Latent Profile Analysis of the Graduate Characteristics in the Education 4.0 of Rajabhat University in Thailand

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Abstract: *This research aimed to analyze the Latent Group Profile, hereafter (LPA) of the graduate characteristics' in the Education 4.0. of 2,148 students. The research instrument was a set of 24 items questionnaire focusing on the graduate characteristics' in Education 4.0. The research findings indicated that the LPA had 3 models, and the numbers of the groups in each model were 2, 3 and 4, respectively. When considering the probability that the classification was the most accurate (E_k), it was the model with 3 groups (likelihood = -3883.156, AIC = 7794.312, BIC = 7873.718, ABIC = 7829.238, E_k = 0.816). The proportion of the students in the LPA group 1 was 243 (54.36%).The LPA group 2 was 1,167 (54.36%) and the LPA group 3 was 737 (34.33%). Overall of the 3 components were at the statistical significance at the level of .01 in every member in the LPA group that means every component can be used to characterize the graduates of Rajabhat University in the Education 4.0 in all profile groups. The forecast accuracy was at 81.60% and in each LPA group; the Corporate Social Responsibility (CSR) was the important indicator.*

Keywords: Latent Profile Analysis, indicators, exploratory analysis, confirmatory factor analysis, Graduate' characteristics in Education 4.0

1. Introduction

The modern world changes and is constantly developing, the state of society, politics, economics and technology have rapidly advanced under the effects of globalization which includes the influx of Western cultures. Changes as mentioned impacted every field of state domestic development. Hence each affected segment shall adjust according to the transformation. Thai educational system is ought to adapt in order to fulfill the government's 'Thailand Economy 4.0' policy. College institutions should promote the graduates' capacity rather than promoting the number of the graduates, train future markets' required skills rather than practicing them routine skills.The labors who want to enhance their potentiality in their work, they should focus on improving technology skills which the robots cannot replace. Education management at the college level should focus on changing the paradigm of creating the graduates as the copier and consumer to be the creators and producers. Therefore, the graduates or new workforces in the future should become the creative and productive persons, the labors with these qualities is needed in the present as well as the future society in order to lead them to the survivability and sustainment.(Siripong Bhiasiri, 2008)

Education 4.0 is the new era of education that satisfies newer generation's needs. Model of educational management will change in the way to create co-working environment on the internet by using the maximum capability of the system to connect physical and virtual environment together. Smart machines such as smart phones, tablets etc., and these devices help to search and learn from extensive cloud storage possible by using modern technologies that connect everything together. Self-learning can be possible, learning become creative, challenging and accumulating. Idea applications from knowledge lead to the creation of the useful product that is suitable for individuals themselves, as well as the society according to each specific case. Hence, learning in the 4.0 era should give importance in changing teaching methods from not just repetition but shift the emphasis into creating learning and adapting skills that allow for lifelong learning. Learners use technologies to self-learn, promoting confidence in presenting ideas, becoming wrong then trying to form creative works into concrete objects that will be beneficial for their communities as well as others. Educational skills, that emphasis on the creative processes of making products, will be able to step along and forward with the current world wisely.(Sunan Sripai and Paithoon Sinlarat, 2017)

College institutions that are units of creating the graduates should have the indicators of the graduate characteristics' in the future in order to move forward into the Education 4.0. However, from the studying of relevant documents, the researcher does not found clearly that who studies on the characteristic, component, and type of education. (Paithoon Sinlarat,2016)

Thus, to fulfill the government's policies together with the policies of the Ministry of Education,it requires educational system reformation guidelines in order to support the 'Thailand 4.0' policy. The Researcher has developed the indicators of the graduate characteristics' in the Education 4.0 of Rajabhat University students and found that there were 3 components, viz; Component 1- Cooperate Social Responsibility (CSR), Component 2 – produce the product creatively, Component 3 – the graduate in the Education 4.0 skills. Thus, the researcher is interested in what the LPA analyzing based on the graduate characteristics' in the Education 4.0 of Rajabaht University students classified by

the three components are. The results from the analysis will help obtain useful guidelines for the higher education institutions to produce the graduates to the changes of the world include helping them and the relevant organization get the important information as the guidelines to support and develop the graduates in the Education 4.0 which are impacted to the education management and the development of the country.

Indicators of the graduate characteristics' in the Education 4.0

The indicators in this research were developed by the researcher and employed mixing methodology in sequential equivalent design. The researcher conducted the qualitative research method first, and then followed by a quantitative research method. The method of the development composed of 4 steps, viz; Step 1: to create the variable of the graduate characteristics' in the Education 4.0; Step 2: to develop and adapt the indicators of the graduate characteristics' in the Education 4.0; Step 3: to apply an exploratory factor analysis; and Step 4: to check the consistency between the Education 4.0 of the graduate characteristics' indicators and the empirical data. The studied was found that there were 3 components and 24 indicators, viz; Component 1- CSR with 9 indicators. There were the graduates had public consciousness, morality and ethics, good human relationship, believed in human value, responsibility, cooperative skills, problem-solving ability, and participating in local development. Component 2- being the innovator with 7 indicators. There were the graduates had analytical thinking ability, able to produce product creatively, creative thinking skills, leadership, confident in their own ability, a consciousness of being an entrepreneur by creating a lot of work on less invested, and had the knowledge about global development as analyzed by critics. Component 3- graduate skills in the Education 4.0 with 8 indicators. The graduates could apply using the technology and innovation, using technology information skills, applying the knowledge to develop themselves, contribute motivation for their own and others, specialize in the field of study and integration of cross-disciplinary learning, professional skills, emotional management skills and communication skills.

Research Objective

To analyze the LPA of the graduate characteristics' in the Education 4.0 of Rajabhat University students

2. Research Methodology

Population and Sample

Population in this research was Rajabhat University students in Thailand. The samples were 2,148 Rajabhat University students which were selected by applying multi-stage sampling technique.

Table 1: The sample in the LPA analysis of the graduate characteristics' in the Education 4.0

S/N	Rajabhat University	Numbers of Samples (person)	%
1	Chaiyaphum	113	5.26
2	Nakhon Ratchasima	113	5.26
3	Roi Et	115	5.35
4	Maha Sarakam	100	4.66
5	Loei	96	4.47
6	Kanchanaburi	103	4.80
7	Phetchaburi	100	4.66
8	Jombueng	100	4.66
9	Nakhon Pathom	100	4.66
10	Ayuthaya	100	4.66
11	Suansunandha	98	4.56
12	Chaingmai	120	5.59
13	Piboonsongkram	89	4.14
14	Kampaeng Phet	100	4.66
15	Phetchabun	96	4.47
16	Nakhon Si Thammarat	100	4.67
17	Yala	104	4.80
18	Phuket	100	4.66
19	Songkhla	102	4.75
20	Udonthani	98	4.56
21	Lampang	101	4.70
Total		2,148	100.00

Research instrument

The instrument in this research was a set of 5-rating scale questionnaire focusing on the graduate characteristics' with 3 components and 24 indicators.

5 = the opinion on what the graduates in the Education 4.0 should have at the highest level.
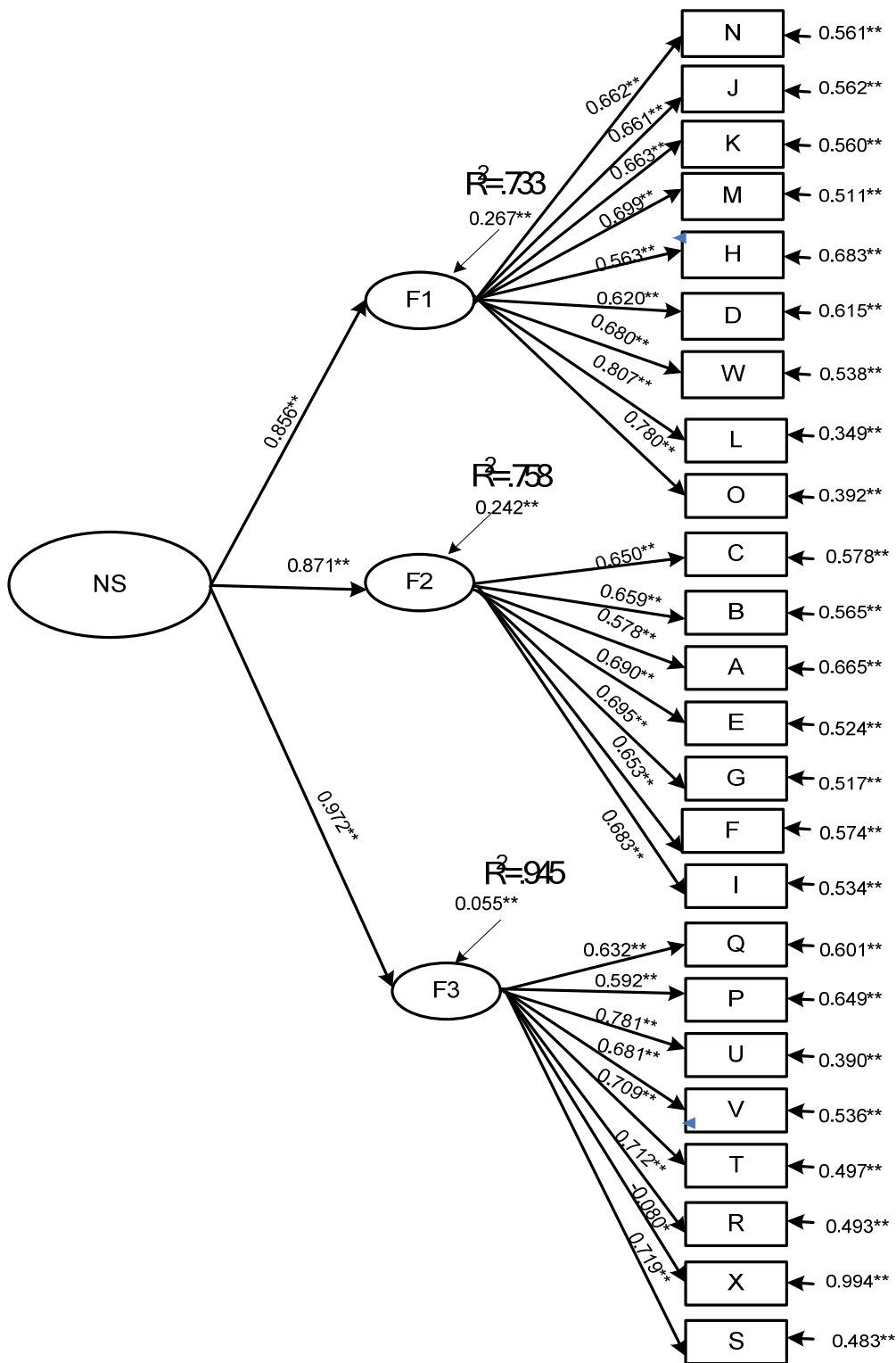4 = the opinion on what the graduates in the Education 4.0 should have at the high level.
3 = the opinion on what the graduates in the Education 4.0 should have at the medium level.
2 = the opinion on what the graduates in the Education 4.0 should have at the low level.
1 = the opinion on what the graduates in the Education 4.0 should have at the lowest level.

The research instrument was developed in the following stages:

1) The researcher employed the exploratory factor analysis, and got 3 components and 24 indicators with Eigen value and variance percentage as shown: Component 1 (4.520 and 18.832), Component 2 (4.041 and 16.836) and Component 3 (3.923 and 16.346). All 3 components can explain the variance of co-characteristic at 52.013%.

2) The researcher found out the discrepancy by employing item total correlation of the score in each item and total score of the rest questions with the Pearson Product Moment Correlation Formula and found that the discrimination was between .329-.688.

3) The researcher originated the reliability of the whole instrument using Alpha Coefficient of Cronbach, which was at .876.

4) Analysis of the construct validity of the questionnaires used the confirmatory factor analysis $\chi^2 = 150.688$, df=149, p-value = 0.4459, CF. = 1.000, TLI = 1.000, RMSEA = 0.033, SRMR = 0.017 and χ^2/df =1.011. (shown in figure 1)

Figure 1: Second order Confirmatory Factor Analysis of the graduate characteristics' in the Education 4.0

Approach

This research was the LPA of the graduate characteristics' in the Education 4.0. The characteristic of the observed variables were the continuous variables and latent variables were the categorical variables. The researcher conducted the research by using M-plus Version 7.2 with 5 phases as follows: (Suntonrapot Dhamrongpanich et al 2012; Muthen & Muthen, 2009).

Step1: the researcher developed the LPA model regarding the indicators of the graduate characteristics' in the Education 4.0 conducted by the researcher with 11 standards and 71 indicators.

Step 2: the researcher specified and determined the data.

Step 3: the researcher estimated the parameters of the model, and defined the number of profile group as 2, 3, 4,...,k which the program would analyze it based on the numbers of profile groups as the following steps:
3.1 Analyze the goodness of fit test of the LPA with the empirical data.
3.2 Estimate the probability of each observed variable in the sample and what it should be in each group.
3.3 Examine the pattern of variables or behaviors of samples in each cluster with the consistency of the probability in each pattern.
3.4 Find mean probability of class memberships.
3.5 Evaluate group differences and the number of the samples.

Step 4: The researcher compared the analysis from Step 3 regarding which model was the most appropriate and what the numbers of that group are by considering the goodness of fit test of the LPA model from the index AIC, BIC and ABIC. That was, if these statistics were small or close to zero, they represent the most appropriate model.

Step 5: The researcher presented the results of the analysis and interpretation.

3. Research Summery

The result of the LPA of the graduate characteristics' in the Education 4.0 of 22 Rajabhat University showed that it was because the analytical indicators were the continuous variables and the latent variables were the categorical variables; thus, the researcher studied the variables according to the indicators in Step 1. The result revealed that the component and indicators of the graduate characteristics' in the Education 4.0 of Rajabhat University had 3 components and 24 indicators. Component 1- CSR with 9 indicators; Component 2 – being innovators with 7 indicatorsand Component 3- graduate skills in the Education 4.0with 8 indicators to categorize the graduates in to groups according the components and indicators. The estimate of parameter of the LPA was shown in Table 2 and 3.

Table 2: Results of the LPA of the graduate characteristics' in the Education 4.0 of Rajabhat University

Number of groups	Log likelihood	Number of free parameter	AIC	BIC	ABIC	E_k	Member of each class
2	-4339.053	10	8698.106	8754.824	8723.053	0.745	1 = 1011 2 = 1136
3	-3883.156	14	7794.312	7873.718	7829.238	0.816	1 = 243 2 = 1167 3 = 737
4	-3737.934	18	7511.868	7613.960	7556.772	0.754	1 = 706 2 = 160 3 = 832 4 = 449

ABIC = sample-size adjust BIC, E_k = Entropy

From table 2, the result of the LPA revealed that there were 3 models of the graduate characteristics' in the Education 4.0 of Rajabhat University students. The numbers of the groups in each model were 2, 3, and 4 groups respectively. When considering the probability of the most accurate classification (E_k), it was the model with 3 groups(likelihood = -3883.156, AIC = 7794.312, BIC = 7873.718, ABIC = 7829.238, E_k= 0.816)

Table 3: The result of the coefficient of the LPA of the graduate characteristics' in the Education 4.0 of Rajabhat University students

Component	Class 1			Class 2			Class 3		
	Mean	S.E.	%	Mean	S.E.	%	Mean	S.E.	%
1.Social responsibility	3.226**	0.061	64.52	4.008**	0.025	80.16	4.581**	0.016	91.62
2.Produce the creative product	3.070**	0.041	61.40	3.585**	0.021	71.70	4.270**	0.026	85.40
3.The graduates' skills	3.016**	0.050	60.32	3.773**	0.025	75.46	4.467**	0.022	89.34
Count	243			1167			737		
Proportions	0.11318			0.54355			0.34327		
Proportions mean	0.850			0.933			0.914		

From table 3, it was found that the proportion of the students in LPA group 1, were 243 students and calculated at 11.32%. LPA group 2,were 1,167 students and calculated at 54.36%. LPA group 3, were 737 students and calculated at 34.33%. There was the significant difference level in each variable in all 3 groups at .01 levels. This has shown that all of the components could be used to represent the graduate characteristics' in the Education 4.0 of Rajabhat University students. The accuracy of the forecast was at 81.60%.

In the LPA group 1, when the mean of each variable was compared with the mean score probability of the group (0.850), it could classify the LPA depending on the indicators in one group. It was the group with significance lower than the mean score in every indicator. Component 1- CSR was at the highest mean score (3.226**) and the most significance indicator to be chosen into group 1. It was followed by Component 2- to produce the product creatively with the mean score (3.070**) and Component 3-the

graduates in the Education 4.0 skills with the mean score (3.016**), respectively.

In the LPA group 2, when the mean of each variable was compared with the mean score probability of the group (0.933), it could classify the LPA depending on the indicators in one group. It was the group with significance lower than the mean score in every indicator. Component 1-CSR was at the highest mean score (4.008**) and the most significance indicator to be chosen into group 2. It was followed by Component 3- the graduates in the Education 4.0 skills with the mean score (3.773**) and Component 2-to produce the product creatively with the mean score (3.585**), respectively.

In the LPA group 3, when the mean of each variable was compared with the mean score probability of the group (0.914), it could classify the LPA depending on the indicators in one group. It was the group with significance higher than the mean score which was Component 1- CSR and lower than the mean score which were Component 2- to produce the product creatively and Component 3- the graduates in the Education 4.0 skills.Component 1- CSR had the highest mean score (4.581**) and the most significance indicator to be chosen into group 3. It was followed by Component 3 - the graduates in the Education 4.0 skills with the mean score (4.467**) and Component 2 – to produce the product creatively with the mean score (4.270**), respectively.

Considering the mean score of all indicators in 3 LPA groups, it was found that the LPA group 3 was significantly higher than those in the LPA group 1 and group 2 in all indicators (The LPA group 1 had the mean score range from 60.32-64.52%, whereas LPA group 2 had the mean score range from 71.70-80.16%, and LPA group 3 had the mean score range from 85.40-91.62%). It meant all components could be used to classify the graduates based on the graduate characteristics' in the Education 4.0 of Rajabhat University students. The LPA group 1 was the group of 243 students and LPA group 2 was the group of 1,167 students and LPA group 3 was the group of 737 students. All 3 groups had CSR as the important indicator. This is shown in Figure 1.
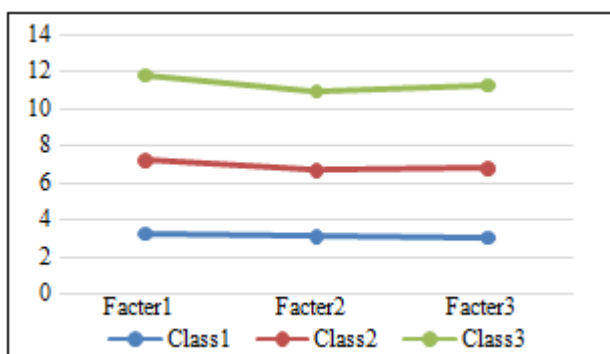

Figure 1: The LPA of the graduate characteristics' in the Education 4.0 of Rajabhat University students

4. Discussion

Results of the LPA of the graduate characteristics' in the Education 4.0 of Rajabhat University students according to 3

components; the component of CSR, the component of produce the product creatively and the component of the graduates in the Education 4.0 skills. The result revealed that the graduates could be divided into 3 groups: LPA group 1 was 243 students (11.32%), LPA group 2 was 1,167 students(54.36%), and LPA group 3 was 737 students(34.33%) and could be accurately forecast at 81.60%. When considering the mean score of every indicator of 3 groups, it was found that LPA group 3 had the mean score higher than LPA group 1 and LPA group 2 in every indicator (The LPA group 1 had the mean score range from 60.32-64.52%, LPA group 2 had the mean score range from 71.70- 80.16%, LPA group 3 had the mean score range from 85.40-91.62%). It meant the entire component could classify the graduate characteristics' in the Education 4.0 of Rajabhat University students clearly. Every group had CSR as the important indicator, this may be because the component of CSR are the characteristics that the students concern the society and nation, public consciousness, ethics, moral, self-responsibility, responsibility of family, social, environment no matter how the world changes and develops rapidly and continuously under the globalization include the influx of Western culture. But one thing that the graduates in every era should have is CSR as can be seen from Announcement of Sukhothai Thammathirat University on the desirable characteristics of the graduates in Bachelor's Degree, Master's Degree and Doctoral Degree (Sukhothai Thammathirat, 2012)which indicated that the desirable characteristic of the graduates is responsibility according to the National Education Act, BE 2542 (1999), Chapter 4 – National Educational Guidelines Section 28 paragraph 2 - The substance of the curricula, both academic and professional, shall aim at human development with desirable balance regarding knowledge, critical thinking, capability, virtue and social responsibility and it was corresponding to the vision for higher education development of Plan 9 (item 1) speculated clearly that "Higher education institutions produce the graduates with knowledge and morality, self-conscious in creating their own product, critical thinking skills, creative thinking skills, discipline, responsible in order to develop the country". It was consistent with the study of Krittaya Thanuwarapat (2012) who studied on preferable qualifications of the English for communication graduates, faculty of Social Sciences and Liberal Arts, North-Chiang Mai University. The studied showed that the preferable characteristics of the graduates for the workplace were moral, ethics and also with Watcharin Paengsri and Theera Ritthirod (2014) who studied on ideal Thai graduates characteristics according to Thailand Qualification Framework for Higher Education (TQF: Hed) of graduate students of Khonkaen University. The studied indicated that the most ideal characteristics' based on TQF of the students were moral and ethics which is corresponding to Pisacha Buakruen(2016) who studied on the development of performance criteria and indicators for the quality of graduates in autonomous universities.It was found thatthe important characteristics of Bachelor's Degree students in autonomous universities were moral, ethics and responsibility.And also consisted with Sunan Sripai (2017) who studied on the good teacher characteristics in the 21st Century in the Northeastern Region of Thailand. The studies revealed that the analysis of the LPA when considering the probability that the classification was the most accurate, it

was the model with 2 groups and all the standards could show the good teacher characteristics' in all LPA groups. The LPA group 1were 483 teachers, who were being a good role model for the learners and the LPA group 2 were 620 teachers, who believed in good values.

5. Suggestions for the Future Research

1) The LPA in this research found that all components and indicators could clearly categorize the graduates who had the characteristics in the Education 4.0 into 3 groups. Therefore, researchers and educators can use the process of the LPA as a guide to analyze latent characteristic of the variables in case there is no clear group classification before. The character of the observed variables must be the continuous variables.

2) The LPA had the social responsibility constituted the most important indicator of the members being classified in all three groups, so the researcher could adopt it as a criterion to classify the graduates.

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