various cases, medical personnel are required to effectively perform tasks through convergence patient management in collaboration with colleagues.

5. Suggestions

Students who were satisfied with the current curriculum expressed a high demand for connected-convergence education. This may be related to high-achieving students' innate desire for learning and education. Moreover, universities must identify the needs of the students and support their education. In college education, it is necessary to establish a curriculum feedback system that reflects the needs of learners as well as the needs of society. This may be achieved via competency-based education and the establishment of a university education quality management system that emphasizes accountability for education[17]. Some studies suggest that a new convergence area may be established in the curriculum or four connected-convergence subjects bundled together to form a convergence module and offered as an independent curriculum[18]. College students' course selection is affected by employment standards. Realistically, it is useful to align jobs with demands and aptitude and interest[14]. Currently, universities are faced with the need to enhance the quality of higher education. This may be achieved by improving creativity convergence competency and creating new values based on creativity and convergence[19]. Universities should strive to enhance job competency in the health field by offering connected-convergence education based on student demand. In dental hygiene education, for example, it is time to implement connected-convergence education to enhance students' convergence thinking abilities.

Notes

Conflict of interest

No potential conflict of interest relevant to this article was reported.

Ethical approval

This study was approved by the Institutional Review Board of Konyang University (IRB No. KYU-2022-04-24).

Author contributions

Conceptualization: Su-Hyeon Hong, Seung-Yeon Shin, Na-Hee Lee, Jin-A Lee, Seon-Im Cheon, and Seol-Hee Kim. Data acquisition: Su-Hyeon Hong, Seung-Yeon Shin, Na-Hee Lee, Jin-A Lee, Seon-Im Cheon, and Seol-Hee Kim. Formal analysis: Su-Hyeon Hong and Seon-Im Cheon. Supervision: Su-Hyeon Hong and Seol-Hee Kim. Writing–original draft: Seung-Yeon Shin, Na-Hee Lee, and Jin-A Lee. Writing–review & editing: Su-Hyeon Hong, Seung-Yeon Shin, Na-Hee Lee, Jin-A Lee, Seon-Im Cheon, and Seol-Hee Kim.

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Data availability

Raw data is provided at the request of the corresponding author for reasonable reason.

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