

**Causal Model of Variables Affecting on
Creativity for Undergraduate Students at
Nakhon Ratchasima Rajabhat University
(NRRU)**

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ABSTRACT

This research aims to select variables affecting creativity and develop a causal model of the variables affecting creativity for Undergraduate Students at NRRU. The 760 students participated in this study. The instruments used were visual language and written language of Torrance Test and questionnaire on variables that influence creativity developed by the researchers. Confirmatory factor analysis, mean and standard deviation, Path analysis with LISREL program were used. The results show that administration, teaching, instructional climate, motivation, and personality variables affected the creativity of the undergraduates. After confirmatory factor analysis the results showed an acceptable goodness-of-fit. All factor loadings were over .30. The results of the CFA indicate that each construct was well represented by the items used for the measurements. The means of creativity and variables affecting creativity of undergraduates were at a medium and high level (between 2.98 to 3.05 and between 3.94 to 4.13), respectively. The goodness-of-fit of the causal model of the variables affecting the creativity of undergraduates which developed is in harmony with the empirical data as well. Considering the $\chi^2 = 125.28$, $df = 104$, $p\text{-value} = 0.07622$, $GFI = .98$, $AGFI = .97$ and $RMSEA = 0.016$ which is based on specified criteria.

Keywords: causal model, creativity, construct validity, goodness of fit

1. INTRODUCTION

The National Education Act of 1999 encourages the learning process by means of thinking practice and problem solving both of which contribute to creativity. The aim of the curriculum focuses on the creativity and thinking skills of the students.¹ The Education Development Plan (2002-2016) aims to develop Thailand into a moral society

in which learning and problem solving contributes to a creative society. Students should develop three core skills, including learning skills, life skills, information and technology skills, which are collectively known as the skills of the 21st century.² Systems thinking ‘promotes the understanding that business and human life are systems, where single components affect the other elements of the set. Too many people focus on “snapshots of isolated parts” and, in effect, do not see the forest for the trees. Systems thinking integrates all five disciplines into an organized structure.’³ The Higher Education Development Plan No. 11 (2012-2016) focuses on producing graduates of quality, with the potential to meet the needs of society, the ability to think critically, to communicate and work together with others with moral responsibility, and a healthy body and mind. This includes the development of teachers with expertise in teaching and research to ensure that graduates achieve the sustainability of the society.⁴

Creativity is the key to resolving or managing problems effectively. Many educators agree that the idea works very well. Creativity is the most important factor of all. Such new discoveries will benefit people’s livelihoods.⁵ A consortium led by psychologist Anderson⁶ shows that this leads to a new type of behavior. This is reflected in the 21st century with new verbs associated with Bloom's Taxonomy with which we are now all familiar. For example, changing verbs to describe different levels of behavior, and putting together different ideas or elements can lead to original ideas and more creative thinking.

Creativity can be promoted and developed, both directly and indirectly, but it cannot be forced. Everyone is creative in themselves and thus creativity can be developed in both children and adults. It does not require much thought, only a growth in nerve fibre. There are several factors that may be the main reason for the creative development of students, such as executive management, teaching, instructional climate, motivation, and personality.

Nakhon Ratchasima Rajabhat University is comprised of six faculties: the Faculty of Education, The Faculty of Humanities and Social Sciences, The Faculty of Industrial Technology, and The Faculty of Health Sciences. The students are both male and female and total of 20,615 people, aged between 18-25 years. The programme is for a period of 4 years, except for the Faculty of Education, where students must study for 5 years. Nakhon Ratchasima Rajabhat University has a policy about the quality of its graduates. Its vision is to be a leader in education, to train teachers and education personnel, and promote research into local development. Thus, the aim is to enhance the quality of people and society so that they have the potential to compete both nationally and internationally. Its mission is to produce graduates with knowledge and of sound morality. The creativity of students is an important feature that will strengthen the community in its work and benefit local development. The academic staff at the university play a primary role in teaching and research in line with the National Education Act BE 2542 and the policy of the university is to promote the creativity of the students. We therefore studied the causal model of the variables that influence the creativity of the undergraduates at Nakhon Ratchasima Rajabhat University. On this basis we intend to draw up a plan which will develop the creativity of the students and which may also be used as information to find solutions to the various problems experienced by students, administrators, faculty, families and society. Further collaboration with all those involved may be necessary.

2. THE PURPOSE OF RESEARCH

2.1 To select of variables affecting the creativity of undergraduates at Nakhon Ratchasima Rajabhat University.

2.2 To develop the causal model of the variables that influence the creativity of the undergraduates at Nakhon Ratchasima Rajabhat University.

3. MATERIALS AND METHODS

The study was conducted in two phases. The first phase was to investigate the variables affecting creativity through documentary analysis and by focusing on group discussions. The second phase was to develop a causal model of the variables affecting creativity

The Sample

In the first phase, nine experts from both inside and outside Nakhon Ratchasima Rajabhat University took part in a group discussion. All the experts met the following requirements: they were doctoral holders on curriculum and instruction, or curriculum research and development, or educational measurement and evaluation, or educational administration, or experienced in using creativity measurements, or have been teaching for at least one year at tertiary level. In the second phase, respondents were 760 regular undergraduate students selected by stratified random sampling by their faculty. Among the 760 respondents, there were 190 male (25%) and 570 female (75%). The respondents' age ranged from 18 to 23 years and the average age was 21 years.

Instrument

The instruments used in this study were a creativity test with a reliability of .914 and a questionnaire on variables affecting creativity with a reliability of .925, .949, .941, .899, and .925, such as executive administration, teaching, instructional climate, motivation and personality, respectively. In order to facilitate the collection of data, the researcher conducted creativity tests and distributed hard copies of a questionnaire to the students. The creativity test consisted of 4 dimensions, namely originality, fluency, flexibility, and elaboration. The questionnaires which included 66 items, were collected from 760 respondents through a self-designed five-point Likert scale (ranging from Strongly Agree-5 to Strongly Disagree-1). A reliability test was conducted to measure the consistency of the measuring instrument. The reliability of the measures was assessed with the use of Cronbach's Alpha. Cronbach's alpha reliability estimates are used to measure the internal consistency of the scales. As a general rule a coefficient greater than or equal to 0.70 is considered acceptable and is a good indicator of reliability.

Data Analysis

The data collected were refined and processed by SPSS 16.0 software. Several methods of analysis were used in this research to find out and test the impact of the variables affecting creativity. After assessing the reliability of the measurements by Cronbach Alpha and the coefficient, then removing unreliable variables, confirmatory factor analysis was used. This method is very useful in determining the construct

variables for the research as well as in finding the relationship between them. The researcher used confirmatory factor analysis for all 6 measurement models consisting of creativity, administration, teaching, instructional climate, motivation, and personality in order to investigate the construct validity of factors for each latent variable to establish the true factors in accordance with the theories of LISREL 8.80.

4. RESULTS AND DISCUSSION

4.1 Selection of variables affecting the creativity of undergraduates at Nakhon Ratchasima Rajabhat University

The variables affected the creativity of the undergraduate students at Nakhon Ratchasima Rajabhat University consisted of administration, teaching, instructional climate, motivation, and personality.

The teaching as the instructional activities of faculty influences the creativity of undergraduates at Nakhon Ratchasima Rajabhat University.⁷⁻¹³

Motivation is demand, dynamic pressure or the desire to struggle in order to achieve its objectives, which may be caused naturally or by learning it, which has three main components, including needs, drive, and satisfaction which influence the creativity of undergraduates at Nakhon Ratchasima Rajabhat University.¹¹⁻¹⁶

Personality is perceived themselves both the physical characteristics and mental characteristics, which has three main components, namely a sense of freedom in their own, self trust, and self esteem influence the creativity of undergraduates at Nakhon Ratchasima Rajabhat University.^{12,14-16}

The instructional climate as the feeling on the environment while learning, which has three main components, namely the support of faculty, acceptance of faculty, and the participation of students influence the creativity of undergraduates at Nakhon Ratchasima Rajabhat University.^{8,10,12,14}

Administration is another variable influencing the creativity of undergraduates at Nakhon Ratchasima Rajabhat University. This is probably due to the scholars might think that the administration is encourages, support, facilities, directing all activities of the university by the university executive committee. Focus group participants agreed that the composition of the three components, including policy, mission, and identity. The administration can contribute creative development of students.

4.2 Development a causal model of the variables affecting the creativity of undergraduates at Nakhon Ratchasima Rajabhat University

2.1 Investigation the construct validity of creativity and variables affecting the creativity of undergraduates at Nakhon Ratchasima Rajabhat University

Creativity consisted of originality, fluency, flexibility, and elaboration. All factor loadings were over 0.30. After confirmatory factor analysis on creativity, the full structural models of creativity indicated fit to the data. ($\chi^2 = 0.51$, $df=1$, $p\text{-value}=0.47497$, $GFI=0.99$, $AGFI=0.96$, $RMSEA= 0.000$). This shows that creativity measured by the creativity test is in accordance with the empirical data. This is probably due to creativity as a response to an event or issue more far-reaching, multi-directional valuable ideas adapted flavored blend of original ideas to be something exotic and helpful. Scholars and researchers are of the opinion that creativity of undergraduates at

Nakhon Ratchasima Rajabhat University consists of four variables such as originality, fluency, flexibility, and elaboration.¹⁷⁻²¹

Administration consists of policy, mission, and identity. All factor loadings were over 0.30. After confirmatory factor analysis on creativity, the full structural models of administration indicated fit to the data. ($\chi^2 = 0.00$, $df = 0$, $p\text{-value} = 1.00000$, $GFI = 0.95$, $AGFI = 0.93$, $RMSEA = 0.000$) This shows that administration measured by the policy, mission, and identity is in accordance with the empirical data. It means that the model is confirmation of the components of the administration are in harmony with the empirical data.

Teaching consists of objectives, content, activity, and evaluation components. All factor loadings were over 0.30. After confirmatory factor analysis on creativity, the full structural models of teaching indicated fit to the data. ($\chi^2 = 5.49$, $df = 2$, $p\text{-value} = 0.06441$, $GFI = 0.96$, $AGFI = 0.93$, $RMSEA = 0.048$) This means that the model is confirmation of the components of teaching are in harmony with the empirical data.

Instructional climate consisted of support, acceptance and participation. All factor loadings were over 0.30. After confirmatory factor analysis on creativity, the full structural models of instructional climate indicated fit to the data. ($\chi^2 = 0.00$, $df = 0$, $p\text{-value} = 1.00000$, $GFI = 0.99$, $AGFI = 0.97$, $RMSEA = 0.000$). This shows that the model of the components confirm instructional climate in harmony with the empirical data.

Motivation consists of needs, drives, and satisfaction. All factor loadings were over 0.30. After confirmatory factor analysis on creativity, the full structural models of motivation indicated fit to the data. ($\chi^2 = 0.00$, $df = 0$, $p\text{-value} = 1.00000$, $GFI = 0.98$, $AGFI = 0.94$, $RMSEA = 0.000$). This means that the model is confirmed components of motivation in harmony with the empirical data.

Personality consists of freedom, trust, and self-esteem. All factor loadings were over 0.30. After confirmatory factor analysis on creativity, the full structural models of personality indicated fit to the data. ($\chi^2 = 0.00$, $df = 0$, $p\text{-value} = 1.00000$, $GFI = 0.97$, $AGFI = 0.95$, $RMSEA = 0.000$). This means that the model is confirmed components of personality in harmony with the empirical data.

The results of the CFA indicate that each construct was well represented by the items used for the measurements.

2.2 Means of creativity and variables affecting creativity of undergraduates at Nakhon Rachasima Rajabhat University

Means of creativity of undergraduates at Nakhon Rachasima Rajabhat University is provided in Table 1

Table 1 Descriptive statistics for measured creativity

Creativity	\bar{X}	SD	แปลความ
Originality	2.97	1.37	Moderate
Fluency	2.99	1.37	Moderate
Flexibility	3.03	1.42	Moderate

Elaboration	3.05	1.41	Moderate
Overall	3.01	1.19	Moderate

Table 1 presents the mean of creativity of undergraduate students at Nakhon Ratchasim Rajabhat University were at a medium level (between 2.98 to 3.05). Considering each components found that is moderate on all sides. In descending order was elaboration, flexibility, originality, and fluently, respectively. Although expectation of teacher professional organization which acknowledging that teacher professional is a crucial career for developing the people and wish the high potential manpower to occupy this work. This is probably due to Nakhon Ratchasima Rajabhat University is the institute for local development in the Northeast, with the number of students is paramount covering an area of 20 provinces, provides the opportunity for everyone to be educated equally. Policy on creating educational opportunities and the mission of the university is to produce graduates and promote lifelong learning to ensure educated people and create a knowledge society. The policy creates educational opportunities for local residents thoroughly, product manpower to meet local demand and the country, emphasize on the context advantage of space and university expertise with regard to the quality and standards of higher education including promote lifelong learning in the community. Providing learning courses, training and technical services to the community constantly. Enhancing the learning process of students in the community with information technology hence student consists of individuals who are multi capacity and creativity as a whole, it is moderately above.

Means of variables affecting the creativity of undergraduates at Nakhon Rachasima Rajabhat University are provided in Table 2

Table 2 Descriptive statistics for measured variables affecting the creativity

variables affecting the creativity	\bar{X}	SD	Descriptive Rating
Administration	3.94	.50	High
Teaching	4.05	.50	High
Instructional climate	4.13	.55	High
Motivation	4.08	.50	High
personality	4.13	.52	High
รวม	4.07	.45	High

Table 2 presents the mean of variables affecting the creativity of undergraduate students at Nakhon Ratchasim Rajabhat University were at a high level (between 3.94 to 4.13). Considering each variable was at a high level. in descending order is a personality, instructional climate, motivation, teaching, and administration, respectively. This is probably due to these variables can be creative development of students as Kawkwangwan²² says, personality referring to the unique of individuals in various dimensions both the external and internal parts which are molded by a combination of genetic, culture, learning, adjustment, and environment. These variables can not be separated but they have relationship and affecting to each other. Tawornwet²³

states that a person's personality consists of four factors: physical personality, emotional and psychological personality, social personality, intellectual personality. Hilgard²⁴ says that the personality is a collective expression of individual and traits of behavior. This suggests the individual adapt to the environment. Including that contribute to interactions with others as feeling self-esteem, motivation, to react to emotions and habits accumulated life experiences. Zimbardo and Ruch²⁵ explains that personality is the sum of the psychological characteristics of each person. Affects the expression of a person's behavior. Both of which are easily observed characteristics and behaviors within the observation difficult. These diverse characteristics result in personal expression in different situations and moments.

2.3 Investigation of the goodness-of-fit of the causal model of the variables affecting the creativity of undergraduates at Nakhon Ratchasima Rajabhat University

The results of the correlations among the variables were statistically significant (see Table 3), but there were not any intercorrelations than .85 in predicted variables. The highest intercorrelation between the variables in the data set was between creativity and variables affecting creativity ($r = .788$, $p < .001$). Kline (2011) advised that certain mathematical operations are not possible when intercorrelations among variables are too high (e.g., $> .85$)

Table 3 Correlation among latent variables

Variables	1	2	3	4	5	6
1. Administration	1.00					
2. Teaching	0.757**	1.00				
3. Instructional climate	0.655**	0.788**	1.00			
4. Motivation	0.672**	0.737**	0.748**	1.00		
5. Personality	0.582**	0.641**	0.625**	0.715**	1.00	
6. Creativity	0.006	0.073*	0.086*	0.031	0.075*	1.00

* $P < .05$, ** $P < .01$

Table 3 shows that descriptive statistics by Pearson product-moment correlation, this study probes into correlation among latent variables. Only administration and personality do not have significant correlation with creativity. ($r = 0.006$, 0.031 , $p > .05$). Therefore, administration and personality variables have significant and positive correlation is not supported. The other variables show significant and positive correlation.

The results of investigation of the goodness-of-fit of the causal model of the variables affecting the creativity of undergraduates at Nakhon Ratchasima Rajabhat University by using structure equation modeling (SEM) are shown in Table 4

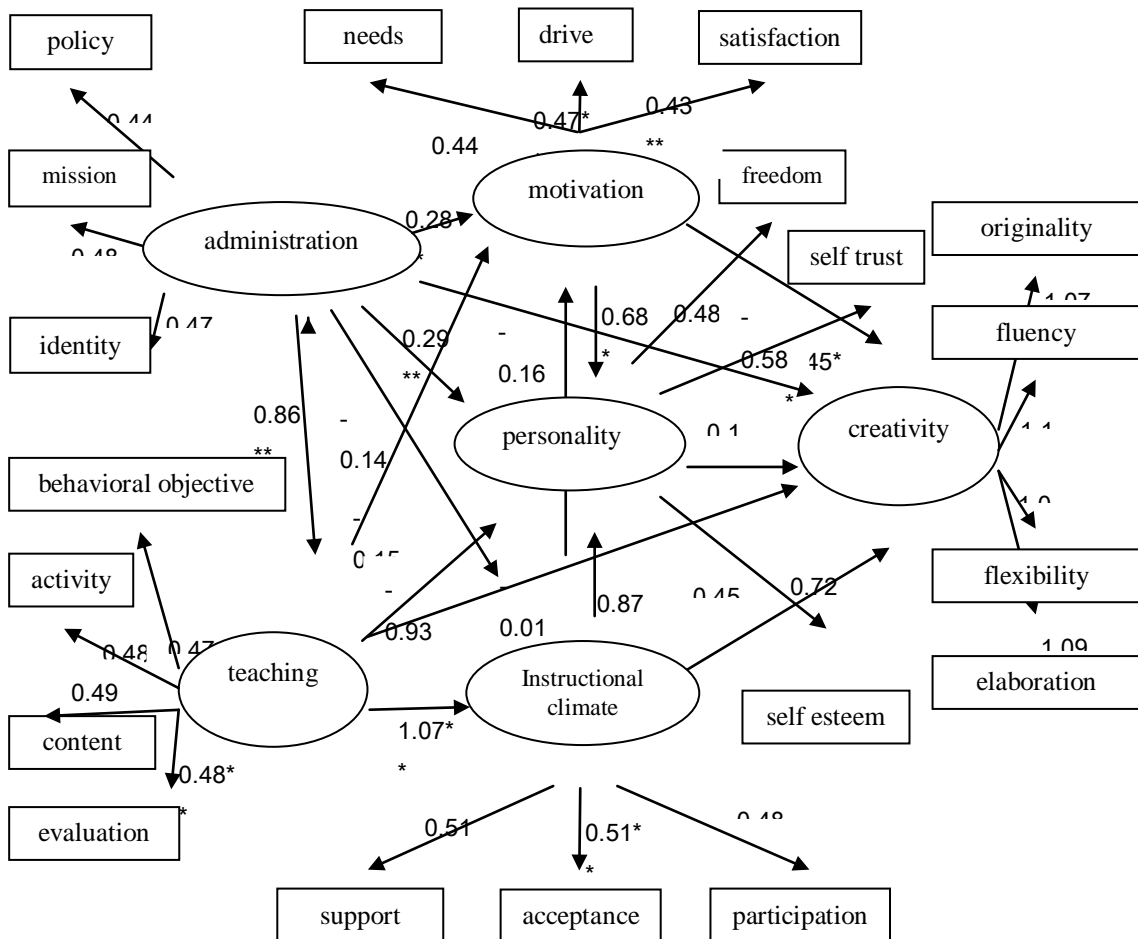
Table 4 The goodness-of-fit index and predictive correlation of causal model of variables affecting the creativity of undergraduate students at Nakhon Ratchasima Rajabhat University

Goodness-of-fit index	Criteria	Statistics	Decision
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χ^2	$P > .05$	0.076	Passed
χ^2/df	≤ 2.00	1.20462	Passed
GFI	≥ 0.90	0.98	Passed
AGFI	≥ 0.90	0.97	Passed
RMR	< 0.80	0.013	Passed
RMSEA	< 0.80	0.016	Passed

Table 4 shows that the causal model of variables affecting the creativity of undergraduate students at Nakhon Ratchasima Rajabhat University which researcher developed fits of to empirical data based on all criteria.

The results of direct, indirect, and total influences of variables affecting the creativity of undergraduate students at Nakhon Ratchasima Rajabhat University by path analysis are shown in Figure 1



* $P < .05$, $\chi^2 = 125.28$, $df = 104$, $p\text{-value} = 0.07622$, $GFI = 0.98$, $AGFI = 0.97$, $RMSEA = 0.016$

Figure 1 Magnitude of direct, indirect, and total influences of variables affecting the creativity of undergraduate students at Nakhon

Ratchasima Rajabhat University

Investigation of the goodness-of-fit of the causal model of the variables affecting the creativity of undergraduates at Nakhon Ratchasima Rajabhat University which developed with empirical data that are in harmony with the empirical data as well. Considering the $\chi^2 = 125.28$, $df = 104$, $p\text{-value} = 0.07622$, $GFI = .98$, $AGFI = .97$ and $RMSEA = 0.016$ which is based on specified criteria. The paths are statistically significant totaled six directions below.

The paths influence from the administration to instructional factors have equal influence 0.86 This is probably due to school administrators in the management of the Ministry of Education to focus on improving the quality of education and create educational opportunities for the people of Thailand, lifelong learning, and responding to the developing countries has made the Education Development Plan of the Ministry of Education. Eleventh Edition 2012-2016. To serve as a framework for action to enhance the quality and international standards. Enhancing educational opportunities for the public to thoroughly study equitable development management system based on good governance and promoting the participation of all sectors. To achieve the vision, objectives and development goals defined. The Ministry of Education has set a strategic one. Raise the quality and standard of education, faculty, staff, students, teachers and schools. It aims to develop the quality of education at all levels so that all students receive a quality education and have higher academic achievement. Can self-study and can live happily in society.

Paths influence from the administration to the motivation factor have equal 0.28 This is probably due to management policies to create incentives to teachers. By promoting faculty and faculty development for teachers and educational personnel have the professional standards of performance. Including the development of education at all levels and types of high quality and standards have been approved by the Office for National Education Standards and Quality Assessment (ONESQA.). Which provides strategic and operational guidance for its quality and standard classes, quality and standard of education, teachers, faculty and staff.

Paths from the administration to personality factors have equal 0.29. This is probably due to management policies to develop in students the creative personality by personality development activity is ongoing every year promotion of virtue ethics and citizenship in the education system by a) Create a learning process for the students to cultivate moral values and pride in the Thailand, public mind philosophy of sufficient economy, b) integrate a variety of learning as the academic, life skills, art, music, culture, religion and Thailand actualization. c) Development of learning process and providing practical activities due to develop citizenship, cultivate discipline, strengthen unity, and adherence to the democratic regime of King as head d) create a network of cooperation between families, religious, educational institutions, in cultivating and developing ethics to students at all levels / types of education.

Path of motivation influences personality factors equal 0.68. This is probably due to motivation is a powerful mechanism to stimulate the body to action with a direction. Consistent with the concept of Woolfolk²⁶ viewed the motivation is an internal condition of the person that the behavior being urged to act at the direction and continuity. Motivation is a condition of increasing behavior, actions or activities of individuals by willful behavior to achieve the desired goal, however, the findings may

not be consistent with the study of Tohgani, Siripan, and Tongkoop²⁷ study of intrinsic motivation for learning and personality of nurse students professional in the three southern border provinces. The study found that intrinsic motivation for learning and the personality are positively correlated fairly low level of statistical significance at .05. Suggestions from the research was nursing course in the three southern border provinces should be encouraged to have intrinsic motivation for learning. Especially to support the challenge learning activity in the nursing profession and should be promoted personality on gentleness, faithfulness to duty including the development of emotional stability continually to be a further desirable graduate student.

Path from the instructional climate to the motivation factor influences of .85. This is possibly due to the climate in the classroom that allows students to learn about their interests and aptitudes can be an opportunity to practice, self-control. If teachers have a good attitude and a sincere to students would affect the students respect the teachers, too. It can be seen that the characteristics of teachers, whether beliefs, values, philosophy, ideals of different teachers will influence and affect the students different. Kreasuwan²⁸ studied the relationship between the incentive to work, organization climate, and organization justice case study: Rural Road (central) Ministry of Transport. The study found that the overall relationship of incentive to work and organization climate, organizational climate and organization justices, and incentive to work and organization justices have a positive relationship statistical significance at .01.

Path from teaching to the instructional climate factor influences of 1.07. This is probably because of this psychological processes that enhance the learning of students to effectively promote the learning of teachers that help students express themselves through appropriate behavior. They can communicate their needs, feelings effectively. This will create a positive impact on the classroom climate.²⁹ Attitude and behavior of teachers must show awareness of their responsibilities towards the students on respect, honor and interests of learners sincerely, trust for each other. Good climate in class is to facilitate and promote effective learning and personality development of students. To see what the instructor is the beginning of a good climate in the class, so the instructor successful in teaching is to succeed in creating a good climate in the classroom.

5. CONCLUSIONS

The administration, teaching, instructional climate, motivation, and personality variables affected the creativity of the undergraduates. After confirmatory factor analysis on these variables the results showed an acceptable goodness-of-fit. All factor loadings were over .30. The results of the CFA indicate that each construct was well represented by the items used for the measurements. The means of creativity of undergraduate students at Nakhon Ratchasim Rajabhat University were at a medium level. The means of variables affecting creativity of undergraduates were at a high level. The investigation of the goodness-of-fit of the causal model of the variables affecting the creativity of undergraduates which developed with empirical data that are in harmony with the empirical data as well.

6. SUGGESTIONS

6.1 The variables affecting creativity of the NRRU's undergraduates consisted of teaching, motivation, personality, and atmosphere of learning and teaching. Hence, the end users of this research should be taken into consideration regarding these variables directly or indirectly influencing creativity of the students.

6.2 The institution administration should play key roles in determining and contributing policy, promote, support, assist or facilitate to push forward the variables in which leading to the development of students' creativity apart from teaching, motivation, personality, and learning and teaching atmosphere.

6.3 The end users of this research should know an overview of the students' creativity levels as to understand the nature of the NRRU's undergraduates. Besides, the university should conduct personality development activity particularly the personality which promotes creativity. To avoid the duplication of conducting activities as well as to high yield efficiency on budgeting, the cooperation within the faculty of conducting personality development activity should be made.

6.4 A causal model of variables affecting creativity of the NRRU's undergraduates consisted of five variables which were the cause of creativity. According to the goodness-of-fit index of model, the alternative model was well harmonized to the empirical data.

6.4.1 If the executive committees of the university give support by determining vision, valuing creativity as significance, supporting and providing fund for training as well as providing equipment for the lecturers to further their knowledge to produce their works. In addition, the executive committee should be giving moral to the lecturers for their workings, follow up their work tasks, prompting the lecturers to pay attention, conducting various activities, stimulating students for learning, and giving suggestions when confronting problems.

6.4.2 The executive committee of the university must understand about what are the motivations that can promote students' creativity.

6.4.3 If the executive committee has policy of personality development particularly the creativity of the students, it will raise students' self-awareness what characteristics they should have in order to develop their creativity.

6.4.4 A person who has goals in lives and works or those who has expectation of achievement must be a person with motivation in lives and works. A thought from expectation brings about the motivation which determines the behavior to achieve what ones' expected and desired. This can cause an ample power to push up ones to do something with their most capability to achieve the expectation. Having goals setting can encourage people to be achieved which can be the cause of enthusiasm and their lives are full of challenge, and energetic. The external personality indicates the thought and internal behavior as well.

6.4.5 The students should be supported, assisted, and suggested to conduct activities relied on their interests. They should be admired their success regarding the creativity development. Besides, students should be taken part in participating for activity planning, evaluating the work tasks and improving their outputs regarding the creativity development as to being variables of motivation to develop creativity.

6.4.6 Lecturer is a key person who; conducts the classrooms' atmosphere to facilitate the learning activity; constructs attention and faith for learning. Besides, having a classroom with cleanliness, bright, appropriate in sizes, and lively decoration could also be another factor which influencing the learners want to come to classes and are willing to participate in a teaching and learning.

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