Journal of The Korea Society of Computer and Information
Vol. 24 No. 1, pp. 197-206, January 2019
www.ksci.re.kr
https://doi.org/10.9708/jksci.2019.24.01.197

Validation of a Diagnostic Model for Core Competencies at the Higher Education Institute in Korea

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Abstract

The purpose of this study is to develop and validate a model for diagnosing core competencies at the higher education level. Based on literature reviews, a potential model for core competencies at university was suggested. A tool for validating the model was composed of 24 items, which were delivered to 226 professors and administrative staffs, 730 students, and 134 graduates & external industrial experts. Five constructs (core competencies) were extracted from the data collected among professors and administrative staff responding to the importance of the items. The results of importance and performance surveys on core competencies with students were respectively 3.28 to 3.66 and 2.68 to 3.28 (4-point Likert scale). Statistical differences between importance level and performance level were found in all the sub-categories of core competencies. Borich priority determination formula and Locus for Focus Model were used for the determination of the priority of needs. Importance survey among graduates and external experts showed that the mean of each items ranged from 2.80 to 3.76 (4-point Likert scale). The overall results of the analyses suggest that the final model is appropriate for measuring the core competencies.

▸Keyword: Core Competencies, Validation, Higher Education, Diagnostic Model

I. Introduction

Over the past decade, interest in core competencies has risen more than ever in governments, businesses, primary and secondary schools and universities in Korea. The Korean government has introduced national competency standards (NCS), which systematizes learning contents including knowledge, skills, and attitudes required to perform tasks at industrial sites. Since then, companies have been utilizing NCS in the development and optimization of human resources and management plans and have also applied an NCS-based curriculum centered on junior colleges. These series of trends have focused on developing key competencies that are relevant to a specific job. However, core competencies in primary & secondary education and college education need to focus more on generic or common competencies required by all jobs, rather than those related to specific jobs [1].

The 2015 revised Korean national curriculum for elementary and secondary education focused on fostering basic competencies and job skills needed by future society and industrial society. It also reflected the NCS-based curriculum, and the six core competencies (self-management competency, knowledge/information processing competency, creative thinking competency, aesthetic emotional competency, communication competency, and civic competency) [2]. The first competency self-management is the ability to lead a self-directed life with personal identity

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• Received: 2018. 10. 31, Revised: 2018. 12. 01, Accepted: 2018. 12. 13.
• This Research was supported by the Korea Nazarene University Research Grants in 2018.

and confidence, along with basic abilities and qualifications necessary for life and career. The second competency knowledge/information processing is the ability to process and utilize diverse knowledge and information in order to solve problems rationally. The third competency creative thinking is the ability to create new and useful things by fusing knowledge, skills, and experiences from various specialized fields on the basis of broad foundations knowledge. The fourth aesthetic emotional competency is the ability to discover and appreciate the meaning and value of life, based on empathetic understanding of the world and cultural sensitivities. The fifth competency communication is the ability to express one's thoughts and feelings effectively in various situations, to communicate with others and to adjust to conflicts. The last civic competency is the ability to actively participate in community development with values and attitudes required for membership in local, national, and global communities.

The need for core competencies in higher education has been linked to criticism regarding the quality of higher education. Most certificates and overall scores obtained in higher education are not comparable across institutions and do not offer reliable and valid indication of the skills and knowledge students acquire over the course of their studies [3]. According to research [4] on excellent students who received A + from S University in Korea, the secret to achieving high scores was through passive attention to instructor's lectures rather than through the expression of creative opinions. Results reveal that the system of evaluating student' achievements focuses much more highly on how much content is remembered than which skills are improved through the lesson.

Early researches on core competencies in higher education focused on the conceptual debate on competency [5][6], the development of core competency [7]. empirical case studies [8], and the general framework for competency assessment components [9]. Such research has the following limitations: First, there is a substantial lack of research on measurement models and valid methods of competency assessment in higher education [10]. In particular, accredited institutions of higher education lack sufficiently reliable and valid methods of measuring students' competencies [11]. Second, prior researches has not reflected a variety of participants' opinions. The collected data included mainly professors and students, and did not consider other important stakeholders such as graduates and industrial experts who were directly related with the core competencies. Third, various statistical methods were used to derive core competencies, but content validity was more important than statistical construct validity. Therefore, reliable and valid research assessing competencies in higher education is needed, taking into consideration stakeholders' opinions in higher education as well as statistical approaches. The purpose of this study is to develop and statistically validate the core competencies in higher education, reflecting a variety of stakeholders' opinions. The research questions are: What is the potential model of the core competency in higher education? And is the potential model statistically valid?

II. Core Competencies in Higher Education

The OECD's DeSeDo project report (2005) [12] has become a critical starting point for discussions on core competencies to prepare for the future. This report describes the core competency as "the ability to produce valuable outcomes on a personal or social level in order to maintain an individual's successful life and a happy society. It is also the ability to use cognitive and practical skills as well as social and behavioral factors such as attitudes, feelings, values and motives to successfully meet the complex needs of a particular context. This report categorizes the core competencies into three sub-categories (i) ability to interactively use tools such as language, symbols, and evaluations; (ii) ability to interact with heterogeneous groups to smoothly engage with others and to work and collaborate within a team; and, (iii) ability to manage and resolve conflicts to act in a large context and to establish and fulfill life plans and personal projects.

Trilling and Fadel (2009) [13] divided 21st century competencies into learning and innovation skills, digital literacy skills, and career & life skills. Learning and innovation skills include critical thinking and problem solving; communication and collaboration; as well as creativity and innovation. Digital literacy skills consist of information literacy, media literacy, and information and communication technology (ICT) literacy. Career and life skills include flexibility and adaptability; initiative and self-direction; social and cross-cultural interaction;

Table 1. Models of Core Competencies in Higher Education

Core Competency		K-CESA	Dong Kuk Univ	Sung kyunk wan Univ.	ATHELLO	NPEC	CLA	ACT	Univ. of Sydney	Univ. of Queens-land	Alverno Univ.
Problem solving	Creative thinking skill	○	○	○	○	○	○	○		○	○
	Critical thinking skill	○	○		○	○	○	○		○	○
	Information literacy	○	○			○		○	○		
Communication	Communication skill	○	○	○	○	○	○	○	○	○	○
	Collaboration skill			○				○			
	Empathy ability		○	○							○
Self-direction	Leadership		○	○							
	Learnability	○		○		○			○		
	Globalization ability	○	○	○							○
Co-existence	Rehabilitation ability									○	
	Social service ability									○	
	Multiculture ability	○									

productivity and accountability; and also leadership and responsibility.

The Partnership for 21st Century Skills (2005) [14] in the United States selected learning and innovation capabilities, lifelong and career development capabilities, as well as information, media and information technology capabilities through surveys and discussions on core competencies in the 21st century. Learning and innovation competencies consist of critical thinking and problem solving, communication and cooperation, creativity and innovation. Life and career development competencies include flexibility and adaptability, determination and self-initiative, social and multicultural understanding, productivity and accountability, leadership and responsibility. Information, media, and information technology competencies consist of information literacy, media literacy, and information and communication technology literacy.

Studies related to core competencies in higher education have been actively conducted, too. The core competencies suggested by the OECD Assessment of Higher Education Learning Outcomes (AHELLO) and CLA (Collegiate Learning Assessment) were problem solving, analytical reasoning, critical thinking, and communication through writing [15]. The National Postsecondary Education Cooperative (NPEC) provided communication and listening, mathematical literacy, information literacy, along with critical thinking and problem solving as core competencies. American College Testing (ACT) suggested communication, information literacy, problem solving, integration, and interpersonal skills. And the University of Sydney in Australia offers communication, information literacy, research and survey, personal and intellectual autonomy, and ethical and social professional understanding. The University of Queensland's core competency is composed of effective communication, critical judgment, and independence and creativity. The Alverno College specifies eight abilities; communication, analysis, valuing in decision-making, problem solving, developing global perspective, social interaction, effective citizenship and aesthetic engagement.

K-CESA (Korea Collegiate Essential Skills Assessment), a core competency model for college students developed by the Korea Research Institute for Vocational Education & Training, consists of communication, comprehensive reasoning, utilization of resources, information & technology, global readiness, self-management, and interpersonal relationship. Dongguk University's core competency is composed of communication, self-development, interpersonal relationship, globalization, ICT utilization, problem solving. Sungkyunkwan University specifies that its competencies are communication, humanitarian capacity, academic skill, globalization, creativity, and leadership.

As shown in <Table 1> above, the results analyzing and synthesizing core competencies of higher education institutes are as follows. Problems solving competency includes creative thinking skills, critical thinking skills, and information literacy. Communication competency consists of clear communication skill, collaboration skills, and empathy. Self-direction competency is composed of leadership, learning ability and global ability. Finally, co-existence competency can be divided into rehabilitation ability, social service ability, and multicultural ability.

Ⅲ. Method

1. Participants

The surveys on the importance of diagnostic items

were conducted among 226 professors and administrative staffs, 730 students, and 134 graduates and external experts. Details of participants are shown in <Table 2>.

Table 2. Questionnaire Participants Information

			Number of Person	Percent
School Personnel		professor	106	46.9%
		admin staff	120	53.1%
		sub-total	226	100%
Student	Grade	freshman	181	24.8%
		sophomore	221	30.3%
		junior	170	23.3%
		senior	158	21.6%
		sub-total	730	100%
	Gender	male	318	43.6%
		female	411	56.4%
		sub-total	730	100%
Graduate & Industrial expert	Affiliation	public institution	51	39.8%
		private institution	41	32%
		extra	36	28.1%
		Missing	6	4.5%
		sub-total	134	100%
	Position	CEO	7	5.2%
		Manager	18	13.4%
		person in charge	76	56.7%
		Extra	26	19.4%
		Missing	7	5.2%
		sub-total	134	100%

2. Instrument

Based on a review of academic articles and official reports related with vision and development strategies of universities, the potential model consisting of 4 core competencies and 12 practical abilities, was developed ([Fig. 1]).

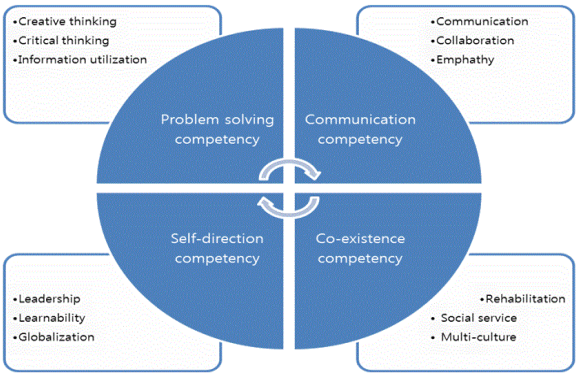

Fig. 1 Potential model of core competencies at a higher education institute

In order to verify the validity of this potential model, 24 items were derived for each practical ability based on the model. Additionally two professors in education and one professor in special education revised and supplemented the items through face-to-face meetings (<Table 3>).

Table 3. Evaluation items by core competency and practical ability

Core competency	Practical ability	Item
A. Problem solving	Creative thinking	1. Solve problems through innovative and creative thinking 2. Approach from various perspectives when solving problems.
	Critical thinking	3. When faced with problems, find solutions by analyzing and evaluating them. 4. Explain or assert opinions based on evidence and reason
	Information utilization	5. Use digital media to solve problems 6. Practice ethical and legal norms when searching and using digital information.
B. Communication	Communication	1. Communicate thoughts and feelings by applying appropriate communication techniques. 2. Understand the meanings of the other person's words and writings correctly.
	Collaboration	3. Complete my roles and responsibilities to achieve common goals. 4. Respect and consider team members when collaborating.
	Emphathy	5. Share the emotions of others and try to become familiar with them. 6. Sympathize with the difficulties that other people experience.
C. Self-directtion	Leadership	1. Be good at time management and goal management in academic and personal setting. 2. Be interested in innovating and improving myself and society
	Learnability	3. Practice the learning skills necessary for effective study. 4. Try to change your lifestyle and value system by applying what you learn.
	Globalization	5. Search and experience actively in the new environment. 6. Be interested in foreign culture and foreign language learning to have an international perspective.
D. Co-existence	Rehabilitation	1. Respect the disabled positively showing human dignity. 2. Resolve and support the social inequalities experienced by persons with disabilities.
	Social service	3. Actively serve society by utilizing the professional skills and knowledge. 4. Practice specifically to help neighbors
	Multi-culture	5. Understand the cultural experiences and backgrounds of various racial and ethnic group members 6. Create innovative ideas for cultural convergence by utilizing cultural differences in society

3. Procedures

Aiming to develop a potential model of core competencies in higher education and to validate the model, a framework was derived based on the literature review. It includes four competencies (problem solving, communication, self-direction, and co-existence), and 12 practical abilities (creative thinking, critical thinking,

information literacy, communication, collaboration, empathy, leadership, learnability, globalization, rehabilitation, social service, multi-culture).

For the purpose of collecting data to validate the derived potential model, 24 evaluation items (4-point Likert scale) were developed. The survey on the importance of core competencies was carried out with professors and administrative staffs (226 persons). After conducting the survey, an exploratory factor analysis was conducted to derive a revised model using collected data. In order to further validate the revised model of core competencies, an importance-performance assessment survey was conducted among 730 students and another survey was carried out to evaluate the importance of core competencies among graduates and external experts (134 persons).

4. Data Analysis

In this study, a frequency analysis and an exploratory factor analysis on the data collected through the survey with professors and administrative staffs were carried out in order to derive the core competencies. Data collected through the survey among students were analyzed through frequency analysis, Wilcoxon's sign rank test, Borich priority determination formula, and Locus for Focus model analysis. And frequency analysis was performed for examining the responses of graduates and external experts.

Ⅳ. Results

In this section, the results of the questionnaire survey for the purpose of deriving core competencies and validating them will be presented. Also, the results of the evaluation of the related groups (students, graduates, external experts) on the developed core competencies will be described.

1. Developing and Validating a Model for Core Competencies at University

In order to confirm the validity of the potential model for the university's core competencies, a survey consisting of 24 evaluation items was conducted. Using data collected from professors and administrative staffs (226 persons), frequency analysis and exploratory factor analyses were performed. The results are shown below.

Table 4. Mean and Standard Deviation for Items

Core Competency	Item	Mean	SD	Core Competency	Item	Mean	SD
Problem Solving	A1	3.61	.58	Self-direction	C1	3.59	.57
	A2	3.65	.56		C2	3.38	.67
	A3	3.57	.59		C3	3.39	.67
	A4	3.51	.63		C4	3.37	.71
	A5	3.26	.70		C5	3.43	.62
	A6	3.32	.69		C6	3.30	.73
Communi-cation	B1	3.62	.59	Co-existence	D1	3.65	.562
	B2	3.63	.57		D2	3.46	.63
	B3	3.76	.50		D3	3.54	.60
	B4	3.76	.51		D4	3.21	.70
	B5	3.54	.60		D5	3.40	.67
	B6	3.48	.65		D6	3.33	.74

As shown in <Table 4>, the mean of each evaluation items ranged from 3.21 to 3.76. It means that 24 items were considered to be of significant importance for a successful university life. An exploratory factor analysis was conducted by using the data collected through the survey among professors and administrative staffs.

The correlation between the items was not high. The correlation between the items and the total score was more than .3 in all 24 items. As a result of examining the KMO value and the Bartlett test, it was found that there was a common factor (KMO = .924, p = .000) among the collected data. Therefore, exploratory factor analysis was performed. In order to determine the number of common factors, Kaiser criterion, scree test, and interpretability were considered, and the number of factors for extraction was set to five (Table 5). The first five factors accounted for 63.74% of the total variance.

Table 5. Relative Importance and Explanation Ratios by Factor

Factor	Eigenvalue	Difference of eigenvalue	Variance explained (%)	Cumulative variance explained(%)
1	10.407	8.848	43.363	43.363
2	1.559	.366	6.496	49.858
3	1.193	.071	4.972	54.831
4	1.122	.105	4.677	59.508
5	1.017		4.236	63.744

After determining the number of factors, a principal component factor analysis and the Varimax rotation method were adopted. The results of the exploratory factor analysis

are shown in <Table 6> below. The items were roughly clustered into five categories: problem solving (factor 1), information communication (factor 2), social relationship (factor 3), innovative learning (factor 4), as well as care and co-existence (factor 5). The internal consistency reliability was analyzed to test the correlation among items. The Cronbach alpha for the diagnostic model of core competencies was .94, which confirmed the adequacy of the internal consistency of the model.

Table 6. Result of Factor Analysis for 5-Factor Model (Model Ⅰ)

Item	Factor Ⅰ (Problem solving)	Factor Ⅱ (Inform-ation & commu-nication)	Factor Ⅲ (Social relation-ship)	Factor Ⅳ (Innova-tive learning)	Factor Ⅴ (Care & Co-exi stence)	Cr on ba ch α
A1	**.664**	-.111	.255	.175	.135	
A2	**.754**	.089	.146	.140	.15	
A3	**.662**	.290	.149	.241	.181	
A4	**.552**	.589	.031	.110	.171	**.942**
A5	.059	**.734**	.315	.183	.272	
A6	.027	**.683**	.207	.301	.369	
B1	.187	**.433**	.203	.596	-.075	
B2	.402	**.333**	.354	.338	.096	
B3	.361	.217	**.686**	.161	.063	
B4	.253	.161	**.742**	.185	.176	
B5	.140	.089	**.606**	.346	.277	
B6	.126	.165	**.581**	.354	.289	
C1	.255	.063	.291	**.618**	.162	
C2	.435	.021	.237	**.410**	.430	
C3	.162	.214	.211	**.686**	.307	
C4	.142	.118	.149	**.776**	.335	
C5	.237	.217	.211	**.559**	.346	
C6	.284	.099	.175	**.359**	.506	
D1	.080	.148	.586	.125	**.470**	
D2	.005	.245	.483	.116	**.610**	
D3	.205	-.030	.426	.295	**.544**	
D4	.136	.154	.295	.170	**.672**	
D5	.138	.135	.160	.157	**.763**	
D6	.204	.249	.015	.194	**.743**	
Eigenvalue	1.122	1.017	1.559	1.193	10.407	
Variance Explained (%)	4.677	4.236	6.495	4.972	43.363	
Cumulative Proportion of total variance (%)	4.677	8.913	15.408	20.38	63.744	

The second exploratory factor analysis, which was carried out again by each factor as separate factor analysis, was conducted to derive sub-factors (practical ability) for each factor (core competency). In result, a two-factor model (Model Ⅱ) (Table 7), a two-factor model (Model Ⅲ) (Table 8), a two-factor model (Model Ⅳ) (Table 9), a three-factor model (Model Ⅴ) (Table 10), a three-factor model (Model Ⅵ) (Table 11) were also suggested, as the factors from each models accounted for 76.7%, 82.8%, 81.2%, 79.6%, and 81.5% of the model variance, respectively.

Table 7. Result of Factor Analysis for 2-Factor Model (Model Ⅱ)

Factor	Item	Factor Ⅱ-1 (creative thinking)	Factor Ⅱ-2 (critical thinking)
Problem solving	A1	.901	.123
	A2	.726	.394
	A3	.355	.783
	A4	.133	.895
Eigenvalue		2.331	.738
Variance Explained (%)		58.268	18.440
Cumulative Proportion of total variance (%)		58.268	76.708

Table 8. Result of Factor Analysis for 2-Factor Model (Model Ⅲ)

Factor	Item	Factor Ⅲ-1 (information utilization)	Factor Ⅲ-2 (communication)
Informa-tion & communi-cation	A5	.913	.194
	A6	.896	.244
	B1	.222	.859
	B2	.195	.869
Eigenvalue		2.415	.898
Variance Explained (%)		60.373	22.457
Cumulative Proportion of total variance (%)		60.373	82.830

Table 9. Result of Factor Analysis for 2-Factor Model (Model Ⅳ)

Factor	Item	Factor Ⅳ-1 (Collaboration)	Factor Ⅳ-2 (Emphathy)
Social relationship	B3	.897	.237
	B4	.815	.373
	B5	.284	.846
	B6	.286	.839
Eigenvalue		2.620	.626
Variance Explained (%)		65.508	15.648
Cumulative Proportion of total variance (%)		65.508	81.156

Table 10. Result of Factor Analysis for 2-Factor Model (Model Ⅴ)

Factor	Item	Factor Ⅴ-1 (Learnability)	Factor Ⅴ-1 (Innovation)	Factor Ⅴ-2 (Globalization)
Innovative learning	C1	.265	.878	.278
	C2	.716	.458	-.030
	C3	.670	.301	.361
	C4	.805	.268	.244
	C5	.732	-.012	.503
	C6	.220	.260	.885
Eigenvalue		3.558	.581	.638
Variance Explained (%)		59.301	9.690	10.631
Cumulative Proportion of total variance (%)		59.301	68.991	79.623

Table 11. Result of Factor Analysis for 3-Factor Model (Model VI)

Factor	Item	Factor V-1 (Rehabili-tation)	Factor V-2 (Social service)	Factor V-3 (Multi-culture)
Care & Co-existence	D1	.874	.248	.181
	D2	.785	.313	.307
	D3	.245	.822	.229
	D4	.312	.749	.279
	D5	.201	.384	.798
	D6	.261	.174	.882
Eigenvalue		.729	.566	3.597
Variance Explained (%)		12.146	9.429	59.947
Cumulative Proportion of total variance (%)		12.146	21.575	81.521

The final model for the analysis of university's core competencies consists of five areas: problem solving, information and communication, social relation, learning innovation, as well as care and co-existence. Each core competency has two or three practical abilities. The problem-solving competency is based on creative thinking and critical thinking. The information and communication competency is related to information literacy and communication ability. The social relationship competency includes cooperative ability and empathy. The learning innovation competency consists of learnability, innovation and globalization. Finally, the care and co-existence competency includes rehabilitation, social service, and multi-culture. Based on the aforementioned results, the final revised criteria model is shown in <Figure 2>

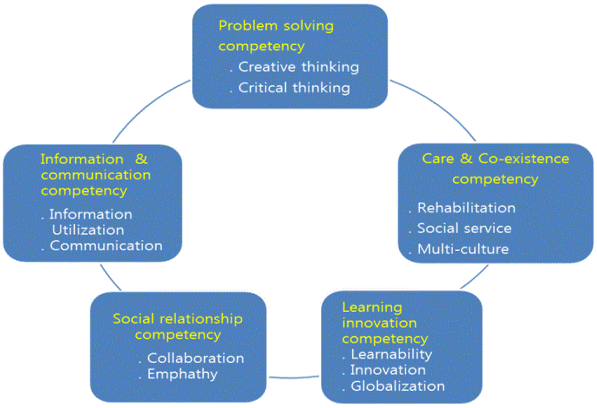

Fig. 2 Final Revised Model for Core Competencies in Higher Education

2. Analysis of Importance-Performance Student Survey on Derived Core Competency

A survey on the importance and performance of the core competency evaluation items was conducted in order to gather students' opinions (730 persons) regarding the competencies which were derived through an exploratory factor analysis. The analysis results are shown in Table 12 below.

As shown in the above table, the average scores for items (4-point Likert scale) in the importance evaluation ranged from 3.28 to 3.66, suggesting that students felt that the practical abilities of each core competency were

Table 12. Difference of importance-performance and prioritization of core competencies.

Core Competency	Practical skill		Importance		Performance		Difference		Borich Priority	
			M	SD	M	SD	Z	p	Score	Rank
Problem solving	Creative thinking	A1.	3.44	.61	2.72	.67	-18.21	.000	1.173	2
		A2.	3.53	.61	2.91	.67	-16.57	.000	.933	7
	Critical thinking	A3.	3.40	.62	2.81	.70	-15.08	.000	.866	9
		A4.	3.43	.66	2.96	.72	-13.06	.000	.724	16
Information & communication	Information utilization	A5.	3.29	.69	3.04	.77	-7.51	.000	.365	24
		A6	3.28	.72	2.85	.78	-12.13	.000	.683	18
	Communication	B1.	3.46	.65	3.01	.71	-12.56	.000	.635	22
		B2.	3.56	.60	3.08	.69	-13.29	.000	.849	10
Social relationship	Collaboration	B3.	3.63	.59	3.20	.70	-13.76	.000	.751	15
		B4.	3.66	.57	3.28	.70	-12.52	.000	.642	21
	Emphathy	B5.	3.49	.62	3.12	.76	-10.26	.000	.555	23
		B6.	3.36	.69	2.89	.75	-13.95	.000	.649	20
Learning innovation	Learnability	C1.	3.40	.64	2.84	.72	-15.10	.000	.787	13
		C2.	3.30	.70	2.74	.73	-14.68	.000	.809	12
	Innovation	C3.	3.52	.68	2.71	.75	-17.08	.000	1.249	1
		C4.	3.35	.69	2.68	.75	-16.02	.000	1.046	5
	Globalization	C5.	3.35	.67	2.76	.75	-14.46	.000	.849	10
		C6.	3.32	.72	2.62	.87	-15.11	.000	.900	8
Care & Co-existence	Social service	D1.	3.40	.69	2.70	.84	-16.74	.000	1.108	3
		D2.	3.33	.72	2.76	.88	-13.67	.000	.949	6
	Rehabilitation	D3.	3.54	.61	3.14	.71	-12.25	.000	.689	17
		D4.	3.45	.65	2.73	.79	-16.63	.000	1.106	4
	Multi-culture	D5.	3.46	.61	3.00	.70	-14.08	.000	.659	19
		D6.	3.43	.69	2.87	.78	-14.99	.000	.775	14

necessary factors for successful university life. The average scores for items (4-point Likert scale) in the performance evaluation ranged from 2.68 to 3.28, indicating the level of performance that students thought was relatively lower than the importance for their practical abilities of core competencies. Moreover, the Wilcoxon's sign rank test for importance-performance difference analysis showed significant difference between importance and performance in all areas at significance level .01.

Furthermore, in order to prioritize practical abilities, the Borich priority determination formula (<Table 12>) and the Locus for Focus model analysis ([Fig.3]) were conducted. Students regarded self-management, critical thinking, and support for people with disabilities as priorities (<Table 13>).

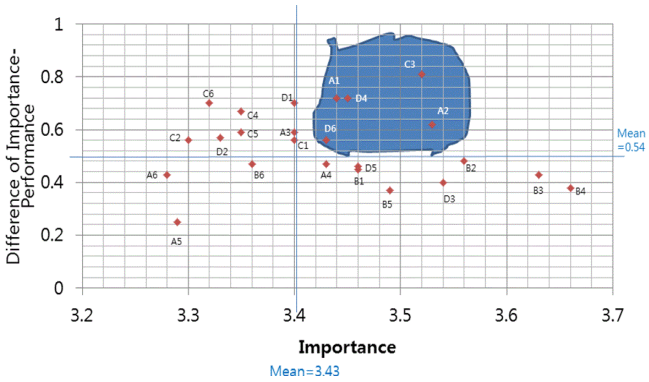

Fig. 3. Priority determination of students' practical skills by analyzing Locus for Focus Model

Table 13. Prioritization of practical skills

	1st	2nd	3rd	4th	5th
Borich Prior-ity	C3. Self-manage-ment	A1. Creative thinking	D1. Profes-sional service	D4. Supporting the handi-capped	C4. Innovation
Locus for Focus	C3. Self-manage-ment	A1. Creative thinking	A2. Flexible thinking	D4. Supporting the handi-capped	D6. Converging multi-culture

3. Analysis of importance evaluation of university's core competencies by graduates and external experts

This section summarizes the results of the survey (4-point Likert scale) for the opinions of the graduates and the external experts (226 persons) about the core competencies derived from the exploratory factor analysis. The results are shown in <Table 14>. The average scores for each evaluation item ranged from 2.80 to 3.76, indicating that graduates and external experts felt that the ability of each core competency was a necessary factor for a successful university life.

Table 14. Mean and Standard Deviation of importance evaluation by graduates and external experts

Compe-tency	Item No.	M	SD	Compe-tency	Item No.	M	SD
Problem solving	A1	3.49	.622	Learning Innovation	C1	3.49	.597
	A2	3.69	.526		C2	3.19	.677
	A3	3.64	.555		C3	3.29	.647
	A4	3.51	.622		C4	3.15	.677
Informa-tion commu-nication	A5	3.28	.656		C5	3.45	.569
	A6	3.27	.695		C6	2.90	.787
Social relationship	B1	3.67	.502	Care & co-existence	D1	3.40	.662
	B2	3.68	.484		D2	3.12	.766
	B3	3.76	.445		D3	3.07	.738
	B4	3.71	.488		D4	2.80	.764
	B5	3.44	.621		D5	3.11	.711
	B6	3.16	.599		D6	3.14	.727

Ⅴ. Conclusion

The purpose of this study was to develop a model of core competencies in higher education and to verify the statistical validity of the model. Based on a review of the literature, four potential competencies (problem solving, community, self-direction, and co-existence) and 12 practical skills (creative thinking, critical thinking, collaboration, empathy, leadership, learnability, globalization, rehabilitation, social service, multi-culture) were identified. The result of an exploratory factor analysis using an importance questionnaire collecting data from professors and administrative staffs revealed, five core competencies (problem solving; information and communication; social relationship; learning innovation; care & co-existence) and twelve practical skills (creative thinking, critical thinking, information literacy, communication, cooperation, empathy, learnability, innovation, globalization, rehabilitation, social service, and

multi-culture). The revised model is identified as valid and reliable. Moreover, through the importance-performance analysis of data collected from students, graduates and external experts, further validation of the model was also conducted. Therefore, it can be concluded that the revised model of core competencies in higher education is valid and reliable.

The implications of this study are as follows. First, this study developed a multifaceted and comprehensive core competency model in terms of establishing and validating the common core competency by major stakeholders (professors, students, administrative staffs, graduates, external experts), all of whom participated in the process of developing the university's core competency. Additionally, the study attempted to overcome the existing researches' limitation of dealing only with a part of the stakeholders. In order for a change or innovation to be successful, participation of all stakeholders is very important, since they decide whether the core competency should be applied to university curriculums or not. Moreover, research revealed that the university administration needs to provide ample time for each department to transform, innovate, and integrate the core competencies into their curriculums [16]. Furthermore, the participation and intervention of local industries and, in particular, communities should also be accompanied by the development of curriculum and the integration of core competencies.

It is also important to highlight that the core competencies derived from this study are focused on the common or generic abilities of a university rather than specific content knowledge to obtain a particular major. However, this perspective does not contrast with Trilling and Fadel (2009)'s suggestion [13] that various powerful forces such as knowledge work, thinking tools, digital lifestyle, and learning research should be are converged for leading us toward new ways of learning for life in the 21st century. The generic core competencies that this study suggests are more viable for application in to a liberal arts curriculum than one in a specific major which focuses on specific knowledge areas. Based on the developed core competencies, a competency-based educational curriculum which integrates generic and specific competencies can be designed and developed for each major.

The results also contain certain limitations. First, the core competencies to be developed in this study focus solely on common or generic ability and not on specific university majors. However, since core competencies are based on 'generic skills' rather than 'specific skills', they cannot ignore basic aspects of general knowledge. Second, the study did not include the participation of parents. Although it tried to reflect a variety of stakeholders' opinions, it did not include all the related stakeholder's ones. In the future, empirical research would from using the model in this study in the investigation of measurement and evaluation of core competencies in higher education.

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