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THE RELATIONSHIP AMONG CORE COMPETENCIES AND ACADEMIC ACHIEVEMENT OF UNIVERSITY STUDENTS: LATENT PROFILE ANALYSIS

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ABSTRACT

With industrial development such as the 4th industrial revolution and the resulting social and cultural changes, the human resources required are also changing rapidly. In this regard, higher education institutions are trying various ways to nurture future talents that can address the new challenges. The core competencies that reflect the university's establishment goals and talents through the case of K-University in Korea and attempted to verify the relationship among core competencies and academic achievement was examine in this research. To this end, it was found that the core proficiencies of K-University students, classified the group profile through the results, and confirmed the characteristics. In addition, we tried to analyze the predictive effect that affected the core competencies. In this research, 983 current K-University students were tested for the core competencies for five days from April 12 to 16, 2021. There are five core competencies at K-University: Humanities, communications, global awareness, creativity, and professional competencies, and each core competency consists of three sub-factors. The latent profiles with heterogeneous characteristics were classified through the results of the core competency diagnosis of the students. From this study, three potential groups were determined, and the students were classified into these groups. The classified potential groups were named upper group, middle group, and lower group, respectively, and a characteristics and influence of the student's gender, grade, and major were complete. The key results are the following: When group 1 was set as the reference group, the student's gender and major were found to be significant factors in the comparison between the groups. In the comparison between upper group and middle group, when the gender was female and the major was science and engineering, the probability of being included to the middle group was high. Finally, as a result of examining the academic achievement level by potential profile according to the core competency aspect, it was confirmed that the higher the core competency level, the higher the academic achievement level. This study is significant in that it analyzed the factors that affect college students' core competencies and comprehensively analyzed the relationship between core competencies and academic success.

Keywords: Core competencies, academic achievement, university student, latent profile analysis (LPA)

1. INTRODUCTION

Organization for Economic Cooperation and Development (OECD) described core competencies as “capabilities essential for everyone to lead a successful life throughout their lives” and highlighted that core competencies should be formed and strengthened through education [1]. Therefore, many countries are creating and providing competency-based curricula in primary,

secondary and higher education. In addition, various diagnoses and evaluations are being conducted to confirm the efficiency of the competency-based curriculum. It is important to improve and use diagnostic tools for core competencies that are appropriate for each educational institution, as each educational institution has its own entrepreneurial ideology, image of talent, and vision. In addition, through this, it is needed to identify students' core competencies, prepare a desirable curriculum in order to support students to grow properly, and support the overall school life.

Key activities related to core competencies were initiated by the OECD's DeSeCo project in 2005 [2]. The DeSeCo project began with the question, "What are the competencies required to realize a successful life and a well-functioning society?" [3]. By bringing up the concept of proficiency, that have primarily debated in the private sector or in the workplace, that is, in the field of education, the DeSeCo project offers the opportunity to define the main abilities that forthcoming abilities must have. This project focused on explaining the meaning and importance of core competencies [4]. Reflecting the social climate shifting from the industrial society to the information society, new common values such as 'use of interactive tools', 'interaction between groups', and 'autonomous behavior' were selected [2]. A concept of core competency was broad, so experts from all over the world commonly agreed and there were differences in standardization. However, in the course of this project, everyone agreed that the core competencies were universal values for 'sustainable development' and 'democratic value realization' [4-7].

The demand for nurturing talented people with core competencies suitable for modern society is connected with the demands for educational reform in various countries. It is also actively mentioned as a conceptual tool to define the direction of education reform [8]. Looking at the recent trends in foreign university education competency policies, many efforts are being made to increase the accountability of universities to respond to globalization and a knowledge-based society, and to reorganize their educational capabilities. After discussing the improvements in quality performance, we are striving to nurture talents in this new era [9]. Competency is a comprehensive concept for solving problems in various situations and includes knowledge, skills, and attitudes [10]. Therefore, the main proficiencies of college students can be the knowledge, attitude, and skills required to develop character through college life, have expertise in their major, communicate with others, and solve social problems. The core competencies should be improved by university students through university education and can be fundamentally developed through university education. At the same time, main proficiency is a diffuse thought that includes talents, understanding, and psychological characteristics. Therefore, core competency can be used as an evaluation criterion that shows a person's ability and potential more complex than simple indicators such as grades [11] [12].

Higher education institutions have been given the public accountability to develop talent that will support social values. Therefore, it is necessary not only to teach students particular knowledge in a systematic manner, but also to set the direction of education so that they can creatively combine knowledge and information, have the ability to solve problems, and have communication skills. In

other words, they are responsible for nurturing their students into future talents equipped with information learning skills [13]. Research on core competencies has concentrated on identifying the main proficiencies that university learners must to measure and identifying factors that affect or affect core competencies [10][14][15][16]. However, few studies have classified the core competency levels of university students, analyzed latent profiles according to competency levels, or examined in-depth differences in core competency levels and academic achievement by latent profiles. Therefore, this study was attempted to find out how much the university curriculum contributes to the strengthening of college students' core competencies and how each student's core competency level affects their academic achievement.

After analyzing the core competencies of students at K University and classifying latent profiles according to a level of core competencies, the level of learning achievement of college students belonging to each profile was predicted. The motive of this research is improving the efficiency of learning by providing customized curriculum for each latent profile according to core competencies through research results, and by resolving obstacles to the development of individual college students' core competencies. In the end, the ultimate goal is to improve the quality of university education so that society can grow into a person desired by society.

The research questions of this study were as follows.

1. How many latent profiles are classified according to the core competency level of K-University learners, and what are the characteristics of each latent profile?

3. What is the effect of K-University students' gender, age, and major on their core competencies?

3. What is the difference in academic achievement among latent profiles classified according to K-University students' core competencies?

2. LITERATURE REVIEW

2.1. Core Competencies of K-University

2.1.1. Core Competencies of University Students

Research on human core competencies was in progress and words including core competency, key capability, essential skills, qualifications, vital skills, and common skills have been used in various ways [47]. The core competencies of college learners are simple and general competencies that must be acquired through university learning for the students to effectively live in the present and the future. The definition of college students' core competencies presented in various studies has a conceptual structure that can be distinguished in terms of content, evaluation, and utilization [48]. In terms of content, individual competencies are identified based on competencies constructed by reflecting the learning situation and context of the organization. First, in terms of evaluation, it has both a purpose-oriented character that is formative and evaluative to develop and support an individual's competency and a measurement-oriented character that derives organizational performance. Second, in terms of utilization, there are cases where the diagnostic tools and methods of core competencies are

commissioned externally and used for comparison, and there are cases where they are commissioned internally.

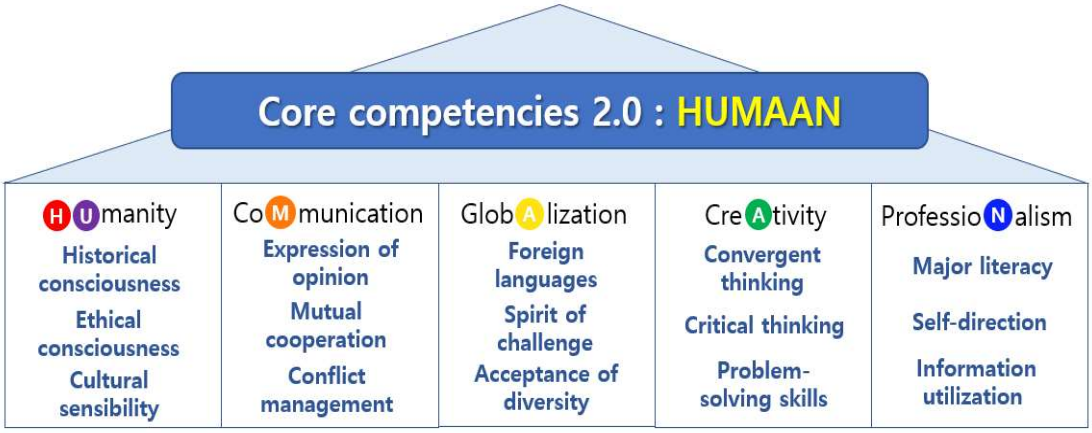
The demand for proficiency-based education is increasing as interest to improve the quality of university education keeps growing due to changes in the image of future talent. This change is due to social changes caused by the 4th Industrial Revolution and the generalization of the university education. Universities around the world are focusing on core competencies that enhance their educational effectiveness and excellence by defining the basic competencies those university students must have in order to nurture their outstanding talents. It is not easy to clearly define the essential capabilities of the college students in that they are closely associated to the resources and environment of the times, society, and culture. However, it can be said that core competencies have a specific ability and attitude required to perform a specific task. In this context, competency is defined as a core competency, a competitive advantage over a set of individual functions and skills rather than a single function or skill [17].

As the core competency in university education is recognized as one of the evaluation indicators of fulfilling the university's social responsibility to nurture excellent talent, it is mainly related to the diagnosis and management of educational outcomes [22]. In particular, in the evaluation of the basic competency of universities conducted by the Korean Ministry of Education, it is stated that core competencies are set by each university according to the characteristics of the university and refer to the general competencies required of students in this higher education stage. For this purpose, universities are responsible for providing various support for competency enhancement in connection with the subject and non-course curriculum.

Among the studies on factors influencing the core competencies of the academy students, and most active field of interest is the topic related to academic achievement, which has been relatively active since 2010 in Korea. In particular, the Ministry of Education in Korea emphasizes that the curriculum should be competency-based while emphasizing the responsibilities of universities. The ACE (Advancement for College Education, Support for Leading Universities for Advancement of Undergraduate Education) project is a project that the Ministry of Education evaluates and certifies the level of teaching students well, selects so-called leading universities, and focuses on supporting them. Through this, Korean higher education institutions have laid the foundation for nurturing talents by innovating their curriculum and education support system, and establishing their own education certification system for undergraduate education. As a result, each university reflects on the limitations of the existing knowledge transfer-oriented academic system and subject-oriented curriculum in nurturing the abilities required by the future public, leading to the development of talents and core values appropriate to the environment and situation of each university. This reflection focuses on deriving competencies and creating a competency-based learning environment. For example, K-University also drew a talent image based on the school's own philosophy and vision and laid the foundation for a curriculum based on this by composing five core competencies and fifteen sub-competencies suitable for it.

2.1.2 Core Competencies and Sub-core Competencies of K-University

The talent image derived based on the educational philosophy of K-University is "challenging talent". This core competency was first developed and utilized in 2012, and then, in 2021, it was recognized that there was a change in the human resources required by society DUE to changes in the times and industrial structure. As a result, a new low-minded competency suitable for social change was derived and implemented.



[**Fig 1].** Core competencies of K-University

First, the "humanity competency" is defined as "capacity to consider others and honestly and faithfully fulfill social responsibilities with correct historical and ethical consciousness". The historical consciousness, which is a sub-competence, is "the ability to recognize oneself as a historical being and grasp social phenomena according to the historical point of view", and the ethical consciousness is "the ability to think and practice the morals and virtues to be observed as human beings". Cultural sensibility is defined as "the ability to receive and respond to stimuli through music, art, literature, theatre, film, religion". Next, as for the second core competency, communication competency is defined as a "capability to manage various social conflicts and achieve common goals through communication and mutual cooperation". Expression of opinion is "the ability to accurately understand the meaning of others' opinions and communicate their opinions clearly and effectively", and mutual cooperation is "to achieve a common goal by working together with members based on consideration and communication". Conflict management is defined as a "capability to resolve and manage various conflicts to achieve a common goal". The third core competency is globalization competency, which is defined as the "capability to lead new changes based on foreign language ability and acceptance of diversity and to realize community values through challenges". The use of foreign languages is "the ability to understand the language of another country and express one's opinion in a foreign language", and the spirit of challenge is "the ability to work towards a goal with an indomitable will to overcome expected difficulties despite the difficulties". Acceptance of diversity is defined as "the capacity to accept and acknowledge external differences such as race, gender and physical disability and internal differences such as religion, values, and social background". The 4th core competency is creativity competency, defined as "the ability to

creatively solve social problems through convergence and critical thinking". Sub-factors include convergence intelligent, critical intelligent and problem-solving skills. Convergent thinking is "the ability to generate new, original and useful ideas outside of the traditional way of thinking", while critical thinking is "the ability to think reflectively based on the logic of thinking and soundness of judgment", and problem-solving skill is "the ability to think in a variety of ways."" It is defined as the ability to correctly recognize a problem and to solve it creatively. The fifth core competency is professionalism competency, which is defined as "the ability to demonstrate expertise in one's own field by possessing knowledge about the major and ability to utilize information". Major literacy is "the ability to acquire specialized knowledge about the major and expand the boundaries of knowledge to respond to social changes", and self-direction is "the ability to take responsibility for one's own life and decide actions according to one's free will". Information utilization is defined as "the ability to identify what information is needed to solve a problem, and to collect, analyze, evaluate, and accurately interpret the necessary information".

2.2 Core Competencies of Universities and Academic Achievement

The results obtained through a student's experience in the learning process are called learning outcomes or academic achievement [23]. Because the aim of learning is to allow students to have academic achievement, it is important to examine how meaningfully the curriculum provided by the university affects the academic achievement of their university students. In recent years, university education has selected core competencies to fulfill their responsibilities and nurture future talents, and the curriculum is being conducted in connection with the curriculum. As such, core competencies are treated as very important in university education, and each university supports the academic achievement of their university students by providing curriculum according to the core competencies and the sub-competencies that constitute them [53].

K-University is a place that establishes universal values required to create information and understanding for the mature growth of the national society [3]. Considering future trends, we have a responsibility to systematically nurture and produce manpower with the core competencies needed in a changing society [4]. Therefore, it has become challenging for universities to answer to changes in the knowledge and services and in the employment marketplace by educating main knowledge or services as in the past. So that students can specialize in their majors, address societal issues, inspire others via convergence thinking, and resolve conflicts, universities all over the world should set up fascinating courses and extracurricular activities as well as offer varied knowledge and skills needed in society. In other words, universities need to be reorganized into program which can stabilized core cognitive and non-cognitive competencies that emphasize the importance of professional knowledge, creativity, sociality, and personality, and nurture future talents that can demonstrate creative abilities [25].

This study emphasized the importance of core competencies as a presentation display of university education from a viewpoint of the reduced effectiveness of university education due to online classes and that there is a limit to the reliability of credits due to credit inflation. In addition, this

study focused on identifying the usefulness of core competencies that have an important effect on the quality of university education and improving academic achievement, and deriving meaningful implications for academic achievement with competencies suitable for the future society.

2.3 Latent Profile Analysis

Latent profile analysis is a mixed mode analysis that discovers non-observational heterogeneous latent groups by classifying the item response patterns of subjects in the study group [49]. In other words, when the population is composed of invisible latent variables, the association is explained assuming that there are potential classification elements that are not directly observed by grouping subjects with similar response patterns into the same group. That is, based on the subgroups latent in the data, the possibility of an individual going to one of the various courses is estimated and classified as a heterogeneous latent group.

The analysis method for classifying the objects into groups can be divided into cluster analysis and latent class analysis (LCA) based on the interrelationship of the analysis objects. Cluster analysis is a method of grouping analysis objects into homogeneous groups by correlation. It is also a variable-centric method that evaluates the degree of similarity by measuring the distance between analysis objects to be classified. On the other hand, the mixed model is characterized by taking an individual-centered approach compared to factor analysis. In the case of factor analysis, it can be said that it is a variable-oriented approach that grasps the structure of a factor through the relationship among the variables of interest. On the other hand, the mixed model is characterized as an individual-centered approach that focuses on the relationship between subjects and classifies potential groups based on their shared characteristics [50].

The mixed model statistically and significantly confirms the appropriate number of potential groups while excluding the researcher's subjective judgment as much as possible. It is also said to be a statistical model that can reflect the diversity of human behavior well. The mixed model differs from the existing traditional cluster analysis in several ways. First, in the traditional cluster analysis, when a cluster is formed, an individual observation appears to belong to only one group, and the observation value is analyzed to reflect only the characteristics of the group. While, the mixed model shows that one individual observation can belong to several groups, so it can be said to better reflect human behavior. Second, in the traditional cluster analysis technique, the quantity of clusters is not determined by statistical criteria. In other words, there is a disadvantage that the number of clusters is generally observed by the subjectivity of the researcher because it does not provide a statistically appropriate number of clusters [50]. However, the mixed model can reduce the bias caused by the subjective judgment of researchers in that it can utilize information criterion indices such as the Akaike information criterion (AIC) and Bayesian information criterion (BIC) to identify the quantity of groups. Third, the mixed model is relatively stable to scale differences compared to cluster analysis and has the advantage of being able to extend the model to include covariates [50]. In conclusion, the mixed model statistically and significantly confirms the appropriate number of potential groups while excluding the subjective judgment of the researcher

as much as possible. It also is a statistical model that can reflect the diversity of human behavior well.

On the other hand, the mixed model is characterized by taking a person-centered methodology compared to factor analysis. In the case of factor analysis, it can be said that it is a variable-oriented approach that grasps the structure of a factor through the relationship among the variables of interest. The mixed model is characterized by a human-centered approach that focuses on the relationships between subjects and classifies potential groups based on their shared characteristics [50].

Latent profile analysis is a mixed model, and it is a method of identifying the heterogeneous characteristics of potential variables for each latent group by finding and categorizing the probability of belonging to each class. In other words, when the population is composed of invisible latent variables, the association is explained assuming that there is a potential classification element that is not directly observed by grouping subjects with similar response patterns into the same group. Based on the subgroups latent in the data, the chance that an individual belongs to one class among several classes is estimated and classified as a heterogeneous potential group. Since a latent variable cannot be directly observed, it is measured by two or more observed variables. Observed variables are induced by latent variables, but observed variables appear probabilistically by errors. Therefore, when analyzing latent variables through observed variables, a statistical model that isolates errors is required [50].

When compared to latent class analysis (LCA), latent profile analysis has the same basic assumptions and methods. However, there is a difference in the observed data. The y observed in the latent category analysis is a categorical variable, but the y observed in the latent profile analysis is a continuous variable. And, categorical variables are called LCA and continuous variables are called LPA. However, these two analyses are not only theoretically the same model, but also use both categorical and continuous variables in actual analysis [49].

When continuous variables are observed, it is assumed that the distribution of variables commonly observed in latent profile analysis is a normal distribution. This analysis does not assume that the sampled profile has a single probability distribution. It is assumed that each latent group in the profile has a probability distribution. Meanwhile, in the latent profile analysis, the parameters are expected by using the maximum likelihood method with the Expectation-Maximization algorithm (EM algorithm). This method tries several possible methods and finally selects the model with the highest likelihood from the assumed parameters. That is, the larger the value and closer to 0, the better the model. One of the strong point of latent profile analysis is that various reference indices can be used to select the final model. In the latent profile analysis which uses continuous variables, the most commonly used criteria contain the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), the Lo-Mendell Rubin likelihood ratio test (LMR), and the entropy index. Both AIC and BIC are statistics that use full likelihood estimates of model parameters and is traditionally used the best among information reference indices. AIC and BIC could show the

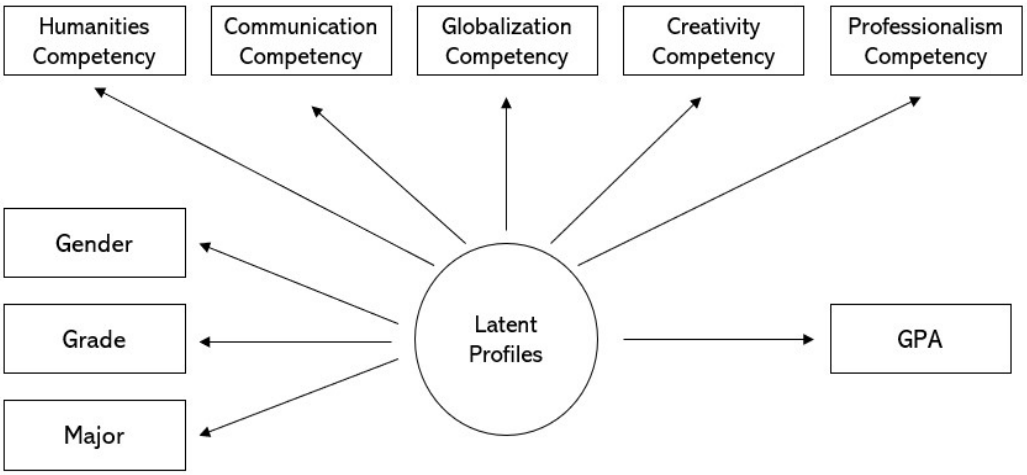
smallest decrease in the maximum likelihood estimate when comparing whether two or more different models are suitable for the same data.

AIC has been criticized for lacking asymptotic characteristics because it does not consider the sample size in estimating the index. An alternative approach to this is BIC based on Bayesian theory [51]. BIC is an index that increases the accuracy of selecting an accurate model as the sample size increases. Although BIC may be preferred to AIC in that it takes into account the sample size, it may need to be adjusted if the sample size becomes very large. An alternative method to this is the adjusted BIC index (SABIC), which is adjusted for sample size. The AIC, BIC, and SABIC indices all indicate that smaller value is a better model. However, these criteria do not provide information on whether the difference is statistically significant. Another criterion used to select a latent profile model is the Entropy index. It is desirable to consider all of these values in order to conclude the quantity of measured latent profiles that standardize the accurateness of classification according to the possibility of belonging to the latent profile of the estimated version.

3. RESEARCH METHOD

3.1. Research Model

The objective of this research is to develop and confirm the core competency scale of university learners, and to analyze various attributes by gender, grade level and major based on this. To do this, consider three issues: how to find suitable components through tentative factor analysis and confirmatory factor analysis, how to validate their consistency and validity, and how to reveal the characteristics of inter-individual differences through profile analysis. There is a need. Accordingly, in this study, the research model was largely divided into a scale development model for exploratory factor analysis, a scale validation model for confirmatory factor analysis, and a profile analysis model. The scale development model was subdivided into item search, item composition, and survey, and the scale validation model was divided into construct validity and cross-validation. And construct validity was subdivided into convergent validity and discriminatory validity, and cross-validation was subdivided into identity analysis. The profile analysis model was subdivided by gender, grade, and major. [Figure 2] shows the structure of the scale development, scale development validation, and profile analysis model proposed in this study. The scale development process includes the 'scale development process' of Netemeyer, Bearden & Sharma (2003) [54], 'scale development-theory and application' of DeVellis (2003) [55], and the development and Related previous studies [26-39] were referred to. In the following, the details of each research model will be discussed in detail.



[Fig. 2] Research model

3.2 Research Subjects

This study was directed for 5 days from April 12 to 16, 2021, directing learners at K-University located in Seoul, South Korea. Surveys were disseminated to a 1,000 students, and 983 of them, excluding 17 insincere responses, were finally utilized and analyzed. By gender, 459 males (46.7%) and 524 females (53.3%) were included in the study. The grade of participants was 445 (46.3%) in the first grade, 182 (18.8%) in the second grade, 193 (19.6%) in the third grade, and 163 (16.6%) in the fourth grade. The majors of the participants were 484 (49.2%) in humanities and social science, 422 (42.9%) in science and engineering, and 77 (7.8%) in arts and sports.

[Table 1] General features

Category		**Number of Cases**	**%**
Gender	Male	459	46.7
	Female	524	53.3
Grade	Freshmen(1^{st})	445	46.3
	Sophomore(2^{nd})	182	18.8
	Junior(3^{rd})	193	19.6
	Senior(4^{th})	163	16.6
Major	Humanities & Social Sciences	484	49.2
	Science & Engineering	422	42.9
	Arts & Sports	77	7.8
Total		983	100.0

3.3 Measures

In 2014, K-University set the image of talents and educational goals based on the results of a survey of the opinions of university members, including graduates, and the need for talents required by society. K-University selected core competencies based on the survey results. In this process, four types of talents were established: “People who practice”, “collaborators who

communicate", "people of the future", and "creative professionals". The creative competency and professionalism competency were also selected. The mptive of university education is to equip university students with core competencies through the university curriculum and various experiences of university life. Educational outcomes are possible through the creation of learning experiences through the specification of the curriculum and the cultivation of ideal talents. Therefore, in order to accurately diagnose and manage the core competencies of college learners, universities need to first develop a diagnostic tool and use it to improve the quality of education [53].

3.3.1 Humanities Competency

This study modified and supplemented the tools of Bang (2014) [26] and Oh (2001) [27] to measure the humanities competency, which means the ability to launch an accurate view of history based on ethical awareness and cultural sensibility. This tool consists of a total of 17 items on the three sub-factors of historical consciousness, ethical consciousness, and cultural sensibility. The details of the items for each core competency and sub-competence are as follows.

[Table 2] Measures of Humanities Competency

Sub-Competences	Items	Cronbach's α
Historical Consciousness	- I tend to understand the founding philosophy and history of our university well. - I frequently think about the lives of historical figures to determine what kind of life is more important .- I understand it well, how historical occurrences affect us today. - I like reading history-related literature. - I tend to try to understand the past history of our country by connecting it with the present situation.	.798
Ethical Consciousness	- When creating a task report, I make an effort to avoid copying other people's ideas without their consent. - I act after giving a serious thought if my act would have any negative effect on anyone. - Before deciding whether or not to take action, I make sure that my intentions are correct. - In my opinion, holding onto values may be harmful in the short run, but it benefits me in the long run. - I believe it is important to be courteous while speaking with others on the Internet and SNSs, even though I am an anonymous user.	.695

Cultural Sensibility	- I wish to express the feelings. - I have benefited from working with others on cultural and artistic works. - I look for a variety of information in the area of culture and the arts. - Books and films regarding culture and art are of interest to me. - By taking part in a programme that promotes understanding of culture and art, I hope to raise my level of cultural awareness. - I write and engage in cultural and artistic work - It's fun to use it as the subject of conversation.	.886

3.3.2 Communication Competency

In this study, the tools of Lee Seok-Jae et al. (2013) [28] and Lee Jun-Hyeong (2014) [29] were modified and developed to measure communication competency, which means the ability to communicate ideas through appropriate communication, manage conflict, and achieve a common goal cooperatively. This tool has a total of fifteen items, with five items each for the three sub-factors of expression of opinion, mutual cooperation, and dispute management. The item for each sub-variable was as follows.

[Table 3] Measures of Communication Competency

Sub-Competences	**Items**	**Cronbach's α**
Expression of opinion	- I am able to express my ideas clearly enough for others to understand them. - Reading and understanding the gist of other people's writing is not challenging for me. - I am able to read, comprehend, and organise the writings of others from my own point of view. - I don't have any trouble understanding the main points of the professor's queries in class. - When a question is posed in class, I can answer it clearly and coherently.	.826
Mutual cooperation	- When working on a team project, I often consider what the other team members will think of what I say. - I've been pondering the emotions that the content might evoke.	.816

	- When I participate in a team effort, I usually lend a hand by taking on duties that are appropriate for my skill set. - I generally attempt to avoid hurting others when performing a collaborative task. - When working on a team project, I have a tendency to consider all of the possible outcomes of my decisions, even the seemingly insignificant ones.	
Conflict management	- When a dispute arises, I actively try to mediate it through communication. - When a conflict arises, I often try to determine its root cause. -I usually manage issues without trying to avoid them when they happen. - When a disagreement emerges, I frequently use a variety of communication techniques to get the other party's consent. - Whenever a dispute arises, I make an effort to resolve it amicably.	.807

3.3.3 Globalization Competency

In this study, Lee et al. (2011) [30], Park et al. (2013) [31], Canale & Swain (1980) [32]was referred to in order to measure globalization competency, which means the ability to embrace cultural diversity by cultivating foreign language skills and having a challenging spirit suitable for a global environment. The tools of Bachman (1990) [33] were also modified and supplemented. This tool has a total of fifteen items, with five items each for the three sub-variables: Foreign languages, challenging spirit, and acceptance of diversity. The questionnaire for each sub-area was as follows.

[Table 4] Measures of Globalization Competency

Sub-Competences	**Items**	**Cronbach's α**
Foreign languages	- I am well aware of the importance of foreign languages. - I did not face any problem in understanding the information in the original language textbook that were used in class. - I have experience completing a task in a foreign language correctly. - I've had experience reading foreign-language texts and summarising their main points. - I've experimented with a variety of techniques to sharpen my foreign Language Skills. I am familiar with it.	795

spirit of challenge	- I like to do new and challenging things, even if it is somewhat risky. - I am willing to do something if I decide that I should do it, even though there is a high probability of failure. - I am not afraid to try new things that are different from what I have been doing before. - I do not settle for reality and try to find new opportunities. - I see the current change as an opportunity, not a crisis.	.867
Acceptance of diversity	- I try to be interested in people of other races, beliefs, and civilizations. - When I first meet a foreign student, I try to make friends with them. - I am well-versed in Korea's immigration laws and current immigrant population status. -I usually make an effort to follow international etiquette by getting to know other cultures' customs. - I am aware of the distinctions across cultures, and I usually approach them with an open mind.	.757

3.3.4 Creative Competency

In this study, Kim et al. (2001) [34], A. Thomson (2009) [35], Park (2011) [36], and Choi et al. (2013) [37] measures the creative competency, which is the ability to critically analyze the phenomenon of university students and solve difficulties found from several perspective. The tools of Oh & Seong (2013) [38] were also modified and supplemented. This tool has a total of fifteen items, with five items each for 3 sub-variables: Convergence thinking, critical thinking, and problem-solving skill. The questionnaire for each sub-area was as follows.

[Table 5] Measures of Creative Competency

Sub-Competences	**Items**	**Cronbach's α**
Convergence thinking	- I want to learn about other fields and my major field. -I believe I can find plenty of inspiration for my major in other academic disciplines. - I believe that having the ability to converge different fields is essential. - In the future, I hope to work with professionals from various fields.	.840

	- I work with students with different majors. I tend to believe that doing this will enhance my major knowledge.	
Critical thinking	- I often pay special attention to wrong reasoning in the writings and viewpoints of others. - I am capable of determining which of the many bits of information is more crucial. - When I encounter a problem, I frequently seek to identify its root cause. -When a situation is not solved, I have a tendency to view things differently. - Even if they differ from mine, I often accept other people's viewpoints.	.711
Problem-solving skills	- I can evaluate the correctness or incorrectness of my opinions from a variety of angles. - When working on challenging problems with my colleagues, I have the capacity to bring out their skills. - I have a propensity to consider every possible solution to an issue from all possible angles. - Even when presented with a complex problem, I can quickly understand its fundamentals. - I am able to react calmly when unanticipated issues arise.	.830

3.3.5 Professionalism Competency

In this study, the tools of Kim et al. (2003) [28] and Lee et al. (2003) [39] were modified and supplemented to measure professionalism competency, which is the ability to acquire and utilize the latest information and in-depth understanding of major knowledge. This tool has a total of fifteen items, with five items each for the three sub-variables of major literacy, self-direction, and information utilization. A questionnaire for each sub-area was as follows.

[Table 6] Measures of Professionalism Competency

Sub-Competences	**Items**	**Cronbach's α**
Major literacy	- I am able to communicate my understanding of my major in a way that non-majors can understand. - I know very well how to use my major knowledge. - I know it very well as to why the major subjects I have studied are necessary for my major.	.820

	- I have clarity of what more is needed for my major knowledge. - I have arranged all the necessary information related to my major.	
Self-direction	- I have a plan for what I will do in 5 years. - I always finish the work I have planned on time. - I tend to believe that I have the ability to lead my own life. - I tend to try to go ahead with my plans. - I tend to work harder when things don't go well.	.778
Information utilization	- I generally find important knowledge and information through various channels. - I do have an experience of using various ways to search for accurate information. - I can properly classify meaningful and valuable information from the information that is collected. - I can solve many problems by using essential information. - I try my best to protect the copyright of the information which I collect.	.813

3.4 Data Collection

This analyzed the core competencies of K University learners to collect data. A sample was made by a simple random sampling method, and prior to the start of the survey, the subjects was requested about their voluntary intention to participate in the study. A total of 1,000 students expressed their intention to participate in the review, and the review was directed for them. To accurately collect data, the core competency diagnosis tool was entered into the online system, and students are guided to join in the survey online. Students self-responded to the survey tool for the five core competencies and diagnosed their level.

3.5 Research Procedures and Methods

First, potential profile analysis was directed with the Mplus 8.0 program to recognize latent profiles based on the core competencies of college learners. A number of latent profiles were determined by inputting data on the five core competencies of K-University: Humanities, Communication, Globalization, Creativity, and Professionalism. To define the total of potential profiles, information relevance indicators such as AIC, BIC, SSABIC, statistical importance, and entropy were comprehensively considered. LRT and BLRT were used to verify statistical significance [40, 41], and the model that best classified the profiles and explained their characteristics and differences was carefully chosen [42]. Next, the SPSS 26.0 platform was utilized to analyze the difference in attributes of every latent profile. In order to analyze the difference in characteristics between the latent profiles in more detail, a difference test was conducted according to gender, grade, and major of university students.

4. RESEARCH RESULTS

4.1 Descriptive Statistical Analysis

Before conducting latent profile analysis (LPA) based on the humanities competency, communication competency, globalization competency, creativity competency, and professionalism competency from the main proficiencies of K-University, correlations between the related variables were investigated, and descriptive statistical analysis was performed. First, each variable showed a statistically important positive relationship with other factors between .448 and .704. As a result of the descriptive statistical analysis, the average communication competency was 3.99, followed by the creative proficiency of 3.96, the humanities competency 3.85, the professionalism competency 3.84, and the globalization competency 3.58. The absolute values of skewness and kurtosis of each factor did not exceed 2 and 8, so it was determined that the standard values were satisfied. Detailed analysis is presented in Table 7.

[Table 7] Descriptive statistics and correlation analysis

Variable	Humanities	Communication	Globalization	Creativity	Professionalism
Humanities	-				
Communication	.519**	-			
Globalization	.480**	.548**	-		
Creativity	.546**	.704**	.596**	-	
Professionalism	.448**	.629**	.576**	.651**	1
Mean	3.85	3.99	3.58	3.96	3.84
SD	0.48	0.46	0.55	0.47	0.54
Skewness	-.099	-.077	.136	.071	-.280
Kurtosis	-.009	.030	.005	-.119	.678

**p<.01

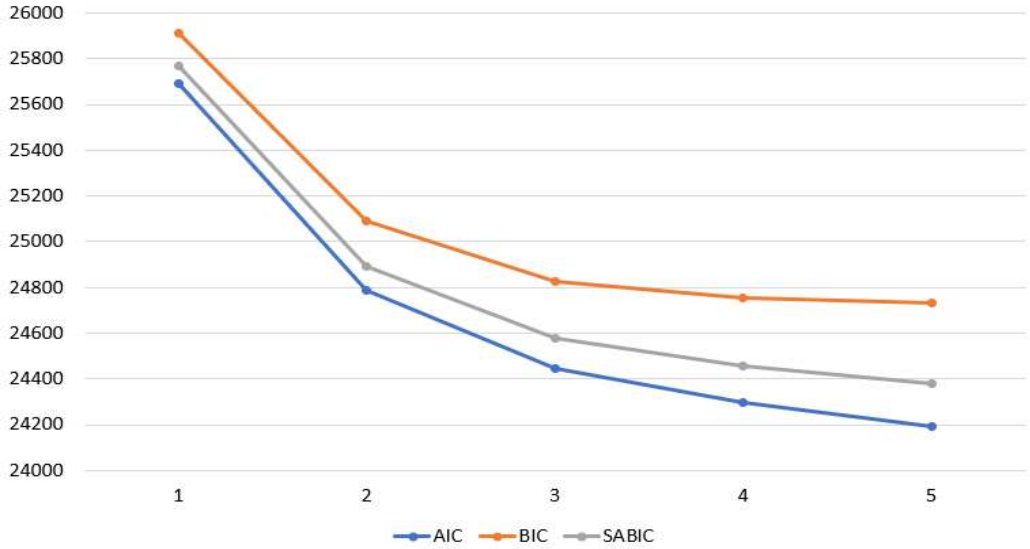
4.2 Number of Latent Profiles

To decide the number of latent profiles according to the diagnosis effects of the college learners' core competencies, an unqualified model minus external variables were first analyzed. Then a conditional model that included variables likely to influence the latent class classification as covariates was analyzed. A three-step approach was used [43, 44], and changes in information index, x^2 p-value, and classification quality were comprehensively examined while expanding the quantity of profiles gradually to accurately define the quantity of latent profiles. The study result is shown in Table 8.

[Table 8] Latent Profile Analysis

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
χ^2 p-value	VLMRT	0.0000	0.0265	0.1457	0.4875	0.5063
	LMR-LRT	0.0000	0.0272	0.1479	0.4891	0.5073
	BLRT	0.0000	0.0000	0.0000	0.0000	0.0000
Classification quality	Entropy	0.862	0.851	0.842	0.809	0.803
%	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



[Fig. 3] Changes in AIC, BIC, and SABIC due to the increase in the number of latent profiles

According to Table 9, AIC, BIC, and SABIC, which are data significance indices, decreased a little to 4 latent profiles, and the Entropy index slowly lessened from two to five latent profiles. However, the rest was favorable with 0.8 or further. As the detail index, model assessment verification, and standard of arrangement, this study determined that when the quantity of latent profiles for the core competencies of K-university learners was three, the heterogeneity by class was best explained, and the final model was selected.

In conclusion, the value of the arrangement is confirmed by the following hierarchical association chance. Overall, when the probability of belonging to the following classification is 0.7 or greater, the classification can be judged to be relatively accurate [46]. As a result of examining the analysis results through the diagonal of the matrix, profile 1 was identified at 90.9%, profile 2 at 93.5%, and profile 3 at 93.4%. Furthermore, the probabilities for the hierarchical classification were

beyond 0.8, which is nearly 1, demonstrating that the hierarchical organization was carried out properly.

[Table 9] Probability of belonging to each latent profile

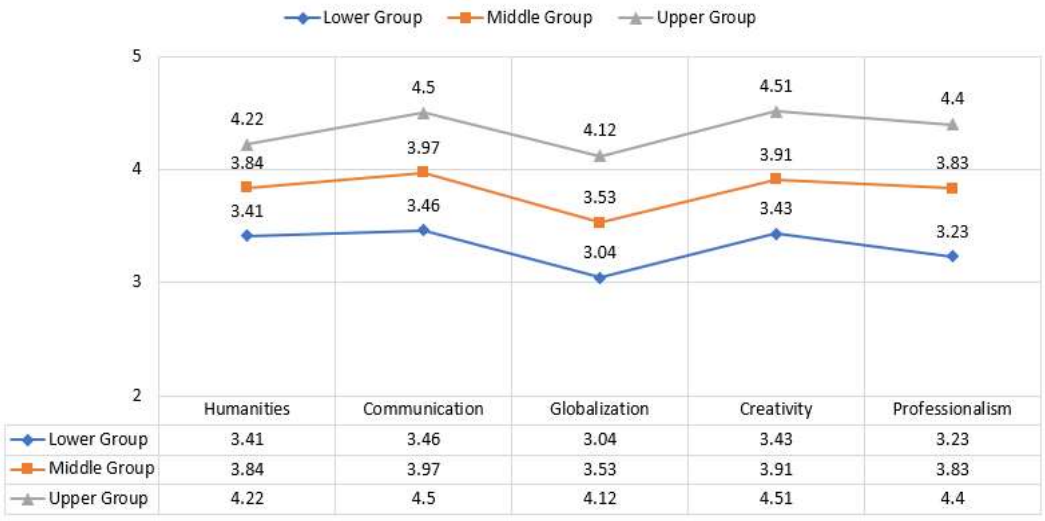
Category	Profile 1	Profile 2	Profile 3
Profile 1	0.909	0.091	0.000
Profile 2	0.036	0.935	0.029
Profile 3	0.000	0.066	0.934

4.3 Latent Profile Characteristics of Course Evaluation

As a result of diagnosing the core competencies of K-University students and classifying potential profiles based on this, three were derived. Considering the characteristics of each profile's competency score, Profile 1 was called the upper group, Profile 2 the middle group, and Profile 3 the lower group. Table 10 represents the results of a vivid statistics that determine the number of potential profiles through the five core competencies: humanities competency, communication competency, globalization competency, creative competency, and professional competency score.

[Table 10] Descriptive statistics of latent profile

Competencies	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	3.41	0.40	3.84	0.37	4.22	0.43	246.572	0.58	c>b>a
Communication	3.46	0.33	3.97	0.26	4.50	0.30	755.049	0.78	c>b>a
Globalization	3.04	0.36	3.53	0.39	4.12	0.45	414.420	0.68	c>b>a
Creativity	3.43	0.30	3.91	0.27	4.51	0.31	827.763	0.79	c>b>a
Professionalism	3.23	0.42	3.83	0.32	4.40	0.37	634.094	0.75	c>b>a



[Fig. 4] Characteristics of sub-factors of course evaluation by latent profiles

When the characteristics of each profile were analyzed, the group with the lowest core competency score in all five competencies was named lower profiles, and it included 21.6% of the total respondents. Among the five core competencies, the average score of communication proficiency was the maximum at 3.46, and globalization proficiency was the lowermost at 3.04. About 52.8% of respondents were involved in the middle profile, and the main competencies of this profile were generally higher than those of the lower profile. Looking at the average score by competency in this profile, communication competency had the utmost score of 3.97, monitored by creativity, humanities, professionalism, and globalization competency. Last but not least, the top group included 25.6% of all responses, and the core competency score is the highest. Looking at the average competency score, creativity competency had the highest score of 4.51, followed by communication, professionalism, humanities, and globalization competency. The communication competency score was the greatest among the key competencies in this profile, while the globalization competency score was the lowest.

4.4 Verification of Factors Affecting Core Competencies

Multinomial logistic regression analysis was performed to verify the influence on latent profile classification by including independent variables in the final model from which three latent profiles were derived. This is an analysis method that sets one standard group and compares it with the rest of the groups, and the main results are as follows. First, as a reference group for the upper core competency group, female by gender, senior by grade, and arts and physical education by major were set as reference groups. As a result, the gender and major of students were found to be significant factors in the comparison between the groups. In the comparison among the upper group and the median group, when the gender was female (b=-.311, p<.05) and the major was science and engineering (b=.525, p<.05), the chance of going to the median group was high. Next, the upper group and the median group were set as the reference groups, respectively, and no significant results were obtained through comparison between groups with the lower group. Finally, in order to analyze the change in the level of student educational achievement by latent profile, student achievement was set as an outcome variable. Academic achievement by latent profile, the academic achievement of the upper group was 3.85, the middle group was 3.75, and the lower group was 3.69.

[Table 11] Validation of latent profiles influential factors according to core competencies

Category		Criteria: Upper Group				Criteria: Middle Group	
		Middle Group		Lower Group		Lower Group	
		b	SE	b	SE	b	SE
Gender		-.311*	.160	-.282	.194	.028	.170
Grade	Freshmen	-.065	.223	.280	.279	.344	.243
	Sophomore	.245	.268	.329	.334	.084	.283
	Senior	-.406	.250	-.186	.318	.220	.285
Major	Humanities and Social	.282	.291	.159	.351	-.123	.322

	Sciences						
	Science and Engineering	.525*	.299	.458	.369	-.067	.327

*p<.05, **p<.01, ***p<.001

5. DISCUSSION

The purpose of this research is to identify the core competencies of college students, to classify heterogeneous latent profiles through the diagnosis results, and to identify the level and characteristics of each group's core competencies. In addition, the characteristics of each classified latent profile were examined and the influencing factors were explored. For this purpose, the core competency diagnosis effects of 983 K-University people were used. First, latent profile analysis was made to classify latent profiles for sub-factors of core competencies. As a result, a total of three heterogeneous latent classes were classified and composed of a upper group, middle group, and a subgroup.

Next, multinomial logistic regression analysis was performed by entering each student's gender, grade, and major as independent variables to verify the significant influencing factors on the classified latent class. As a result of the analysis, when the upper group of core competencies was used as the reference group, the gender and major of the students were found to be significant factors in the comparison between groups. In the comparison between the upper group and the middle group, it was verified that the probability of belonging to the middle group was high when the gender was female and the major was science and engineering.

In order to analyze the difference in student academic achievement according to the potential profile, the student's academic achievement was set and analyzed as the final outcome variable for the five core competencies; humanities, communication, globalization, creativity, and professionalism. As a result, differences between groups were identified in the level of educational achievement for each possible profile. It was confirmed that college students with excellent core competencies received higher scores, and their academic achievement was higher than that of college students who did not.

6. CONCLUSION

The significance of this study based on the analysis results is as follows:

First, this study is meaningful in that it identifies the core competencies of college learners and examines how the factors influencing the core competencies affect academic achievement. This means that an in-depth understanding of the core competencies pursued by universities is required.

Second, from a methodological point of view, individual characteristics of the university students for each sub-factor of core competency were reflected in the analysis. Through latent profile analysis, students were classified into several latent profiles through the main competencies of K-University, i.e., the subject of study. In addition, the humanities, communication, globalization, creativity, and professionalism competencies that constitute the core competencies were judged as sub-elements of the core competencies. Their influence in various contexts was examined, and the

core competencies' characteristics of each latent profile were analyzed in relation to academic achievement. In doing so, a plan was sought to secure the quality and excellence of university education.

Finally, suggestions for follow-up studies are as follows. This study diagnosed students' core competencies and classified potential groups through this to identify the differences and characteristics between groups. For this purpose, cross-sectional data were used, and it is expected that the follow-up studies will focus on the changes and development of students' core competencies by using longitudinal data.

Based on the analysis results, recommendations for follow-up studies are the following: The subjects were students enrolled in a university in Korea, which is a specific region. Therefore, if the follow-up research is conducted in consideration of various university types and regional characteristics, more meaningful results can be derived. Second, as society is rapidly changing due to the 4th industrial revolution, human capacity to respond is more important than ever. Therefore, although this study is meaningful in examining the relationship among university students' competencies and academic achievement, there is a limitation in that it does not consider the competencies of more diverse university students. Accordingly, it is necessary for follow-up studies to examine the effect on academic achievement by considering more diverse college students' competencies. Third, this study included only gender, grade, and main as the overall attributes of university learners. However, it is necessary to consider other factors such as admission grades, entrance examination screening, academic achievement, and grades for follow-up studies and check the differences.

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