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Seven Facets of Learning Agility in Higher Education for Future Society*

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Learning agility as high potentials is drawing attention as a competency for leading an uncertain future society. The present study aims to determine the factors of learning agility in higher education context for future society. To address this goal, Major factors related to learning agility were derived through literature review and statistically verified. For statistical analysis, the nationwide data were collected from 1,000 undergraduate students in South Korea by National Youth Policy Institute. The participants asked to answer 29 items of learning agility questionnaires (LAQ). The collected data were analyzed by descriptive statistical analysis, exploratory factor analysis, and confirmatory factor analysis. As a result, learning agility items were verified normality and reliability. Learning agility was identified seven factors; *challenging mind, learning responsibility, reflecting experience, intellectual curiosity, systemic thinking, change adaptability*, and *logical thinking*. Also, the structural model fit of the seven factors of learning agility was also confirmed to be good. Based on the findings of the present study, empirical, theoretical, and practical contributions were presented, and suggestions for further research were proposed in detail.

Keywords : Future society, Learning Agility, Leadership, Competency, Higher Education

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Introduction

Recently, higher education is having a difficult time in recruiting new students due to the decrease in the school-age population. At the same time, great changes in society such as the 4th industrial revolution are constantly increasing the demand for nurturing talents who can create new social values in higher education (MOE, 2019; Sung & Lee, 2020). To this end, higher education needs to improve the learning competency of talented people who can lead changes in the future society. This is because learning competency is regarded as a core competency that future talents must have in order to not only adapt to the changing society and environment, but also lead social change (Bellanca & Brandt, 2010; Im, Wee, & Lee, 2017; Partnership for 21st Century Skills, 2015; Ryu & Oh, 2016; Sung, 2018; World Economic Forum, 2016).

Learning agility is a concept that encompasses the learning competency of talents who will lead changes in the future society. "Learning agility refers to the willingness and ability to learn new competency required in the situation of performing tasks experienced for the first time" (Lombardo & Eichinger, 2000, p. 323). Previous studies have reported that such learning agility is closely related to the leadership of the CEO or organizational members in the context of corporate success (Burke, 2018, Im et al., 2017, Lombardo & Eichinger, 2000). Thus. It is worth noting that learning agility is an important predictor of individual and organizational performance and success (Bedford, 2011; Connolly, 2001) and is a capability that can be developed at any time (Swisher, 2013). While learning agility is a topic of high interest in HRD fields such as corporate education, the discussion of learning agility in the context of higher education has generally been absent, the concept is still ill-defined and efforts to measure it have been limited (De Rue, Ashford, & Myers, 2015; Muphy, 2021).

In order to leading, adapting, managing, and sustainability in such rapid changes in society, higher education should need to cultivate leaders who are flexible, adaptable, and adapt well to external environments. The practical reason why learning

agility as a leadership quality in higher education should be treated as an important topic is that it is regarded as a key attribute that companies or organizations should look for when selecting talent and developing and retaining their potential (Murphy, 2021). Therefore, cultivating leaders who will lead a continuously changing and complex society should be the goal of higher education. Learning agility, which has been studied limitedly in higher education, is as follows. Sung, Choi, Kim, Oh, and Jin (2013) reported a concept of learning agility as a sub-component of lifelong learning competency while examining the competencies required for a changing future society for university students. Afterwards, a study to develop and validate a measurement tool based on the concept of learner's learning agility (Sung, Baek, & Jin, 2014; Sung, Jin, & Kim, 2016), a study on the effect of learning agility on the characteristics of university students that learning agility showed the highest intellectual curiosity, followed by learning initiative, and change acceptability (Jang et al., 2015) and the structural relationship of related factors (Sung, 2017, 2018; Sung & Lee, 2020) was also carried out. In addition, a study to analyze the relationship between university students' learning agility on university life adaptation and career preparation behavior (Song, Lee, & Im, 2018), and a study to the effect of learning agility on career preparation behavior through learning challenge (Lee, 2019) have been carried out.

As such, if we closely look at studies on learning agility targeting university students in higher education, it is necessary to check whether the factor characteristics of learning agility reflect the contextual characteristics of university students. This is because, in order to analyze the influence relationship on learning agility from the perspective of competency, the characteristics of learning agility must reflect the characteristics of excellent agile learners. However, in previous studies, the factors for learning agility of university students were developed based on the characteristics required in the corporate context (Im et al., 2017), or the factors used in the characteristics of the corporate context were applied to university students and utilized (Lee, 2019; Song et al., 2018). There was also a study that analyzed learning

agility among university students in higher education context. Sung et al. (2016) developed the learning agility of university students as a sub-competence of lifelong learning competency and suggested the factors of learning agility as change acceptability, intellectual curiosity, and learning initiative. However, in the study of Sung et al. (2016), three factors were explained with a limited number of seven items to measure competence at the national level. Therefore, there was a limitation that it could not be explained including various characteristics related to the learning agility of university students. Based on prior research analysis, the need to analyze the factors of learning agility that responding to changes in the future society focus on the characteristics of university students, and to analyze the characteristics of university students in connection with the characteristics of learning agility.

Therefore, the main purpose of this study is to determine the factors of learner's learning agility in higher education context. For this purpose, the factors of learning agility are identified and validated. In addition, there are tried to briefly examine the differences in learning agility factors according to the demographic characteristics of university students. The specific research questions are as follows.

1. What are the factors of learner's learning agility in higher education context?
2. Are the factors of learning agility structurally validated?
3. Are there any differences in the factors of learning agility according to the demographic characteristics of university students?

Theoretical background

The concept of learning agility

The concept of learning agility was derived from the study of the failure of potential leaders with outstanding capabilities and crystallizing experiences of successful leaders at the Center for Creative Leadership in the United States (Im et

al., 2017; Lombardo & Eichinger, 2000). The difference between successful and unsuccessful leaders is how quickly they learn from challenging experiences and how flexible they can change their thoughts and actions to respond (Swisher, 2013). Lombardo and Eichinger (2000) named learning agility in their paper, which was high potentials as high learners. They described learning agility as a willingness to learn new things from experience and the ability to practice quickly and flexibly and apply newly learned things.

On the other hand, Connolly (2001) described learning agility as a major variable that explains performance and promotion potential in an organization, independent of intellectual ability or personality factors such as IQ. Scholars who study learning agility have found that people with high learning agility are (1) well aware of their strengths and weaknesses, (2) actively acting for self-development, (3) constantly taking on new challenges, (4) solicit feedback from others, (5) learn through introspection, and (6) produce practical and practical outcomes (London & Maurer, 2004; McCaulley, 2001). This concept of learning agility can be understood as starting from the business management aspect to identify and development a core talent from an organizational point of view.

The above concept of learning agility has an ambiguous boundary between adult learning and informal learning. However, "informal learning is a concept in situations and environments where learning takes place in an unplanned, improvised way where people learn how to do their jobs" (Cross, 2007, p. 236), Learning agility can be distinguished in terms of the ability to learn speedy and flexibly from formal learning or informal experiences (De Meuse, Dai, & Swisher, 2012). In the corporate context, the scope of job-oriented informal learning is wider than that of formal learning, and the university context is focused on formal learning, but the scope of informal learning differs depending on individual capabilities. Therefore, the ability to learn from the experience quickly and flexibly, whether formal or informal (De Meuse et al., 2012), can be said to be an important quality for future talent. The study that identified the characteristics of learning agility in South Korea is as follows. Im et al.

(2017) identified factors of learning agility in the corporate context. They reported that learning agility can be regarded as a future success factor in an environment of dynamic and uncertain change. In particular, they interpreted learning agility as a variable that can predict the growth potential that will drive future changes. In addition, they defined learning agility as the ability to learn through experience and change one's thoughts and actions quickly and flexibly based on this.

On the other hand, Sung et al. (2016) interpreted learning agility as the core competency of university students required to prepare for an uncertain future and lead an active life in the present, and reported the characteristics of learning agility as a sub-factor of lifelong learning competency. They defined learning agility as the ability to quickly learn based on intellectual curiosity in new experiences, and suggested sub-competences of learning agility such as change acceptability, intellectual curiosity, and learning initiative

Component characteristics of the learning agility

The component characteristic of learning agility is the CHOICE model proposed by Lombardo and Eichinger (2000). They defined learning agility such as people agility, result agility, mental agility, and change agility, and developed 76 items, which were to measure learning agility.

Regarding learning agility, Bedford (2011) studies the role of learning agility in terms of workplace performance and career growth, and developed a 9 items questionnaire to measure learning agility. Also, Spreitzer, McCall, and Mahoney (1997) found that the ability to learn from experience is the key to successful overseas job placement through a study on expatriates working abroad and measured it from six perspectives.

Im et al. (2017) described learning agility as five factors: self-awareness, growth-oriented, flexible thinking, reflective behavior thinking, and behavioral change.

Table 1. Contents of CHOICE Model of Lombardo and Eichinger (2000)

Factors	Contents of CHOICE Model
People agility	· Knowing yourself well, learning from experience, and being constructive with others · Actively seek feedback and make changes through it · Recognize that even if there is a difference of opinion in the process of working with others, it is a mutually cooperative and constructive relationship, open to different perspectives
Result agility	· Thinking from a new perspective on a problem · Be comfortable with complexity and ambiguity, and be good at explaining your thoughts to others · Thoroughly analyze the problem and find meaning
Mental agility	· Curious and full of enthusiasm for ideas · Comfortable accepting new situations and challenges, active in learning new skills
Change agility	· Create results even in difficult and difficult situations for the first time · Inspire others to instill confidence and create above-average results

Table 2. Contents of learning agility of Bedford (2011) and Spreitzer et al. (1997)

Scholars	Contents
Bedford (2011)	· Accept feedback from others · Flexible, correcting your own way when things don't go well · A lot of curiosity and questions · Knowing yourself well such as strengths and weaknesses · A strong desire to acquire new knowledge and skills · Active pursuit of personal growth and improvement · Pursuing new challenges and experiences · Open to change and new ideas · Learning from mistakes
Spreitzer, McCall, & Mahoney (1997)	· Use of feedback (e.g. change as a result of feedback) · Adventurous (e.g. enjoys the challenge of working in another country) · Actively seeking learning opportunities · open to criticism · Actively seeking feedback · Flexible

Table 3. Contents of learning agility of Im et al. (2017)

Factors	Contents
Self-Awareness	· Knowing self-strengths and weaknesses clearly · Being aware of own emotional state · Knowing what affects emotions
Growth-Oriented	· Believe that I can improve my potential through hard work · Interested in growing to a higher level than now · Strong motivation to develop new skills · Interested in my career development · Accepting other people's feedback as an opportunity for growth · Thinking about my future and results · Pursuing high-level goals
Flexible Thinking	· Integrate disparate concepts and ideas to present new perspectives · Thinking about the invisible side of an event or situation. · Thinking about a problem or opportunity from a new perspective
Reflective Behavior Seeking	· Actively requesting feedback from others about my work activities · Constantly asking questions about my current job or activity · Continuous exploration of the root causes of success and failure · Explaining rationale before making decisions and taking action
Behavioral Change	· Trying something new get out of my comfort zone · Don't be swayed by resistance to change · Taking responsibility for change challenges · Recognizing failure as part of the innovation or learning process · Taking risk not to hesitate in uncertain situations

Sung et al. (2016) defined learning agility as the ability to learn quickly based on intellectual curiosity in new experiences and suggested sub-competences of learning agility such as change acceptability, intellectual curiosity, and learning initiative. According to them, change acceptability refers to the ability to actively accept and utilize external stimuli or changes, and intellectual curiosity refers to the tendency to like to learn new things, and learning initiative refers to the mindset of planning, implementing, and reflecting on one's own learning with a sense of ownership.

Table 4. Contents of learning agility of Sung et al. (2016)

Factors	Contents
Change acceptability	· Taking the initiative to accept the changes that occur around mine when learning · Using a newly launched product or service
Intellectual curiosity	· Enjoying to learn something new or to get a new experience · Asking others when you have a question
Learning initiative	· Exploring the success factors after succeeding something work. · Analyzing the failure factors after failing something work. · Asking for feedback from others about my work

Method

Data collection

The present research used a data set from the Korean Youth Competency Measurement and International Comparative Study II was nationwide collected from undergraduate students (1~4th grades) in South Korea. In this research, a stratified clustered sample design was used on the sample group of randomly selected 1,000 undergraduate students (499 males, 501 females) from 7 cities and 9 provinces in South Korea. The mean age of participants was 22.19 years (SD=2.44) for undergraduate students. The participants were 339 (33.9%) 1st grade, 321 (32.1%) 2nd grade, 196 (19.6%) 3rd grade and 144 (14.4%) 4th grade undergraduate students. According to the college, there were 123 (12.3%) *Liberal arts*, 207(20.7%) *Social Science*, 87(8.7%) *Education*, 206 (20.6%) *Engineering*, 132(13.2%) *Natural Science*, 111 (11.1%) *Medicine*, and 134 (13.4%) *Art* & *Physical.*

Materials

The paper-based material consisted of 2 parts such as participant characteristics

questionnaires and learning agility questionnaires (LAQ). The participant questionnaire solicited demographic information concerning a participant's age, gender, grade, college, and types of college. The learning agility questionnaires consisted of 29 rating items for each scales were selected from previous reported indicators by Bedford (2011), Burke (2018), Connolly (2001), De Meuse et al. (2012), De Rue et al., (2015), Im et al. (2017), Lombardo and Eichinger (2000), Spreitzer et al. (1997), Sung et al. (2016), Swisher (2013), Swisher et al. (2013), and Wanberg and Banas (2000). Among the 29 items of the learning agility questionnaires, the contents of the items described based on the corporate context were modified and corrected to fit the university context, and the contents were justified by 3 experts in learning agility. Learning agility questionnaires were asked to rate their level of agreement with each statement by using 4-point Likert scale (*with 1 = very little and 4 = very much*). The means of all items on learning agility ranged from 2.74 to 3.2 with standard deviation from .60 to .81. The reliability coefficient of learning agility obtained by Cronbach's alpha was .89, indicating suitable reliability.

Data analysis

The purposes of this study were to determine the factors of learner's learning agility and to examine relationship between learning agility factors in higher education context. In order to address those goals, techniques for data analysis were used descriptive statistics, exploratory factor analysis, confirmatory factor analysis, and t-test and ANOVA.

During the first phase of the analysis, the descriptive statistics and reliability of learning agility's items was identified. In the second phase, exploratory factor analysis was employed to identify the factors for learning agility of undergraduate students in higher education context. In the third phase, confirmatory factor analysis was employed to verify structural relationship on the factors of learning agility by driven exploratory factor analysis. In final phase, the t-test and one-way ANOVA were

employed to examine the learning agility's differences on participant's demographic information (i.e., level of learning agility, age, gender, grade, and types of college). To analyze the data, SPSS 27.0 and AMOS 18.0 were employed.

Result

Descriptive statistics for learning agility questionnaires

As a result of descriptive statistics for learning agility questionnaires (LAQ), there were identified to ensure their appropriateness as measurement items. The means of LAQ ranged from 2.73 (SD=.79) to 3.20(SD=.70). Skewness (<7) ranged from -.45 to .07, and kurtosis (<2) ranged from -.69 to .67, indicating that normality of LAQ was verified. Based on reliability coefficients, Cronbach's alpha for all items was .89, which ranged from .88 to .89, indicating suitable reliability.

Exploratory factor analysis for learning agility

Table 5 shows the result of exploratory factor analysis for learning agility. The data for exploratory factor analysis were screened by means of Kaiser-Meyer-Oklin(KMO) that was .900. Also, Bartlett's test of sphericity was to be significant, $\chi^2 = 7545.419$, $p < .01$. In short, the data of learning agility were adequate for the exploratory factor analysis.

The factors of learning agility were extracted 7 factors from 29 items, which explained 52.169 % of the total variance. For each item, the highest factor loading above .400 is indicated in bold.

The extracted 7 factors of learning agility were labeled as *challenging mind, learning responsibility, reflecting experience, intellectual curiosity, systemic thinking, change adaptability,* and *logical thinking. Challenging mind* loaded 8 items and explained 25.080% of the variance

with eigenvalue = 7.273 and factor loadings ranging from .461 to .655. *Challenging mind* factor included items such as "*I feel pleasure in struggling while challenging difficult problems (Q.27).*", "*I like the new things more than I do well (Q.24).*", "*I am practically applying new ideas to find the best solution for a given problem (Q.26)*", and Q.21, Q.25, Q22, Q23, Q. 20. Based on these items, *the challenging mind* refers to *the mental state of trying to solve problems and learn new ways, even if it is difficult.*

Learning responsibility loaded 4 items and explained 5.954% of the variance with eigenvalue = 1.727 and factor loadings ranging from .523 to .571. *Learning responsibility* included items such as "*I like to discuss with people who have different ideas with me (Q.5)*", "*When I learn something, I try to use the changes around me to get a positive effect (Q.4)*" and Q.14, Q.13. Based on these items, *the learning responsibility* refers *to a willingness to learn until the end without giving up even if it is difficult when learning.*

Reflecting experience loaded 4 items and explained 5.118% of the variance with eigenvalue = 1.484 and factor loadings ranging from .405 to .719. *Reflecting experience* included items such as "*I try to find failure factors after failing a task (Q.11)*", "*I try to find the success factors even after successfully completing a task (Q.10)*" and Q.09, Q12. Based on these items, *the reflecting experience* refers to *practical actions that learn by reflecting on successful and unsuccessful experiences.*

Intellectual curiosity loaded 4 items and explained 4.620% of the variance with eigenvalue = 1.340 and factor loadings ranging from .477 to .765. *Intellectual curiosity* included items such as *"I like to taste a variety of foods (Q.07)*", "*When I have a question, I ask others about it (Q.08)*", and Q.06, Q.15. Based on these items, *the intellectual curiosity* refers to *behavioral attitudes and activities that like diverse and new experiences and actively ask questions.*

Systemic thinking loaded 4 items and explained 3.947% of the variance with eigenvalue = 1.145 and factor loadings ranging from .511 to .619. *Systemic thinking* included items such as "*I think there is a close relationship between the subjects I study (Q.18)*". "*I accept without prejudice the new ideas or solutions that I find in the process of solving problems (Q.19)*", and Q.17, Q16. Based on these items, *the systemic thinking* refers to *the process*

of thinking while examining the overall relationship of related elements in problem solving or learning situations.

Change adaptability loaded 3 items and explained 3.883% of the variance with eigenvalue = 1.126 and factor loadings ranging from .508 to .739. *Change adaptability* included items such as "*I use new products or services even if they are not widely used by others (Q.02)*", "*I like the change of living environment (Q.03)*", and Q.01. Based on these items, *the change adaptability* refers to *an attitude that likes and positively accepts changes in new environments, objects, and people.*

Finally, *Logical thinking* loaded 2 items and explained 3.567% of the variance with eigenvalue = 1.034 and factor loadings ranging from .654 to .747. *Logical thinking* included items such as "*When people speak, I think about whether they are logical. (Q.28)*" and "*I think from various perspectives when I judge an argument (Q.29)*". Based on these items, *the logical thinking* refers to *the process of thinking in consideration of the causal relationship of related elements in problem solving or learning situations.*

Table 5. Factor loadings for learning agility items by exploratory factor analysis

	Component						
	01 Challenging mind	02 Learning responsibility	03 Reflecting experience	04 Intellectual curiosity	05 Systemic thinking	06 Change adaptability	07 Logical thinking
Q.27	**.655**	.113	.187	.042	.075	.128	.187
Q.24	**.640**	.062	.135	.133	.038	.199	-.071
Q.26	**.638**	.117	.234	.061	.200	.084	.087
Q.21	**.625**	.231	.045	-.076	.060	.159	.036
Q.25	**.607**	.033	.130	.208	.173	.028	.057
Q.22	**.570**	.452	-.030	.086	.036	-.070	.017
Q.23	**.536**	.205	.007	.284	.178	.000	-.030
Q.20	**.461**	.024	.145	-.133	.333	.342	.172
Q.05	.112	**.571**	.015	.056	.116	.156	.312
Q.04	.124	**.559**	.026	.167	-.087	.276	.008
Q.14	.254	**.549**	.195	.115	.127	.080	.094

Table 5. Factor loadings for learning agility items by exploratory factor analysis (continued)

	Component						
	01 Challenging mind	02 Learning responsibility	03 Reflecting experience	04 Intellectual curiosity	05 Systemic thinking	06 Change adaptability	07 Logical thinking
Q.13	.172	**.523**	.264	-.038	.063	.080	-.006
Q.11	.129	**.105**	.719	-.056	.239	.072	.016
Q.10	.202	**.138**	.645	.014	.052	.262	.059
Q.09	.264	**.046**	.531	.452	-.092	.059	.190
Q.12	.087	**.356**	.405	.088	.220	.112	-.140
Q.07	.122	**-.005**	-.054	.765	.086	.146	.021
Q.08	.172	**.094**	.462	.514	-.035	-.013	.147
Q.06	.106	**.284**	.025	.495	.229	.199	.111
Q.15	.030	**.378**	.118	.477	.392	-.084	.057
Q.18	.366	**.055**	.020	.058	.619	.000	.042
Q.19	.378	**-.129**	.050	.108	.596	.247	.062
Q.17	.112	**.293**	.380	.101	.553	.032	.110
Q.16	.026	**.367**	.288	.308	.511	-.085	-.006
Q.02	.073	**.086**	.146	.034	.094	.739	.072
Q.03	.195	**.160**	.133	.102	-.084	.696	-.128
Q.01	.183	**.300**	.021	.192	.132	.508	.201
Q.28	.005	**.038**	.183	-.003	.049	.098	.747
Q.29	.143	**.131**	-.080	.176	.054	-.050	.654
% of Variance	25.080	**5.954**	5.118	4.620	3.947	3.883	3.567
Cumulative %	25.080	**31.034**	36.152	40.772	44.720	48.603	52.169
Initial Eigenvalues	7.273	**1.727**	1.484	1.340	1.145	1.126	1.034
KMO	.900						
Bartlett's test	7545.419						
Sig.	.000						

Correlations analysis on the seven factors of learning agility

Table 6 shows correlations among the seven factors of learning agility. The seven factors of learning agility were found to be significantly correlated with all factors based on two-tailed test at $p<.01$. *Challenging mind* was found to be most highly

correlated with other factors, ranging from *r*=.234 to *r*=.556. On the contrary, *logical thinking* was found to be most lowly correlated with others factors ranging from *r*=.162 to *r*=.255.

Table 6. Pearson Correlations among Four Factors of smart media literacy

	01	02	03	04	05	06	07
01.Challenging mind	-						
02.Learning responsibility	.499**	-					
03.Reflecting experience	.484**	.452**	-				
04.Intellectual curiosity	.416**	.448**	.455**	-			
05.Systemic thinking	.556**	.421**	.486**	.480**	-		
06.Change adaptability	.430**	.426**	.383**	.299**	.301**	-	
07.Logical thinking	.234**	.253**	.196**	.255**	.223**	.162**	-

Factorial validity of learning agility: Confirmatory factor analysis (CFA)

Confirmatory factor analysis of a measurement instrument on learning agility questionnaires is to determine internal consistency of fully developed and the validated factorial structure in the EFA. Table 7 depicts multiple model fit indices for CFA model in first-order model and second-order model. In CFA model, the first-order model was used to examine the a priori proposed factor structure (Kline, 2005), and the second-order model is a more advanced CFA that is intended to identify the loadings of the first-order factors onto the second-order factors (Leem & Sung, 2019; Sung & Mayer, 2012).

As shown in the first raw in Table 7, first-order CFA model fit is significant based on χ^2 goodness-of-it test, χ^2 (327)=831.757, p=.000. This means that the CFA model is not good. χ^2 test is likely to reject the model because it is highly sensitive to the sample size (Kline 2005; Sung & Mayer, 212). Thus, CFA model fit should be confirmed multiple indices such as GFI, CFI, TLI, IFI, and RMSEA (Byrne, 2001;

Hu & Bentler, 1995). In reviewing these indices, they are consistent in their reflection of a good-fitting model: GFI=.945 (>.900), CFI=.929 (>.900), TLI=.912, (>.900), IFI=930 (>.900), and RMSEA=.039(<.080). Also, as shown second raw in Table 3, second-order CFA model fit that is more advanced CFA intended to identify the loadings of the predefined seven factors of learning agility had a good model fit on GFI, CFI, TLI, IFI, RMSEA except χ^2 goodness-of-it test: χ^2 (321) = 866.158, p=.000, GFI=.942 (>.900), CFI=.926 (>.900), TLI=.912, (>.900), IFI=927 (>.900), and RMSEA=.039(<.080).

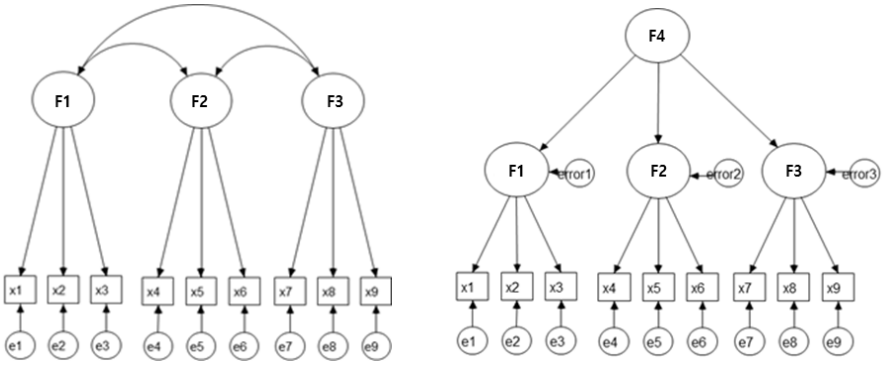

Figure 1. Concept model for first-order CFA(left) and second-order CFA(right)

Table 7. Model fit indices for first-order and second-order CFA model of learning agility

CFA	(df)	GFI	CFI	TLI	IFI	RMSEA
First-order factor model	831.757 (327), p=.000	.945	.929	.912	.930	.039
Second-order factor model	866.158 (321), p=.000	.942	.926	.912	.927	.039

Average Variance Extracted (AVE) and Composite Reliability (CR) of the seven factors of learning agility were analyzed to examine the validity of the factor structure identified by confirmatory factor analysis in more detail. As a result, the mean AVE

is 3.02, the range from .200 - .357 (>.50), the mean of CR is .608, the range from .330 - .772 (>.50). Thus, there were somewhat acceptable AVE values, and were acceptable CR values (Kline, 2011). Also, in general, discriminant validity is verified when the AVE values of both factors are greater than the square of the correlation coefficient. In this study, the range of the square of the correlation coefficient between the two factors was .025 - .302, and most of the AVE values were greater than .302, so discriminant validity was verified.

Moreover, as shown in Table 8, covariance of seven factors of learning agility onto second-order factor were explained by second-order factor loadings with regression as structural weights (Byrne, 2001; Sung & Mayer, 2012). Estimate of seven factors of learning agility on second-order factor ranged from .583 (as *systemic thinking)* to .875 (as *systemic thinking*), indicating appropriate loadings.

Table 8. Estimate of first-order factors on second-factors of learning agility

Factors	Estimate
01.Challenging mind	**.814**
02.Learning responsibility	**.870**
03.Reflecting experience	**.785**
04.Intellectual curiosity	**.789**
05.Systemic thinking	**.875**
06.Change adaptability	**.711**
07.Logical thinking	**.583**

Overall, those result means that learning agility's factors have internal consistence of structural factors in higher education students. To better understand how university students can become an agile learner, consider each of the seven factors that contribute to learning agility - *challenging mind, learning responsibility, reflecting experience, intellectual curiosity, systemic thinking, change adaptability,* and *logical thinking.*

Difference on learning agility with learner's characteristics

Table 9 shows results of the t-test and ANOVA on learning agility with learner's characteristics such as level of learning agility, gender, grade, and types of college. In level of learning agility, the high level group is students higher than the average score of learning agility (M=2.94, SD=.32), and the low level group is students lower than average score of the learning agility. There were significantly differences in level of learning agility at the levels p<.01, t=34.17 with t-test. High level learners (M=3.56, SD=.18) was higher scores of learning agility than general level learners (M=2.87, SD=.25). In gender with t-test, there was significantly differences in learning agility at the levels p<.01, t=3.658. Male learners (M=3.00, SD=.33) was higher scores of learning agility than female learners (M=2.92, SD=.32). In grade with ANOVA, there

Table 9. Result of t-test and ANOVA on learning agility

		N	Mean	Std. Deviation	T/F value	Post Hoc tests
Level of learning agility	High level	507	3.19	.19	37.77**	-
	General level	493	2.70	.22		
Gender	Male	499	3.00	.33	3.66**	-
	Female	501	2.92	.32		
Grade	1st	339	2.90	.32	6.06**	2, 3, 4 > 1
	2nd	321	2.96	.33		
	3rd	196	3.02	.32		
	4th	144	3.00	.33		
College	Liberal arts	123	2.96	.31	1.530	N.S.
	Social Science	207	2.97	.33		
	Education	87	2.95	.299		
	Engineering	206	2.93	.33		
	Natural Science	132	3.02	.37		
	Medicine	111	2.91	.30		
	Art & Physical	134	2.98	.31		

N.S. Not Significant, **: p<.01

was significantly differences in learning agility at the levels $p<.01$, $F=6.055$. As result of Post Hoc tests, 2nd (M=2.96, SD=.33), 3rd (M=3.02, SD=.32), and 4th (M=3.00, SD=.33) students were higher than 1st students (M=2.90, SD=.32). In types of college, there was statistically no significant differences in learning agility.

Discussion

The purpose of this study was to identify the factors of learning agility, which is regarded as the core competency of university students who must prepare for an uncertain future society, and to verify the characteristics of university students according to the factors of learning agility. Based on these results, some implications are discussed as follows.

Empirical contribution

Learning agility for university students was driven seven facets such as *challenging mind, learning responsibility, reflecting experience, intellectual curiosity, systemic thinking, change adaptability,* and *logical thinking*, and verified the structural relationships of factors of learning agility by first-second confirmatory factor analysis. Based on this, as a result of analyzing learning agility according to the characteristics of university students, the high-level students were significantly higher than the general-level students in terms of the level of learning agility, and the male students were significantly higher than the female students in terms of gender. The 2nd, 3rd, and 4th grade were higher than the 1st grade in terms of grade. However, there were no significant differences by types of college.

The results of this study confirmed that the normality and reliability of the items constituting learning agility were valid, and the factor structure model of learning agility was found to be suitable. Also, the factors with high estimate in learning agility were system thinking (.875), learning responsibility (.870), and challenging mind

(.814). In particular, significant differences were confirmed in all seven factors in the difference between the high level group, which is the top 10% of learning agility, and the general group. This can be said to be the empirical verification that the seven factors of learning agility are factors that can distinguish the high level group from the general level group.

The major empirical contribution of this study is identified the seven factors of learning agility of university students by applying systematic statistical research methods to extract and validate them that is not to react and adapt in changes of the future society, but to lead and facilitate the changes.

Theoretical contributions

The theoretical contribution in this study is to bring learning agility, discussed in the corporate context, to the context of university education, overcoming the ambiguity of the concept, and clarifying the concept of learning agility. In particular, it is very meaningful that the concept of learning agility that they should have for university students who will lead the future society is clearly defined based on empirical evidence. In this study, the concept of learning agility was identified as the seven factors (*challenging mind, learning responsibility, reflecting experience, intellectual curiosity, systemic thinking, change adaptability,* and *logical thinking*) that thinks, feels, and behaviors in terms of actual performance beyond understanding it as a human attribute.

Based on this, the definition of learning agility is presented as follows. Learning agility can be defined as *the ability to learn responsibly by reflecting on experiences and accepting changes through systematic and logical thinking based on intellectual curiosity and challenging mind in the changing environment and complex problem situations in the future*. In addition, the seven factors of learning agility can be classified into four dimensions. The first is the mind dimension. It is related to the learner's mind-set for the changing situation, and it is *the challenge mind* and *intellectual curiosity*. The second is the thinking dimension. In order for the Mind dimension to be transferred to practical actions, thinking that looks at

the whole from a macro point of view and a detailed analysis of a specific situation from a micro point of view are required. These include *systemic thinking* from a macro perspective and *logical thinking* from a micro perspective. Third is the action dimension. The mind and thinking dimensions can only have meaning when put into action. Because mind and thinking without practice are meaningless. The related characteristics can be called *change adaptability* and *reflecting experience*. The last is responsibility dimension. The ability to learn responsibly is required for the mind, thinking and action to continue and the performance of the action to be meaningfully derived. This is made possible by the responsibility to improve the quality of learning by continuously monitoring and giving feedback on the learning process and the results derived from the process. A characteristic related to this is *learning responsibility*.

These four dimensions of learning agility are similarly shown in the learning agility model presented by De Rue, Ashford, and Myers (2012). According to them, learning agility is divided into cognitive processes including cognitive simulations, counterfactual thinking, and pattern recognition and behavioral processes such as feedback seeking, experimentation, and reflection based on speed and flexibility. It was confirmed that *the mind* and *thinking* dimensions presented in this study correspond to cognitive processes, and *the action* and *responsibility* dimensions can be explained as behavioral processes.

Practical contributions

The practical contribution of this study is that the factors of university students' learning agility can be utilized from the perspective of diagnosis-teaching and learning-evaluation as follows.

First, it can be used as a measurement tool to discover core talents for university students to select students by diagnosing the characteristics of agile learners who will lead a changing society. Higher education needs to be approached from the perspective of learners' continuous growth potential. Learning agility is important for

present performance, but it must be developed so that it can continuously find new challenges in the future society, experience and reflect, enjoy growth, and improve the ability to produce practical results. To this end, the results of this research can be utilized in the process of selecting talented people with high future potential or in the process of discovering core talents from within.

Second, it can be used as a reference for teaching and learning design direction to develop learning agility to foster future core talent. The seven factors of learning agility proposed in this study can develop educational programs in four types, which are mind-setting strategy, thinking process, action strategy, and reflection and responsibility strategy. Mind setting strategy can be an educational program that induces, promotes, and maintains a challenging spirit and intellectual curiosity. The thinking process can be an educational program on the process and strategy of systematic thinking and logical thinking. An action strategy can be an educational program for strategies and know-how to establish and practice a series of strategic processes such as planning-execution-evaluation for carrying out actual learning. A reflection and responsibility strategy can be an educational program with the content of a strategy to monitor the learning process and provide feedback.

In order to have the effectiveness of such educational programs related to learning agility, an educational policy that provides various opportunities to develop learning agility according to the level of learning agility and the characteristics of the major should be prepared together.

Lastly, in the perspective of future talent development, it can be used as a measurement tool to measure educational performance on learning agility. Various educational efforts are being made at the university level to improve the capabilities of future talents to prepare for an uncertain future society. If so, it can be used as a performance measurement criterion to determine whether the educational effort to improve the competency of future talent is being created.

In particular, agility is not just a concept of speed, but a meaning of flexibility (Burke, 2018; De Rue et al., 2015; Kim, 2019; Im et al., 2017). Since learning is

included in the concept of agility of speed and flexibility, learning agility as a growth potential, it is necessary to continuously consider about how to develop this ability as a part of human resource development.

Limitations and future directions

The ultimate purpose of this study was to identify the factor characteristics of learning agility as a competency that uncertain future talent should have. In order for the results of this study to be more generalized and used universally, it is necessary to proceed with various follow-up studies.

To this end, first, it is necessary to check the predictive validity of whether learning agility factors and measurement tools actually predict the capabilities of future talents. Second, it is necessary to check the official validity of whether the learning agility factor and measurement tool are producing measurement results that are highly correlated with other similar testing tools. Finally, it is necessary to comprehensively analyze the learner's variables according to the measurement result of learning agility. For example, analysis of differences in the attributes or characteristics of learners according to learning agility (i.e., characteristics of learners according to the level of learning agility or type of learning agility, the relationship between individual characteristics and intelligence, etc.), or analysis of the relationship between learning ability and actual potential, performance ability, and problem-solving ability. Additionally, according to De Rue et al. (2012), in the learning agility model, the level of activation of learning agility of organizational members may be different depending on the context of the actual work experience and the context of the internal environment of the organization. Thus, when applying learning agility to higher education, it is necessary to take a different approach depending on the task and job according to the characteristics of college. In other words, it is necessary to empirically identify the basis for predicting the various behavioral and psychological characteristics of learners with a focus on learning agility.

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Appendix 1. Learning agility questionnaires for university students in higher education

	Items
(01)	I actively accept changes that occur in my surroundings when I study.
(02)	I use new products or services even if they are not widely used by others.
(03)	I like the change of living environment.
(04)	When I learn something, I try to use the changes around me to get a positive effect.
(05)	I like to discuss with people who have different ideas with me.
(06)	I like to learn something new or have a new experience.
(07)	I like to taste a variety of foods.
(08)	When I have a question, I ask others about it.
(09)	I am a curious person for a variety of things.
(10)	I try to find the success factors even after successfully completing a task.
(11)	I try to find failure factors after failing a task.
(12)	I get other people's feedback on what I did.
(13)	I cannot stop what I want to do if I get caught up in one thing.
(14)	I learn by myself when I need to learn something new.
(15)	I feel the need to learn something.
(16)	I associate my long-term goal with what I am learning.
(17)	I do what I have to do, no matter how hard I am.
(18)	I think there is a close relationship between the subjects I study.
(19)	I accept without prejudice the new ideas or solutions that I find in the process of solving problems.
(20)	I find unique ideas through counterfactual thinking (if I do).
(21)	I work in a different way from what I was doing.
(22)	I like to learn in the process of trying new ways, even if I do not succeed at solving problems.
(23)	I am willing to take risks if I'm interested.
(24)	I like the new things more than I do well.
(25)	I am looking for opportunities to learn something.
(26)	I am practically applying new ideas to find the best solution for a given problem.
(27)	I feel pleasure in struggling while challenging difficult problems.
(28)	When people speak, I think about whether they are logical.
(29)	I think from various perspectives when I judge an argument.