Development of Core Competencies for University Students during the Pandemic, Crisis of Public Health

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Abstract

Future competency is a necessary condition for securing the competency of college students who lead the changed era. Therefore, this study was conducted to derive core competencies reflecting future competencies and to develop diagnostic tools. To this end, the reliability and validity of the draft questionnaire prepared after reviewing previous studies and receiving reviews from experts were secured. The survey was conducted for 983 college students from April 12 to 16, 2021, and the final 75 questionnaires were confirmed through statistical verification. Through the collected data, potential profiles with heterogeneous characteristics based on core competencies were classified into three, and the characteristics of each potential group profile were confirmed. The main analysis results are as follows. First, the five core competencies (humanities competency, communication competency, globalization competency, creativity competency, professionalism competency) consists of 15 sub-competencies and 75 questionnaires. Second, the improved K-University core competency scale has secured validity after verifying the improvement plan through the expert meetings and surveys. Third, based on the improved K-University Core Competency Diagnosis scale, the overall average of core competencies was 3.85, communication competencies 3.99, creativity competency 3.96, humanities competencies 3.85, professionalism competencies 3.85, and globalization competencies 3.58. Furthermore, a total of three analyzing the latent profile through the core competency diagnosis result, a total of three latent profiles (upper group, middle group, and lower group) were identified. Through the analysis results, a new core competency diagnostic scale was developed by reflecting the educational goals, vision, and future capabilities of the university. Through the results of this study, other higher education institutions will also be able to raise their interest in the future competencies of university students and provide competency-based curriculum to enhance the quality and effectiveness of education.

Keywords: core competency, competency scale, latent profile analysis, university education, educational performance

1. Introduction

The OECD defined core competencies as 'the competencies that are essential for everyone to lead a successful life', and it emphasized the enhancement of core competencies through education (OECD 2005). Countries around the world are applying competency-based curriculum to higher education as well as elementary and secondary education, and it is necessary to diagnose and evaluate students' core competencies to confirm the effectiveness of this curriculum. In particular, it is important to develop and apply a core competency diagnosis scale suitable for each university, as each higher education institution has different founding ideology, talent image, vision, etc. In addition, it is required to clearly identify the level of each student's competency by using the core competency diagnosis scale, and to provide a desirable curriculum and support for school life for student growth.

A representative study on core competencies is the Definition and Selection of key Competencies (DeSeCo) project announced by the OECD in 2005. This project started with the question ‘What competencies are needed to realize a successful life and a well-functioning society?’ (Lee 2019). This project reflected the concept of competency, which has been mainly discussed in private companies or occupational fields, to the education field, and provided an opportunity to recognize the core competencies that future talents should possess. In addition, the focus was on

defining and selecting the core competencies required to live in the modern society and revealing their meaning and importance (Yoon, 2017). The core competencies selected at the time were in three categories: 'use scales interactively', 'interact in heterogeneous groups', and 'act autonomously'. “Key Competencies for a Successful Life and a Well-Functioning Society” were derived and selected (OECD, 2005). Various experts from all over the world participated in the process of selecting core competencies, but there was a difference of opinion or priority on core competencies by country, which caused difficulties in reaching agreement. However, it was agreed that 'sustainable development' and 'democratic value' are values common to all countries, and based on this, they agreed to select the final core competencies (Lee, 2019).

A desirable human resource image can be said to be the image that a particular society in a particular era ultimately seeks and wants to create through education (Kim, 2019). However, the human resources required by the times change according to social and cultural changes and technological evolution. In the past, people with more knowledge than others were considered talented people, but recently, people with diverse knowledge and fusions to create new values, so-called creative convergence talents, are preferred. A creative convergence talent can be defined as ‘a person who can create new knowledge by combining humanities imagination and scientific and technological creativity with the right personality, and who can create new values by fusion of various knowledge’ (Ministry of Education in South Korea 2005). The talents required for the future society are self-management capabilities, communication skills, community capabilities, aesthetic emotional capabilities, knowledge information processing capabilities, and creative convergence thinking capabilities. In fact, the Ministry of Education of the Republic of Korea announced that the goal of the '2015 Revision Curriculum' is to foster creative convergence talents. Rather, it emphasizes the need to reflect future competencies in the curriculum (Gil et al., 2019; OECD, 2010; OECD, 2012; OECD, 2018; OECD, 2018).

Even if the times change, higher education institutions (HEIs) are still given the public responsibility of nurturing talents who will lead the social value of our society. For this reason, HEIs must systematically educate students on specialized knowledge in their majors, and at the same time have the responsibility to nurture talents with future capabilities (Lim et al., 2021; Achmad et al., 2019). The HEIs are given the public responsibility of nurturing talents who will lead social values. They are responsible for not only systematically educating specialized knowledge in the field of study, but also providing a curriculum that fosters creative fusion of knowledge and information, problem-solving ability, and nurtures future talents with information literacy skills. Therefore, in order to nurture talents that can lead social change, universities need to select core competencies suitable for each university's talent profile and educational environment, and prepare an educational environment by reflecting them. Each university should comprehensively consider their founding ideology, human resources, educational goals, and characteristics of the current students. They should select and diagnose the core competencies to ensure that the students can actually acquire them.

Studies on the core competencies of university students are mainly focused on presenting the core competencies that university students should have, developing scales for measurement, or identifying factors affecting core competencies (Park et al., 2018; Jin et al., 2011; Ju 2019). However, attempts to improve existing core competencies by reflecting future competencies that change according to technological evolution and social development are extremely insufficient. The university puts a lot of effort into strengthening the core competencies of students through the curriculum, and through these efforts, it should have a significant impact on students' academic achievement. Therefore, it is necessary for universities to explore future competencies to newly improve the core competencies that current students should have, and to improve the scales for diagnosing them.

This study aims to determine new core competencies that reflect future competencies, improve the scale, and verify the reliability and validity of the improved scale. And, by using the improved core competency diagnostic scale, the core competency of college students is analyzed and characteristics are confirmed.

2. Literature Review

2.1 Educational Outcomes of University Students

What university students acquire through major education is called learning outcomes (Jin et al., 2011). Since the goal of learning is to enable university students to adapt to university life and achieve through their major studies, universities have a responsibility to examine how meaningfully the educational services they provide affect their students' academic performance (Lim at al., 2021; Chungyun, 2020). Recently, HEIs are facing a demand to foster creative and convergence talents who will lead the future society. Therefore, each university must ensure that its

students possess core competencies so that they can grow into the future through the curriculum, and these core competencies must be formed in connection with the academic subjects and non-curricular courses in school (Kim, 2019).

Excellent talents required by the future society should not simply have knowledge, but should be able to create new values by combining them with various fields based on their knowledge and expanding their thinking, or to solve problems facing mankind. This means that there is a need for more creative talents who can respond flexibly and effectively to social changes, such as the more complex link between the individual and society and the integration of work and learning (Kim, 2019). In a rapidly changing world situation such as the recent one, the ability to understand and solve problems in a new way is required. In addition, the major classes in the past were not limited to the relevant field, but students themselves should be able to expand their thinking and converge with adjacent disciplines. Accordingly, the university is trying to achieve the academic performance of university students by deriving core competencies for nurturing current students and providing major curriculum based on this.

To look at the components of core competencies, it is necessary to look at the DeSeCo project. The DeSeCo defines core competencies as interactive use of tools, interaction within heterogeneous groups, and autonomous behavior and leads the OECD-led International Assessment of Adult Competencies (PIAAC) assessment and analysis program (OECD, 2005). The PIAAC's key survey is a survey of adult skills that measures proficiency in key information processing skills (literacy, numeracy, problem solving) and provides information and data about how adults use technology at home, work and in the community (OECD, 2010; OECD, 2012; OECD, 2013; OECD, 2018). In this study, core competencies are the knowledge, skills, attitudes, and ability to derive outstanding results in the process of performing a job (Spenser et al., 1993). It is the ability to live a down-to-earth life. In other words, core competency is a concept that encompasses the skills, knowledge, and attitudes required to solve problems in a diverse and changing environment.

Now, the university has become a place to establish the universal values required by the times, lead the times, and create knowledge and wisdom for the mature development of the national society. As in the past, it has become difficult to respond to changes in knowledge and skills and changes in the labor market only with education on major knowledge or skills. Universities around the world provide excellent subjects and non-course subjects, allowing students to develop specialization in their majors, solve social problems, lead others through convergence thinking and manage conflicts (Ministry of Education in South Korea, 2015). In particular, excellent universities develop and provide a curriculum that helps to balance core cognitive and non-cognitive abilities, and teach students to demonstrate their creative abilities (Jin et al., 2011).

In the past, the academic achievement of college students could only be checked with one credit. However, in a changed society, the achievements of university education include not only major knowledge and expertise, but also critical thinking skills, problem solving skills, communication skills, leadership, and global mind. However, there are universities or college students with low awareness of core competencies, and even if there are developed core competencies, it is necessary to apply social changes that require new future competencies (Kim, 2019). In this study, it was determined that it was necessary to improve core competencies through new future competencies required by a developed society, and accordingly, core competencies, sub competencies, and diagnostic tools were improved.

2.2 Core Competencies of University Students

Core and Sub Competencies. Competencies, which emerged in the context of intensifying productivity and competition, does not mean the ability in a specific area, but rather includes life skills to make an individual's life worthwhile and human, including even the non-cognitive area, which is an individual's characteristics and abilities. is being expanded to Emphasizing competency is a way to spread awareness of individuality according to respect for individual values and to reveal the emphasis in the non-cognitive domain, which has turned from the emphasis on the cognitive domain. Competency can be understood as an 'internal characteristic of an individual' to appropriately respond to a certain job or situation (Spenser et al., 1993). Since the 1990s, when the DeSeCo project, which provided a new meaning to competency, was implemented, it became more active by forming a discourse on core competency and educational performance indicators.

Core competencies can be developed by themselves, but core competencies can be subdivided and materialized through sub-competencies. Sub-competency is a more subdivided and concrete concept for each core competency. The concept of competency itself is abstractly broad, so it is important to avoid overlapping or conflicting hierarchies or categories between core competencies, between core competencies and sub-competencies, and between sub-competencies. The setting of sub-competency is useful when applied to the curriculum in that it subdivides and materializes the vague and abstract concepts and areas of core competencies (Jin et al., 2011).

2.3 Core Competencies of K-University

K-University is the first national history school established by the patriots of the Provisional Government of Shanghai in 1946. The government desired for pure academic enthusiasm and a balanced intellect at the said university. Any great ideal involves the belief that meaningful results can only be achieved through consistent practice under a concrete plan. Seong-gon Kim, who took over K University in 1959, inherited the above founding ideology and at the same time laid the foundation for the university's revival by adding the four major educational ideologies of 'nationalism, humanism, culturalism, and industrialism'. ‘Nationalism’ emphasizes that science should contribute to the welfare and prosperity of the nation, while ‘humanism’ expresses the spirit of universal respect for humanity that transcends national and ethnic boundaries. In addition, 'culturalism' emphasizes that the purity of academics should be highly valued in universities, and 'industrialism' means that science should be practically used in real life and national industrial development (Kookmin University, 2013).

Based on this founding philosophy and education philosophy, K University has established a university philosophy to nurture competent talents with a strong national view and national consciousness. The university philosophy is embodied as an educational purpose that reflects the needs of the nation, society and the times, and in Chapter 1 Article 1 of the school regulations, “Based on the spirit of Hong-ik Humanity (widely benefit humans), the educational philosophy of Korea, and the founding philosophy and education philosophy of the university. By faithfully performing education, research, and social service activities necessary for the development of the nation and human society, it aims to nurture talents equipped with the knowledge of practicing cultured people, communicators, leading future people, and creative professionals.” stated (Kookmin University, 2014).

Character education, cooperative education, initiative education, and creativity education are the educational goals set by K University to nurture students into practicing liberals, communicative collaborators, leading future people, and creative professionals. These educational goals are achieved when students have the core competencies each educational goal requires. From November 2013 to February 2014, the university went through a multifaceted research and analysis process, such as analyzing the university ideology, surveying the talents required by companies, surveying the talents of domestic and foreign universities, and surveying the opinions of university members including alumni. The five core competencies established were, first, ‘humanities competency,’ which is the core competency required for the realization of character education; ‘communication competency,’ which is the cooperative education; ‘globalization competency,’ which is the initiative education, and; ‘creativity competency’ and ‘professionalism competency’ which are the core competencies required for creativity education. Through the achievement of the above-mentioned university philosophy, four educational objectives, four educational goals, and five core competencies, should be aimed by K-University to cultivate talents that meet the needs of the nation, society and the times, that is, “challenging talents” (Kookmin University, 2015).

The definitions of the five core competencies and sub-competencies established by K-University to nurture talented people who take on challenges are as follows. First, ‘humanities competency’ refers to efforts to establish a correct view of history and practice service based on morality and cultural literacy. These competencies are further subdivided into four sub-competencies: historical knowledge, ethical awareness, cultural sensibility, and service spirit (Kookmin University, 2014). Among them, historical knowledge refers to the ability to understand and explore people and life through correct historical consciousness. On the other hand, ethical consciousness refers to an attitude to seriously reflect on the right and wrong about human behaviour and way of life, an attitude to consider the interests of others or the community before one's own interests, and a tendency to act according to belief in morality. Cultural sensibility means the effort and attitude to be interested in and enjoy culture and art, and the sensitivity to beauty. Lastly, the spirit of service refers to the attitude of voluntarily sacrificing oneself to help others or for the sake of the community, even though there is no material gain.

The second core competency, ‘communication competency’, refers to the ability to produce results through cooperation in the community by using appropriate media to convey one’s thoughts and empathize with others. These communication skills are subdivided into three sub-competencies: communication ability, cooperative spirit, and responsibility. Communication competency' refers to the ability to effectively express one's intentions and thoughts, and to understand and listen to various information. It is the ability to coordinate opinions and effectively collaborate for a common goal in a community (Kookmin University, 2015). Also, ‘responsibility’ refers to an attitude of willingly accepting what one must endure for a common goal in the community.

The third core competency, ‘globalization competency’, refers to the ability to cultivate foreign language skills and accept cultural diversity based on self-identity and initiative in a global environment (Kookmin University, 2014). The first sub-competency that constitutes this is 'self-direction', which sets goals for one's life, establishes and

implements specific plans to achieve them, evaluates the results and reflects them in the next plan. On the other hand, the second sub-competency, 'challenge spirit,' strives to find new possibilities rather than passively living one's life according to a given pattern, acts one step ahead of others, and is afraid of failures that may occur in this process. The third sub-competence, 'global mind', refers to the ability to understand oneself as a part of the global environment, apply one's thoughts to this environment, and act according to the situation and context. 'Ability' refers to the ability to express one's opinion through communication with a foreigner, understand the other's opinion, as well as adjust the opinion according to the situation.

The fourth core competency, 'creativity competency', refers to the ability to critically analyse phenomena and solve problems found from various perspectives. This competency consists of three sub-competencies: creativity, critical thinking, and problem solving. First, creativity refers to the ability to find new and appropriate solutions out of a fixed way of thinking, and critical thinking ability refers to the thinking and attitude that can derive valid and reliable evaluations based on objective analysis of data (Kookmin University, 2014). Problem-solving refers to the ability to find new problems in unstructured problem situations, suggest various alternatives, and derive optimal solutions.

The last core competency, 'professionalism competency', refers to the ability to think convergence that can be applied to various fields by acquiring in-depth major knowledge. These specialized competencies are composed of two sub-competencies, namely, major knowledge and convergence thinking ability. First, 'major knowledge' refers to the ability to acquire core major knowledge or skills required in the relevant field through major education, and to systematically manage it to utilize it appropriately as needed (Kookmin University, 2014). 'Convergence thinking competency' refers to the confidence and positive attitude toward convergence necessary to grow into a talented person who can solve problems creatively and comprehensively based on convergence knowledge, that is, interest in the process.

2.4 Competency-Based Curriculum and University Education Outcomes

Because core competency is the ability to engage in the holistic ideal of life beyond the special competency required to perform a specific job (Lim et al., 2021), the core competency of a university is a basic requirement that all college students must have regardless of department or major. Therefore, what to teach and how to learn in university education is an ongoing educational topic. In particular, the recent 4th industrial revolution, the New Normal, and the spread of infectious diseases such as COVID-19 are demanding a fundamental change to the conventional university education. The characteristics of the 21st century, in which social uncertainty is aggravated, boundaries between domains are becoming increasingly vague, and driving rapid change and continuous change, require a fundamental reflection on the talent nurturing paradigm.

Accordingly, the Korean government emphasizes the need to prepare a curriculum based on core competencies and provide it to students (Ministry of Education in South Korea, 2015). The competency-based curriculum transforms educational goals, which have been at an abstract level, into behavioural goals. According to the competency-based curriculum, the educational goals can be revealed in action, and the final educational goals, educational conditions, situations, and achievement standards can be clearly set throughout the course of the class. In other words, it is possible to clarify educational goals in university education, to manage the entire process by focusing on capacity building, and to effectively achieve educational outcomes (Jin et al., 2011).

In response to these demands, it is timely to reflect on university education so far, look at the challenges facing university education based on core competencies that can open the life of the future society, and seek desirable improvement directions. This study closely examines the five core competencies and sub competencies envisaged by K University, analyses the shortcomings in preparing for the new era and the future, and prepares improvement plans by reflecting the competencies required by the future society. Furthermore, through the improved core competency scale, the core competency level of current students is identified, and the characteristics of each potential profile are identified to find ways to enhance competency in college education, thereby contributing to substantialize education.

3. Method

3.1 Research Design

This study was designed in the order of data review, expert review, survey, validity and reliability verification, and latent hierarchical analysis in order to develop a college student core competency diagnostic tool that reflects future competencies. First, all studies related to core competencies conducted at K University were tracked and collected, and the contents were also comprehensively analysed. And by examining the literature on the future competencies of college students, competencies to be additionally reflected were derived. The derived factors were set as

sub-domains of the core competency, and a total of 75 initial questions that could best reveal the meaning of each sub-domain were developed, 5 for each sub-domain. Next, through experts, the hierarchy and categories of core competencies and sub-competencies, as well as the contents of the questionnaire, were reviewed, and opinions were collected to derive additional necessary future competencies. Some questions were revised by reflecting the expert review results, and a survey was conducted for college students. Reliability and validity were verified based on the collected data. Finally, to analyse the students' core competency level, a potential class analysis was conducted, the level and characteristics of each class' core competency were confirmed, and the differences by type were analysed.

3.2 Research Participants

The subject of this study was an online survey conducted for 5 days from April 12 to 16, 2021, targeting 15,000 students at K University in Korea, and a total of 983 people participated. The gender of the study participants was 46.7% male and 53.3% female, and the grades were 1st grade 45.3%, 2nd grade 18.5%, 3rd grade 19.6%, 4th grade 16.6%. As for major fields, 49.2% were in the humanities and social sciences, 42.9% in science and engineering, and 7.8% in the arts and sports.

3.3 Analysis Method

This study used SPSS 25.0 for Windows, AMOS 25.0 and Mplus 8.7 for data analysis. The statistical methods used were frequency analysis, descriptive statistical analysis, reliability analysis, correlation analysis, T-test and ANOVA, confirmatory factor analysis (CFA), latent profile analysis (LPA), and chi-square test, and the statistical significance level was set to 0.05 in all analyses.

4. Results

4.1 Development of K-University Core Competency Scale

In order to improve the K-University core competency scale developed and used since 2014, the direction of improvement was set by maintaining the five core competencies and adding and supplementing sub-competencies. To this end, the core competency and sub-competencies, and the hierarchy, category, and coherence between the sub-competencies were discussed in depth. As a result, three sub-competencies were composed to each of the five core competencies, and five questionnaires were developed for the diagnosis of the fifteen sub-competencies. Except in the case of maintaining or supplementing the existing sub-competence, preliminary questions other than the five main questions were placed for the new sub-competence to be replaced by excluding questions that impair reliability or validity in the verification process. After that, content validity was verified through seven expert meetings and three online surveys. A preliminary survey was conducted for current students using the questionnaire, and the Cronbach's α was confirmed through reliability analysis. The validity was verified through factor analysis. As a result, 75 questionnaires for the 15 sub-competencies initially selected were confirmed as the final scale.

4.2 Scale Development

Since August 2013, K-University recognized the need to establish a new image of the university. It has reviewed the founding philosophy of the university and the image of social talent from various angles, and established five core competencies unique to K-University. Based on this, by reorganizing the curriculum and non-curriculum subjects, we have laid the necessary foundations to nurture students into practicing liberals, communicative collaborators, leading future people, and creativity professionals. In addition, K-University is to operate the curriculum and non-curricular curriculum appropriately for educational goals, and to diagnose and manage the competency level of current students, which can be said to be the outcome for sustainable education, and how much has changed through education (Kookmin University 2014).

The core competency scale is an essential element necessary to build such a system. By using the core competency scale, it is possible to continuously analyze the change in students' competency. In addition, it can be used as basic data to set guidelines for establishing various strategies and policies necessary to effectively operate educational programs. Students can also use the core competency scale to check their own competency level, so that they can clearly determine the areas that need improvement. It is expected that the educational performance will also increase by allowing students to set clear goals and participate in the curriculum and non-curricular subject areas (Kookmin University, 2015).

However, as mentioned at the beginning of the development of the diagnostic tool in 2014, even if it is the same core competency, the detailed sub-competencies that constitute it and the specific questions to measure it may vary according to the changes of the times. Therefore, it is necessary to continuously review and supplement the validity

and reliability of diagnostic tools. The core competency scale provides a virtuous cycle structure to achieve the educational goals pursued by K-University, and through this, builds a high-quality educational environment, which ultimately contributes to cultivating 'challenging talents'.

This study is a pre-developed K-University core competency scale to enhance the excellence of the educational programs provided by K-University, ultimately lead the future, and nurture challenging talents with the ability to solve social problems. It is intended to improve the diagnostic tool by deriving future competencies that should be newly included and preparing questionnaires for diagnosing them.

4.3 Experts Review

This study aims to improve the current K-University Core Competency scale (5 core competencies, 16 sub-competencies, 87 questions), which has been developed to clearly diagnose the core competencies of current students by reflecting the changing future competencies and talents of our university. To this end, a literature review was conducted first. Through literature review, the existing unnecessary sub-competencie was removed and replaced with a new future competency, but the concept and category of the new competency did not overlap or contradict the existing competency conceptually. Through this process, the existing 16 sub-competencies of the 5 core competencies were improved and derived 15 sub-competencies, and detailed questions were developed to measure the newly added sub-competencies. Detailed questions for each sub-factor were developed primarily through literature review, and contents were reviewed and compatibility with existing questionnaires was discussed through experts in the relevant field. Through this process, 75 main items and 32 preliminary items were prepared to measure the 5 core competencies and 15 sub-competencies.

According to Lynn (1986) that the number of members of the expert group for evaluating the content validity of an item is desirable in the range of 3 to 10, a Task Force Team was formed through six experts in each field such as education, sociology, and business administration. For this expert group, seven online and offline meetings and 3 e-mail surveys were conducted to verify the validity of the new sub-competency and competency-specific questionnaires. The expert meeting was held from November 17, 2020 to the end of February 2021 to review the importance of future capabilities derived through literature review and the need to reflect the core competency diagnostic tools, and to seek ways to include them in the existing core competency diagnostic tools.

At the first meeting, the need for improvement of existing core competencies and the scope and direction were discussed as the demand for future talents due to rapid increase in social change. In order to maintain the existing tools as much as possible for comparison with the past diagnosis results and to conduct longitudinal studies, the five core competencies are maintained and the sub-areas are supplemented. To avoid conflicting values between competencies, the coherence was carefully reviewed. At the 2nd and 3rd meetings, the subcompetencies that need to be newly added were derived centered on the five core competencies, and the direction of removing unnecessary existing subcompetencies was discussed. In this process, an in-depth discussion was conducted on the composition of 15 sub-competencies that students could equip and develop during their college life. At the fourth and fifth meetings, the concepts of some sub-competencies were expanded and renamed by reflecting the opinions of experts. At the sixth meeting, the questionnaire of the changed sub-competency discussed in the process was finally reviewed, and the questionnaire maintained in the existing sub-competency was also reviewed. While reviewing the adequacy of the 15 sub-competencies, it was comprehensively reviewed to see if there were any overlapping or similar contents with the existing questions. Finally, at the seventh meeting, the 5 core competencies and 15 sub-competencies were finally reviewed, and the questionnaire was searched for and concluded using methods to improve students' practical competencies.

4.4 Validation of Scale through Preliminary Investigation Results

Content, construct, discriminant validity, and reliability were analyzed to verify the validity of the K-University core competency diagnostic tool developed through expert meetings. First, to verify construct validity, confirmatory factor analysis was performed using the structural equation model, and correlation analysis was performed to verify discriminant validity. To check the reliability of the diagnostic tool, Cronbach's α was calculated. In this study, to improve the diagnostic tool, the main question and the preliminary questions were prepared separately, and the validity and reliability were verified mainly with the main question alone, and the preliminary questions were used when the verification was difficult. Therefore, the first analysis including only the preliminary questions was first conducted, and as a result of the analysis, 15 questions on the 5 core competencies and 75 questions on the sub-competencies were confirmed as the final questions excluding the preliminary questions.

4.5 Descriptive Statistical Analysis

To understand the analysis results of the data collected through the preliminary survey, first, descriptive statistical analysis was performed on 75 main sections of the humanities competency, communication competency, globalization competency, creativity competency, professionalism competency. As a result of the analysis, there were no extreme values, and the absolute values of skewness and kurtosis were analyzed to be less than two and seven, respectively, confirming that the collected data generally satisfies normality. Among them, ethical consciousness, mutual cooperation, convergence thinking, and information utilization showed high scores with an average score of over 4.0, and it can be seen that the average score of historical consciousness, foreign language use, and challenging spirit was relatively low. The detailed results are shown in Table 1 below.

Table 1. Descriptive Statistical Analysis (N=983)

Competency	Min.	Max.	M	SD	Skewness	Kurtosis
Historical Consciousness	1.0	5.0	3.484	.703	-.404	.508
Ethical Consciousness	2.2	5.0	4.359	.469	-.573	.165
Cultural Sensibility	1.0	5.0	3.700	.826	-.389	-.098
Humanities Competency	2.20	5.00	3.847	.481	-.102	-.022
Expression	1.2	5.0	3.809	.625	-.213	.250
Mutual Cooperation	2.4	5.0	4.264	.528	-.322	-.441
Conflict Management	1.4	5.0	3.905	.607	-.317	.454
Communication Competency	2.53	5.00	3.992	.458	-.080	.023
Foreign Language Use	1.4	5.0	3.584	.753	-.034	-.440
Challenge Spirit	1.0	5.0	3.547	.807	-.072	-.423
Diversity Inclusion	1.0	5.0	3.605	.679	-.115	.309
Globalization Competency	1.53	5.00	3.578	.548	.135	.003
Convergent Thinking	2.0	5.0	4.198	.617	-.551	.065
Critical Thinking	2.4	5.0	3.967	.503	-.004	.045
Problem Solving	1.2	5.0	3.717	.638	-.023	-.113
Creativity Competency	2.47	5.00	3.961	.471	.070	-.127
Major Expertise	1.0	5.0	3.679	.700	-.281	.220
Self-direction	1.0	5.00	3.751	.711	-.414	.398
Information Literacy	1.6	5.0	4.101	.566	-.283	.149
Professionalism Competency	1.20	5.00	3.854	.541	-.298	.695

4.6 Reliability Analysis

Reliability analysis was conducted to determine the internal consistency of each competency through the results of the questionnaire survey in the main section to measure 15 sub-competencies of the 5 core competencies. First, the Cronbach's α of all items is .951. The Cronbach's α for each of the five core competencies was analyzed as .825 for humanities, .867 for communication, .838 for globalization competency, .872 for creativity, and .878 for professionalism competency. The Cronbach's α for each of the 15 sub-competencies is .798 for historical consciousness, .695 for ethical consciousness, .886 for cultural sensitivity, .826 for expression, .816 for mutual cooperation, .807 for conflict management, .795 for foreign language use, .867 for challenge spirit, .757 for diversity inclusion, .840 for convergence thinking, .711 for critical thinking, .830 for problem solving, .820 for major expertise, .778 for self-direction, .813 for information literacy were analyzed.

Next, in order to verify construct validity for core competencies, the cross correlation among core competencies was first analyzed. As a result, the bivariate correlation coefficient between sub-competencies was in the range of .162 to .624. All were confirmed to have a statistically significant correlation ($p<.01$). These results can be interpreted that each core competency has an organic relationship with each other, and ultimately each sub-competency forms a construct well.

4.7 Factor Analysis

First, exploratory factor analysis was performed to statistically extract the number of factors. By examining the sample adequacy of KMO, it was checked whether the size of the correlation matrix of the sample was suitable for factor analysis. Second, the factor structure was analyzed referring to Bartlett's sphericity verification results and scree plots. Third, an orthogonal rotation method using principal component analysis and varimax was performed. The analysis sequence was conducted in the order of humanities competency, communication competency, globalization competency, creativity competency, and professionalism competency. As a result of a factor analysis on historical consciousness, ethical consciousness, and cultural sensitivity, which are sub-competencies of humanities competency, the KMO was analyzed as .853, which was close to 1, and was judged to be a valuable index value (Sung, 2019). Also, the Bartlett test result was statistically significant at x^2=5245.194 (df=105, p<.001). As a result of the following exploratory factor analysis on the main section selected to diagnose communication competency, the KMO was .890 and Bartlett test result was x^2=5431.776 (df=105, p<.001), thus statistical significance was confirmed. The result of the factor analysis on the spirit of challenge, foreign language use, and acceptance of diversity, which are sub-competencies of globalization competency, were .867 on KMO and x^2=5414.373 (df=105, p<.001) on Bartlett's test result, statistical significance was confirmed. As for creativity competency, the KMO was .902 and the Bartlett test result was statistically significant at x^2=5422.642 (df=105, p<.001). For professionalism competency, the KMO was .906 and Bartlett test result was statistically significant at x^2=5628.790 (df=105, p<.001).

4.8 Validation

Through the verification of the preliminary survey results, it was confirmed that the sub-factors of each core competency generally had a significant positive correlation. Several goodness-of-fit indices were reviewed for the goodness of fit of the structural equation model. This is because one goodness-of-fit index indicates the overall fitness of the model by reflecting only specific aspects of the model. In addition to the model's absolute fitness index, the standard agreement index TLI and the incremental fit index CFI are commonly used. It is recommended to use RMSEA as an index showing the simplicity of the model (Hong, 2000).

There are three criteria for structural equation model validation, and the details are as follows. First, the model is accepted or rejected through statistical verification as a single model. Second, several competing hypotheses are assumed and the most suitable model is selected through statistical verification. Among them, the third method is the most used in research, and this study tried to verify it by using the first method through a research model established through careful review of previous studies.

4.8.1 Humanities Competency

Table 2. Humanities Competency Factor Analysis

			λ	AVE	CR
historical consciousness	→	historical consciousness1	.484	.462	.808
	→	historical consciousness2	.696		
	→	historical consciousness3	.726		
	→	historical consciousness4	.722		
	→	historical consciousness5	.737		
ethical consciousness	→	ethical consciousness1	.482	.339	.708
	→	ethical consciousness2	.741		
	→	ethical consciousness3	.719		
	→	ethical consciousness4	.439		
	→	ethical consciousness5	.450		
cultural sensibility	→	cultural sensibility1	.682	.611	.886
	→	cultural sensibility2	.824		
	→	cultural sensibility3	.846		
	→	cultural sensibility4	.757		
	→	cultural sensibility5	.788		
x^2=323.376, df=87, p=.000, q=3.717, CFI=.954, TLI=.945, NFI=.939, RMSEA=.053					

Table 2 shows the results of confirmatory factor analysis of humanities competency. Considering that the test is sensitive to the size of the sample, and the larger the sample size, the easier it is to reject the null hypothesis that the model and the complete collection are consistent, the other goodness-of-fit indices were also examined. The analysis results are x^2=323.376, df=87, p=.000, q=3.717, CFI=.954, TLI=.945, NFI=.939, and RMSEA=.053. When the index values of TLI and CFI are close to 1.0, the researcher's model has a relatively better fit than the independent model (base model) with zero covariance. The RMSEA was also less than .08, thus, it can be considered that the level of approximation error is appropriate. Based on the concentration validity, the standardization coefficient, a factor load showing the relationship between the three subdomains of 'humanities competency' (historical consciousness, ethical consciousness, cultural sensitivity) and each item was within the range of .439 to .846. Further, the square values of the correlation coefficients between the factors were all found to be smaller than the AVE values, so discriminant validity could be confirmed. The convergent validity was also confirmed through CR and AVE (Thomson 2008; Fornell el al., 1981).

4.8.2 Communication Competency

Table 3 shows the results of confirmatory factor analysis of communication capacity which are x^2=463.925, df=87, p=.000, q=5.332, CFI=.930, TLI=.915, NFI=.915, and RMSEA=.066. The researcher's model has a relatively better fit than the independent model with zero covariance. The RMSEA can be judged that the approximate level of error is appropriate. The convergence validity shows that the standardization coefficient, the factor load indicating the relationship between the three sub-domains of 'communication competency' (opinion expression, mutual cooperation, conflict management) and each item was confirmed within the range of .603 to .766. All the square values of the correlation coefficient between factors are smaller than the AVE value, confirming the discriminant validity.

Table 3. Communication Competency Factor Analysis

			λ	AVE	CR
	→	expression1	.632		
	→	expression2	.722		
expression	→	expression3	.744	.491	.828
	→	expression4	.700		
	→	expression5	.702		
	→	mutual cooperation1	.715		
	→	mutual cooperation2	.715		
mutual cooperation	→	mutual cooperation3	.658	.474	.818
	→	mutual cooperation4	.659		
	→	mutual cooperation5	.693		
	→	conflict management1	.674		
	→	conflict management2	.603		
conflict management	→	conflict management3	.637	.468	.814
	→	conflict management4	.727		
	→	conflict management5	.767		
x^2=463.925, df=87, p=.000, q=5.332, CFI=.930, TLI=.915, NFI=.915, RMSEA=.066					

4.8.3 Globalization Competency

Table 4 shows the results of confirmatory factor analysis of globalization competency where x^2=407.987, df=87, p=.000, q=4.690, CFI=.940, TLI=.927, NFI=.925, and RMSEA=.061. As a result of meeting the fitness index criteria, it was confirmed that the fitness was good. The researcher's model has a relatively better fit than the independent model with zero covariance. The RMSEA was also less than .08, thus, it can be judged that the approximate error level is appropriate. The standardization coefficient between the three sub-domains of 'globalization competency' (foreign language application, challenge spirit, acceptance of diversity) was .366 to .816. The criterion for judging the factor load factor is usually ±.3 or more, which is judged to be significant, so .4 is applied as a more conservative criterion. However, since there is no absolute standard for judging this, this study applied the standard of .3 (Crocker et al., 1986). The square of the correlation coefficient between the factors was all smaller than the AVE, so discriminant validity was verified

Table 4. Globalization Competency Factor Analysis

				λ	AVE	CR
	→	foreign language use1	.366			
	→	foreign language use2	.733			
foreign language use	→	foreign language use3	.810		.454	.798
	→	foreign language use4	.746			
	→	foreign language use5	.623			
	→	challenge spirit1	.806			
	→	challenge spirit2	.650			
challenge spirit	→	challenge spirit3	.816		.572	.869
	→	challenge spirit4	.803			
	→	challenge spirit5	.690			
	→	diversity inclusion1	.651			
	→	diversity inclusion2	.650			
diversity inclusion	→	diversity inclusion3	.535		.403	.770
	→	diversity inclusion4	.692			
	→	diversity inclusion5		.634		
x^2=407.987, df=87, p=.000, q=4.690, CFI=.940, TLI=.927, NFI=.925, RMSEA=.061						

4.8.4 Creativity Competency

Table 5 shows the results of confirmatory factor analysis of Creativity Competency where x^2=421.172, df=87, p=.000, q=4.841, CFI=.938, TLI=.925, NFI=.923, and RMSEA=.063, confirming that the fitness was good. The researcher's model has a relatively better fit than the independent model with zero covariance. The RMSEA can be judged that the approximate error level is appropriate. The result of analyzing the factor load indicating the relationship among the three subdomains of convergent validity, standardization coefficient, and 'creativity' (convergent thinking, critical thinking, and problem solving) was .372 to .767. All the squares of the correlation coefficient between factors were confirmed to be smaller than the AVE, confirming the discriminant validity. The concentrated validity can be confirmed through CR and AVE (Thomson 2008; Fornell et al., 1981).

Table 5. Creativity Competency Factor Analysis

			λ	AVE	CR
	→	convergent thinking1	.725		
	→	convergent thinking2	.741		
convergent thinking	→	convergent thinking3	.711	.516	.842
	→	convergent thinking4	.718		
	→	convergent thinking5	.697		
	→	critical thinking1	.612		
	→	critical thinking2	.687		
critical thinking	→	critical thinking3	.621	.350	.723
	→	critical thinking4	.618		
	→	critical thinking5	.372		
	→	problem solving1	.712		
	→	problem solving2	.663		
problem solving	→	problem solving3	.767	.503	.834
	→	problem solving4	.752		
	→	problem solving5	.644		
x^2=421.172, df=87, p=.000, q=4.841, CFI=.938, TLI=.925, NFI=.923, RMSEA=.063					

4.8.5 Professionalism Competency

Table 6 shows the results of confirmatory factor analysis of professionalism competency where x^2=359.182, df=87, p=.000, q=4.129, CFI=.951, TLI=.941, NFI=.937, and RMSEA=.056. The fit index criteria were good. The researcher's model has a relatively better fit than the independent model with zero covariance. The RMSEA was less than .08 and it can be judged that the approximate error level is appropriate. The standardization coefficient between the three subdomains of 'professionalism' (literacy, self-direction, information utilization) was within the range of .420 to .758. The squares of the correlation coefficients between factors were all smaller than the AVE confirming the discriminant validity.

Table 6. Professionalism Competency Factor Analysis

			λ	AVE	CR
major expertise	→	major expertise1	.654	.490	.827
	→	major expertise2	.756		
	→	major expertise3	.708		
	→	major expertise4	.750		
	→	major expertise5	.621		
self-direction	→	self-direction1	.526	.437	.793
	→	self-direction2	.657		
	→	self-direction3	.680		
	→	self-direction4	.742		
	→	self-direction5	.680		
information literacy	→	information literacy1	.758	.505	.830
	→	information literacy2	.716		
	→	information literacy3	.796		
	→	information literacy4	.791		
	→	information literacy5	.420		
x^2=359.182, df=87, p=.000, q=4.129, CFI=.951, TLI=.941, NFI=.937, RMSEA=.056					

4.9 Selection Final Items of Core Competency Scale

This study provides a tool to accurately diagnose students' humanities, communication, globalization, creativity, and professionalism competency by maintaining the existing five core competencies provided by K-University, but adding the sub competencies required by the future society. The diagnostic tool improved through this study will help a lot in realizing the educational goals of K-University to foster creative convergence talents. K-University creates and provides a competency-based curriculum to students, to be equipped with specialized majors and the ability to create new values in connection with adjacent disciplines to solve social problems.

Table 7. The Final Scale Consisting of Selected Core Competencies and Questionnaires

Core competency	Sub competency	No.	Items
humanities competency	historical consciousness	1	I have a good understanding of our university's founding philosophy and history.
		2	I think about what kind of life is more valuable through the lives of historical figures.
		3	I have a good understanding of how historical events affect us today.
		4	I am interested and interested in books about history.
		5	I try to understand our country by connecting the past history with the present situation.
	ethical	6	When I write my homework report, I try not to take other people's work without permission.

	consciousness	7	I act after thinking that the consequences of my actions will harm others.
		8	I make a decision on whether to act after examining whether there is anything wrong with the intention of my actions.
		9	I believe that keeping morals can be detrimental in the short term, but in the end it helps me.
		10	I believe that you should be polite when communicating with others on the Internet and on social media, even if you are anonymous.
	cultural sensibility	11	I want to share with others the emotions I have gained through cultural and artistic works.
		12	I look for various information in the field of culture and art.
		13	I am interested and interested in books and videos about culture and art.
		14	I want to raise the level of my culture by participating in a program that helps people understand culture and art.
		15	I enjoy making cultural, artistic works and writes the subject of conversation.
communi-	expression	16	I can express my thoughts in words so that others can understand them better.
cation		17	I don't find it difficult to read other people's writings and get the gist of it.
competency		18	I can read and understand other people's writings and organize them from my own point of view.
		19	I don't find it difficult to grasp the core of the professor's questions in class.
		20	I can express my opinion coherently and clearly when asked questions in class.
	mutual cooperation	21	When I work on a joint project, I tend to think about how other team members will feel about what I said.
		22	When I write an email to a co-project team member, I've been thinking about what emotions it might create.
		23	When I work on a joint project, I tend to contribute to the team by taking on tasks that fit my abilities.
		24	When I work on a joint project, I tend to try not to harm others because of my opinions or actions.
		25	When I work on a joint project, I tend to think about the consequences of my actions in many ways, even small actions.
	conflict management	26	When conflict arises, I tend to actively attempt dialogue and mediation.
		27	When a conflict arises, I tend to try to figure out the cause.
		28	When conflict arises, I tend to resolve it without avoiding it.
		29	When a conflict arises, I tend to communicate in various ways to get the other person's consent.
		30	When a conflict arises, I tend to try to find an appropriate solution for the situation.
globaliza-	foreign language use	31	I have a good understanding of the importance of using foreign languages.
tion		32	It is not difficult for me to understand the contents of the original language textbooks used in class.
competency		33	I have experience in using foreign languages appropriately when performing assignments.
		34	I have experience reading texts written in foreign languages and summarizing key points.
		35	I have experience trying various methods to improve my foreign language skills.
	challenge spirit	36	I like new and challenging things, even if they involve some risk.
		37	I'm willing to do it when I feel like I should do it, even if I'm more likely to fail.
		38	I'm not afraid to try something new that is different from what I've been doing before.

		39	I do not settle for reality and try to find new opportunities.
		40	I see the current change as an opportunity, not a crisis.
	diversity	41	I try to be interested in various races, religions, and cultures.
	inclusion	42	When I meet a foreign student, I have the experience of trying to be friends first.
		43	I have a good understanding of the current situation of immigrants in Korea and related policies.
		44	I try to observe international etiquette by learning and understanding the behaviors of other cultures.
		45	I understand differences from other cultures, and I am open to other cultures.
creativity competency	convergent thinking	46	I want to learn not only in my field of study but also in other fields.
		47	I think I can get a lot of ideas for my major from other majors.
		48	I think the ability to converge various fields is necessary.
		49	I would like to have a job working with experts in various fields in the future.
		50	I think collaborating with students from other majors helps to broaden my major knowledge.
	critical thinking	51	I watch carefully for incorrect logic in other people's writings and opinions.
		52	I can judge which of the many pieces of information is more important.
		53	When I have a problem, I figure out what is causing the problem.
		54	When a problem is not resolved, I look at it from a different perspective.
		55	I accept other people's opinions even if they are different from mine.
	problem solving	56	I can judge the right or wrong of my opinion from various points of view.
		57	I have the ability to bring out their skills when solving difficult problems with my co-workers.
		58	I tend to think comprehensively about how to solve problems from multiple angles.
		59	I can grasp the core of a problem well, even when given a complex problem.
		60	When unexpected problems arise, I can respond without panic.
Professional -ism competency	major expertise	61	I can explain my major knowledge so that non-majors can understand it.
		62	I know how to use my major knowledge.
		63	I am well aware of why the major subjects I have studied are necessary for my major.
		64	I know what I need more of my major knowledge.
		65	I have experience in systematically categorizing and organizing information related to my major.
	self-direction	66	I have a plan for what I will do in 5 years.
		67	I always get things done on time.
		68	I believe in the ability to take control of my own life.
		69	I try to keep things going according to my plan.
		70	I try harder when things don't go well.
	information literacy	71	I can find the necessary knowledge and information through various channels.
		72	I have experience using various search methods to search for accurate information.
		73	I can properly classify meaningful and valuable information among the collected information.
		74	I can select and utilize essential information for problem solving from among many information.
		75	I strive to protect the copyright of the information I collect.

4.10 Core Competency Scale and Analysis Result

4.10.1 Descriptive Statistical Analysis

The level of core competencies and sub-competencies of 983 students who participated in the preliminary survey, based on their average, was 3.85. Among the core competencies, the average of 'communication competency' (3.99)' and 'Creativity Competency' (3.96)' was relatively high, followed by 'humanities competency' (3.85)' and 'professionalism competency' (3.85). As a result, the average of 'globalization competency' (3.58) was the lowest. The detailed results are shown in Table 8 below.

Table 8. Descriptive Statistics Analysis Result (N=983)

category	M	SD	skewness	kurtosis
historical consciousness	3.48	.703	-.40	.51
ethical consciousness	4.36	.469	-.57	.17
cultural sensibility	3.70	.827	-.39	-.10
humanities competency	3.85	.480	-.10	-.01
expression	3.81	.625	-.21	.25
mutual cooperation	4.26	.528	-.32	-.44
conflict management	3.90	.607	-.32	.45
communication competency	3.99	.457	-.08	.03
foreign language use	3.58	.753	-.03	-.44
challenge spirit	3.55	.807	-.07	-.42
diversity inclusion	3.60	.679	-.12	.31
globalization competency	3.58	.547	.14	.01
convergent thinking	4.20	.617	-.55	.07
critical thinking	3.97	.503	-.00	.05
problem solving	3.72	.637	-.02	-.11
creativity competency	3.96	.471	.07	-.12
major expertise	3.68	.700	-.28	.22
self-direction	3.75	.711	-.41	.40
information literacy	4.10	.566	-.28	.15
professionalism competency	3.85	.538	-.28	.68
total	3.85	.403	.03	.11

4.10.2 Difference in Core Competencies between Groups According to Gender

Core competencies were diagnosed for K-university students, and differences in competency levels were analyzed according to gender. As a result of the analysis, the statistically significant differences between the male and female students were analyzed as humanities competency ($t=-3.537$, $p<.001$) and creativity competency ($t=2.138$, $p<.05$). As a result of analyzing sub-competencies, cultural sensitivity ($t=-6{,}379$ $p<.001$), expression ($t=2.291$, $p<.05$), mutual cooperation ($t=-3.480$, $p<.01$), challenge spirit ($t=4.598$, $p<.001$), diversity inclusion ($t=-2{,}156$ $p<.05$), critical thinking ($t=2.860$, $p<.01$), and problem-solving ($t=2.744$, $p<.01$). Differences between groups according to gender were confirmed. The detailed analysis results are shown in Table 9.

Table 9. Differences in Core Competencies and Sub-competencies by Gender (N=983)

category		N	M	SD	t
historical consciousness	Male	459	3.50	.750	.805
	Female	524	3.47	.660	
ethical consciousness	Male	459	4.34	.472	-.966
	Female	524	4.37	.467	
cultural sensibility	Male	459	3.52	.876	-6.379***
	Female	524	3.86	.747	
humanities competency	Male	459	3.79	.507	-3.537***
	Female	524	3.90	.449	
expression	Male	459	3.86	.634	2.291*
	Female	524	3.77	.614	
mutual cooperation	Male	459	4.20	.540	-3.480**
	Female	524	4.32	.511	
conflict management	Male	459	3.94	.608	1.467
	Female	524	3.88	.605	
communication competency	Male	459	4.00	.471	.358
	Female	524	3.99	.445	
foreign language use	Male	459	3.55	.761	-1.259
	Female	524	3.61	.744	
challenge spirit	Male	459	3.67	.795	4.598***
	Female	524	3.44	.801	
diversity inclusion	Male	459	3.56	.696	-2.156*
	Female	524	3.65	.661	
globalization competency	Male	459	3.59	.557	.771
	Female	524	3.57	.538	
convergent thinking	Male	459	4.19	.629	-.262
	Female	524	4.20	.607	
critical thinking	Male	459	4.02	.523	2.860**
	Female	524	3.93	.481	
problem solving	Male	459	3.78	.649	2.744**
	Female	524	3.67	.622	
creativity competency	Male	459	4.00	.498	2.138*
	Female	524	3.93	.444	
major expertise	Male	459	3.68	.722	.127
	Female	524	3.68	.682	
self-direction	Male	459	3.77	.746	.696
	Female	524	3.74	.678	
information literacy	Male	459	4.10	.571	-.167
	Female	524	4.10	.561	
professionalism competency	Male	459	3.85	.559	.308
	Female	524	3.84	.519	

4.10.3 Difference in Core Competencies between Groups According to Grade

Table 10 shows the results of examining the differences in the level of each of the five core competencies according to the grades of the current students using the K-university core competency scale. As a result of the analysis, a statistically significant difference was found in professionalism competency among the five core competencies ($F=6.175$, $p<.001$), and through the Scheffe's test results, the mean of the freshmen was significant compared to the junior and senior grade groups.

Next, it was checked whether there was a difference in the level of core competencies according to grade in the 15 sub-competencies. According to the analysis results, expression of opinion ($F=2.941$, $p<.05$), foreign language use ($F=5.445$, $p<.01$), major expertise ($F=3.934$, $p<.01$), self-direction ($F=4.424$, $p<.01$) and information utilization ($F=5.468$, $p<.01$) were statistically significant. As a result of conducting the Scheffe's test to examine the differences more accurately between groups, meaningful results were derived in foreign language use, self-direction, and information literacy.

Table 10. Differences in Core Competencies and Sub-competencies by Grade Level (n=983)

category		N	M	SD	F (Scheffe's test)
historical consciousness	Freshmen	445	3.51	.672	.950
	Sophomore	182	3.48	.770	
	Junior	193	3.41	.694	
	Senior	163	3.49	.722	
ethical consciousness	Freshmen	445	4.37	.469	.429
	Sophomore	182	4.36	.482	
	Junior	193	4.36	.458	
	Senior	163	4.32	.468	
cultural sensibility	Freshmen	445	3.68	.821	1.016
	Sophomore	182	3.65	.820	
	Junior	193	3.78	.844	
	Senior	163	3.73	.827	
humanities competency	Freshmen	445	3.85	.477	.120
	Sophomore	182	3.83	.510	
	Junior	193	3.85	.451	
	Senior	163	3.85	.498	
expression	Freshmen	445	3.77	.610	2.941*
	Sophomore	182	3.79	.654	
	Junior	193	3.81	.671	
	Senior	163	3.94	.558	
mutual cooperation	Freshmen	445	4.25	.536	1.489
	Sophomore	182	4.26	.540	
	Junior	193	4.33	.501	
	Senior	163	4.22	.519	
conflict management	Freshmen	445	3.92	.616	.539
	Sophomore	182	3.85	.585	
	Junior	193	3.91	.614	
	Senior	163	3.92	.597	
communication competency	Freshmen	445	3.98	.465	.762
	Sophomore	182	3.97	.446	
	Junior	193	4.02	.461	
	Senior	163	4.03	.445	
foreign language use	Freshmen[a]	445	3.50	.756	5.445**
	Sophomore[b]	182	3.53	.723	a < d

	Junior[c]	193	3.68	.731	
	Senior[d]	163	3.74	.771	
challenge spirit	Freshmen	445	3.54	.794	.438
	Sophomore	182	3.53	.875	
	Junior	193	3.61	.791	
	Senior	163	3.53	.783	
diversity inclusion	Freshmen	445	3.59	.665	.485
	Sophomore	182	3.57	.657	
	Junior	193	3.63	.711	
	Senior	163	3.65	.706	
globalization competency	Freshmen	445	3.54	.540	2.363
	Sophomore	182	3.54	.550	
	Junior	193	3.64	.554	
	Senior	163	3.64	.547	
convergent thinking	Freshmen	445	4.21	.594	.260
	Sophomore	182	4.19	.630	
	Junior	193	4.19	.659	
	Senior	163	4.17	.619	
critical thinking	Freshmen	445	3.95	.503	.469
	Sophomore	182	4.00	.485	
	Junior	193	3.98	.551	
	Senior	163	3.96	.464	
problem solving	Freshmen	445	3.70	.638	.583
	Sophomore	182	3.71	.611	
	Junior	193	3.76	.686	
	Senior	163	3.73	.602	
creativity competency	Freshmen	445	3.95	.475	.140
	Sophomore	182	3.97	.449	
	Junior	193	3.98	.496	
	Senior	163	3.95	.454	
major expertise	Freshmen	445	3.61	.690	3.934**
	Sophomore	182	3.65	.779	
	Junior	193	3.77	.683	
	Senior	163	3.79	.633	
self-direction	Freshmen[a]	445	3.67	.704	4.424**
	Sophomore[b]	182	3.74	.754	a < c
	Junior[c]	193	3.88	.751	
	Senior[d]	163	3.82	.599	
information literacy	Freshmen[a]	445	4.02	.589	5.468**
	Sophomore[b]	182	4.17	.551	a < c
	Junior[c]	193	4.18	.551	
	Senior[d]	163	4.14	.510	
professionalism	Freshmen[a]	445	3.77	.546	6.175***
competency	Sophomore[b]	182	3.86	.564	a < cd
	Junior[c]	193	3.94	.542	
	Senior[d]	163	3.92	.449	

4.10.4 Difference in Core Competencies between Groups According to Major

In this study, the majors of K-University were divided into three departments: 'Humanities and Social Sciences', 'Science and Engineering', and 'Arts and Physical Education'. In addition, descriptive statistical analysis was

conducted to confirm the level of core competencies according to the student's major. As a result of the analysis, it was only possible to confirm the difference in the competency level according to the students' major fields in the humanities competency among the core competencies (F=16.423, p<.001). As a result of the Scheffe's test, it was confirmed that the average score of humanities competency was significantly lower in 'Science and Engineering' compared to 'Humanities and Social Sciences' and 'Arts and Physical Education'.

Among the lower competencies, historical consciousness (F=10.900, p<.001), cultural sensitivity (F=17.902, p<.001), challenging spirit (F=3.649, p<.05), diversity inclusion (F=5.001, p.01), and convergent thinking (F=3.801, p<.05) showed differences in competency levels according to students' majors. To examine the differences between groups more closely, the Scheffe's test was conducted, and as a result, significant results were derived in historical consciousness, cultural sensibility, challenging spirit, diversity inclusion, and convergent thinking. Detailed analysis results are presented in Table 11.

Table 11. Differences in Core Competencies and Sub-competencies by Major (n=983)

	category	N	M	SD	F
historical consciousness	Humanities and Social Sciencea	484	3.58	.700	10.900*** b < a
	Science and Engineeringb	422	3.37	.696	
	Arts and Physical Educationc	77	3.48	.671	
ethical consciousness	Humanities and Social Sciencea	484	4.38	.466	2.447
	Science and Engineeringb	422	4.32	.469	
	Arts and Physical Educationc	77	4.43	.479	
cultural sensibility	Humanities and Social Sciencea	484	3.74	.784	17.902*** ab < c
	Science and Engineeringb	422	3.57	.845	
	Arts and Physical Educationc	77	4.16	.808	
humanities competency	Humanities and Social Sciencea	484	3.90	.461	16.423*** b < ac
	Science and Engineeringb	422	3.75	.484	
	Arts and Physical Educationc	77	4.02	.482	
expression	Humanities and Social Sciencea	484	3.84	.601	1.365
	Science and Engineeringb	422	3.78	.654	
	Arts and Physical Educationc	77	3.78	.598	
mutual cooperation	Humanities and Social Sciencea	484	4.28	.519	.750
	Science and Engineeringb	422	4.24	.534	
	Arts and Physical Educationc	77	4.30	.551	
conflict management	Humanities and Social Sciencea	484	3.91	.605	.032
	Science and Engineeringb	422	3.90	.587	
	Arts and Physical Educationc	77	3.89	.719	
communication competency	Humanities and Social Sciencea	484	4.01	.447	.770
	Science and Engineeringb	422	3.97	.467	
	Arts and Physical Educationc	77	3.99	.470	
foreign language use	Humanities and Social Sciencea	484	3.61	.787	.624
	Science and Engineeringb	422	3.56	.711	
	Arts and Physical Educationc	77	3.55	.757	
challenge spirit	Humanities and Social Sciencea	484	3.48	.839	3.649*
	Science and Engineeringb	422	3.61	.772	
	Arts and Physical Educationc	77	3.63	.755	
diversity	Humanities and Social Sciencea	484	3.66	.676	5.001**

inclusion	Science and Engineeringb	422	3.53	.673	
	Arts and Physical Educationc	77	3.69	.694	
globalization competency	Humanities and Social Sciencea	484	3.58	.570	
	Science and Engineeringb	422	3.57	.521	.399
	Arts and Physical Educationc	77	3.62	.544	
convergent thinking	Humanities and Social Sciencea	484	4.16	.632	3.801* a < c
	Science and Engineeringb	422	4.21	.598	
	Arts and Physical Educationc	77	4.37	.603	
critical thinking	Humanities and Social Sciencea	484	3.98	.507	
	Science and Engineeringb	422	3.96	.498	.288
	Arts and Physical Educationc	77	3.94	.510	
problem solving	Humanities and Social Sciencea	484	3.71	.635	
	Science and Engineeringb	422	3.73	.638	.151
	Arts and Physical Educationc	77	3.70	.647	
creativity competency	Humanities and Social Sciencea	484	3.95	.472	
	Science and Engineeringb	422	3.97	.468	.485
	Arts and Physical Educationc	77	4.00	.475	
major expertise	Humanities and Social Sciencea	484	3.68	.688	
	Science and Engineeringb	422	3.65	.714	2.453
	Arts and Physical Educationc	77	3.84	.692	
self-direction	Humanities and Social Sciencea	484	3.76	.728	
	Science and Engineeringb	422	3.73	.685	.344
	Arts and Physical Educationc	77	3.78	.749	
information literacy	Humanities and Social Sciencea	484	4.11	.564	
	Science and Engineeringb	422	4.10	.572	.245
	Arts and Physical Educationc	77	4.06	.544	
professionalism competency	Humanities and Social Sciencea	484	3.85	.535	
	Science and Engineeringb	422	3.83	.538	.575
	Arts and Physical Educationc	77	3.90	.561	

4.11 Latent Profile Analysis

Latent profile analysis (LPA) was conducted according to the core competencies of current students to classify the potential groups of core competencies and to identify the characteristics of the classified groups. First, through the improved K-University Core Competency scale that reflects the opinions of experts, the humanities, communication, globalization, creativity, and professionalism competencies of university students were measured. Afterwards, the number of potential classes was derived based on the survey results answered. In order to determine the number of latent layers, Akaike Information Criteria (AIC), Baysian Information Criteria (BIC), Sample-size Adjusted BIC (SSABIC), statistical significance, and entropy, which are information fit indices, were referred to. For statistical significance testing, likelihood ratio test (LRT) and bootstrap likelihood ratio test (BLRT) were used, and the model that best explains the classification between groups was finally selected. Next, the SPSS 26.0 program was used to identify the characteristics of each potential class and to examine the differences between potential profiles more closely, classifying groups based on gender, grade, and major, which are general characteristics of college students, and analyzing the differences between groups.

The core competency level of current students was measured through the improved K-University core competency scale, and the number of potential profiles was determined after analyzing the unconditional model without exogenous variables. The analysis was conducted using a three step approach that analyzes a conditional model that includes variables that are expected to affect the analysis. This analysis method is a method of comprehensively

examining the information index, verification results, statistical significance, and changes in the quality of classification while increasing the number of layers by one to determine the number of latent profiles. The analysis results are presented in Table 12.

Table 12. Latent Profile Classification Criteria

Criteria		number of latent profiles				
		2	3	4	5	6
Information index	Loglikelihood	-12798.550	-12331.865	-12143.924	-12053.292	-11986.610
	AIC	25689.100	24787.730	24443.848	24294.584	24193.219
	BIC	25914.068	25090.948	24825.316	24754.301	24731.186
	SABIC	25767.971	24894.035	24577.586	24455.755	24381.824
x^2 p-value	VLMRT	.0000	.0265	.1457	.4875	.5063
	LMR-LRT	.0000	.0272	.1479	.4891	.5073
	BLRT	.0000	.0000	.0000	.0000	.0000
Entropy		.862	.851	.842	.809	.803
classification rate (%)	profile 1	56.7	21.6	36.1	4.6	33.4
	profile 2	43.3	52.8	42.5	24.2	10.1
	profile 3		25.6	9.2	38.1	3.6
	profile 4			12.2	24.2	24.9
	profile 5				8.9	9.6
	profile 6					18.4

The AIC, BIC, and SABIC, which are information relevance indices, decrease slightly from four potential groups. Looking at the verification results and statistical significance, VLMRT and LMR LRT were significant up to three potential groups, and showed non-significant results from the four. Entropy, which shows the quality of classification, is an index indicating the accuracy of classification based on the posterior probability and has a standardized value from 0 to 1. The larger the entropy value, the more suitable the model. In general, more than .8 can be considered a good classification. As a result of the analysis, the entropy index gradually decreased from two to five of the latent layers, but all were good at .8 or more. As a result, considering the information index, model comparison verification, and the quality of classification, it was judged that this study best explains hierarchical heterogeneity when the number of potential profiles for college students' core competencies is three. Therefore, a model with four latent profiles was selected as the final model by comprehensively considering classification criteria and interpretability.

Finally, the quality of the classification was checked through the posterior hierarchical membership probability. In general, it can be said that the classification is relatively accurate when the probability of belonging to the posterior class is .7 or higher (Nagin et al., 2005). Looking at the diagonals of the matrix in the mean posterior probability table in Table 13, group 1 was 90.9%, group 2 was 93.5%, and group 3 was 93.4%. All of the hierarchical classification probabilities were above .8, which was close to 1, confirming that the hierarchical classification was performed correctly.

Table 13. Posteriori Probability

	profile 1	profile 2	profile 3
profile 1	.909	.091	.000
profile 2	.036	.935	.029
profile 3	.000	.066	.934

4.11.1 Characteristics for Each Latent Profile

According to the results of the diagnosis of the core competencies of college students, three potential classes were classified, and for each class, Tier 1 was named ‘upper group’, Tier 2 was ‘middle group’, and Tier 3 was ‘lower group’. Table 14 shows the descriptive statistical analysis results of the potential classes extracted according to the humanities, communication, globalization, creativity, and professionalism competency that make up the core

competencies.

Looking at the characteristics of each group in detail, the core competency subgroup accounts for 21.6% of the total respondents, and shows low scores in humanities, communication, globalization, creativity, and professionalism competency. Among them, the average communication competency is the highest at 3.46, and the globalization competency is the lowest at 3.04. About 52.8% of the respondents were included in the median group, and all the core competency diagnostic scores were higher than those of the subgroup. As for the average score, communication competency was the highest at 3.97, followed by creativity, humanities, professionalism, and globalization competency. Finally, 25.6% of all respondents belonged to the upper group, and the core competency score was higher than that of the middle group. The sub-competency with the highest average is creativity with a score of 4.51, followed by communication, professionalism, humanities, and globalization competency. As for the core competencies of college students, the communication competency score is the highest in all classes and the globalization competency score is the lowest.

Table 14. Descriptive Statistics by Latent Profiles

Category	Lower Group (n=212, 21.6%)		Middle Group (n=519, 52.8%)		Upper Group (n=252, 25.6%)		F	η^2	Scheffe's test
	M	SD	M	SD	M	SD			
humanities competency	3.41	.40	3.84	.37	4.22	.43	246.572	.58	c>b>a
communication competency	3.46	.33	3.97	.26	4.50	.30	755.049	.78	c>b>a
globalization competency	3.04	.36	3.53	.39	4.12	.45	414.420	.68	c>b>a
creativity competency	3.43	.30	3.91	.27	4.51	.31	827.763	.79	c>b>a
professionalism competency	3.23	.42	3.83	.32	4.40	.37	634.094	.75	c>b>a

4.11.2 Determination of the Number of Latent Profiles

Table 15. Distribution of Latent Profiles and Differences between Groups

category	total	Lower Group		Middle Group		Upper Group		χ^2
		n	%	n	%	n	%	
Gender	983	212	21.6	519	52.8	252	25.6	
Male	459	98	21.4	233	50.8	128	27.9	2.396
Female	524	114	21.8	286	54.6	124	23.7	
Grade	983	212	21.6	519	52.8	252	25.6	
Freshmen	445	106	23.8	227	51.0	112	25.2	
Sophomore	182	38	20.9	107	58.8	37	20.3	10.074
Junior	193	38	19.7	93	48.2	62	32.1	
Senior	163	30	18.4	92	56.4	41	25.2	
Major	983	212	21.6	519	52.8	252	25.6	
Humanities and Social Science	484	99	20.5	255	52.7	130	26.9	
Science and Engineering	422	96	22.7	228	54.0	98	23.2	3.376
Arts and Physical Education	77	17	22.1	36	46.8	24	31.2	
Total	983	212	21.6	519	52.8	252	25.6	

The results of analyzing the classification ratio of the potential group according to the characteristics of the respondent are presented in Table 15. First, the classification ratio of the latent group was confirmed based on gender, grade, and major, which are characteristics of the respondent, and compared with the overall classification ratio. The test was performed to determine whether the distribution of the latent group appears differently depending on the characteristics of the respondent. As a result of the analysis, there was no statistically significant difference in the distribution of latent groups according to the characteristics of the respondents, such as gender, grade, and major. Looking at the differences between potential groups according to gender characteristics, it was found that the proportion of women in the upper group was relatively lower than that of men, and the probability of being included in the median group was high. Looking at the differences between latent profiles according to the characteristics of the grade, the probability of belonging to a subgroup gradually decreases as the grade increases. Lastly, looking at the differences between latent profiles according to the characteristics of majors, students majoring in humanities and social sciences have the lowest probability of belonging to the lower group and the highest probability of belonging to the upper group. On the other hand, students majoring in science and engineering showed the highest probability of belonging to the lower group, while the lowest probability of belonging to the upper group.

5. Discussion

This study reflected future competencies in the core competencies of K-University, and improved and validated diagnostic tools. Using the improved diagnostic tool, the core competency level of college students was diagnosed and analyzed. The discussion presented in the process and results of this study is summarized as follows.

First, information competency was identified as the future competency newly required for college students in this era. The experts who participated in this study agreed that information competency is important to college students and that it should be improved by including information competency in the core competency. As a result of these results, it has been confirmed in many previous studies that college students' information competency is a must-have for college students in the recently changed environment (Han et al., 2016).

Second, as a result of improving the core competencies by reflecting the educational philosophy, goals, and vision of K-University, we were able to finally identify 5 core competencies and 15 sub competencies. Competencies can be divided into cognitive competencies and non-cognitive competencies, and all of these competencies can be acquired through the coursework and extracurricular programs offered by universities (Kwon 2020). In the case of non-cognitive ability, it is difficult to improve over time, whereas cognitive ability can be sufficiently improved depending on what students learn at university, so it is necessary for universities to fully reflect this in their curriculum (Spenser et al., 1993).

Third, as a result of classifying potential profiles according to the core competency diagnosis results of K-University students, they could be divided into three groups: upper group, middle group, and lower group according to competency level. Among them, the middle group contained the most students. Next, the upper group, and finally, the lower group included many students. As a result of a chi-square test to determine whether the distribution of the latent group differs according to the characteristics of the respondent, there was no difference in the distribution of the latent group according to the characteristics of the respondent (gender, grade, major). However, in terms of gender, it was confirmed that the proportion of women in the upper group was relatively lower than that of men, the probability of being included in the median group was high, and the probability of belonging to the lower group gradually decreases as the grades go up. Lastly, according to the characteristics of the major, the humanities and social sciences have the lowest probability of belonging to the lower group and the highest probability of belonging to the upper group. On the other hand, science and engineering had the highest probability of belonging to the lower group and the lowest probability of belonging to the upper group. This supports the argument of previous studies that it is necessary to develop and provide customized education and training programs according to the core competency level of college students (Lee 2013; Han et al., 2016; Kwon 2020). This study was conducted with the aim of improving the core competencies developed and used by K-University by reflecting the future competencies required by the society, and improving the diagnostic tools for this purpose. To this end, the systematic scale development procedure suggested by previous studies was applied, the opinions of experts were reflected, and the final draft reflecting the educational philosophy, goals, and vision of K-University was finalized. In addition, by using the improved diagnostic tool, the core competency level of current students was investigated, and the validity of the scale was verified.

6. Conclusion

This study is significant in that it is improved by reflecting the future capabilities required by the new era of the university due to the fantasy of the university. To this end, through the reviews of literature and expert, humanities competency, communication competency, globalization competency, creativity competency, professionalism competency could be organized and 15 core competencies and 15 sub - competencies. Since then, data can be collected and analyzed to college students to secure the reliability and validity of the tool. Through the core competency diagnostic tools that have been improved by this study, college students have prepared a plan to diagnose and secure the level of future competencies, and follow-up studies have been able to continue related research through the understanding and importance of core competencies in college students. However, there is a limit to generalization in that this study has selected only college students who are attending a certain university in a country. In addition, it is revealed that the study is not considered the socioeconomic status and the learning environment of parents, which are various factors that affect the level of developmental development of college students. In subsequent studies, if you collect and analyze a variety of data on the background variables of college students, you will be able to derive more meaningful research results.

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