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Creativity: Promotion of the Creative Process; Innovative and Collaborative 21st Century Learning

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Abstract

21st century learning requires the world of education to produce graduates who have creativity, who encourage creative and collaborative processes in solving problems. The purpose of this study was to obtain dimensional data and indicators of creativity skills in students, teachers and school principals. This research method is Mixed Method, with Exploratory Sequential Design model. The conclusions of this study are: (1) The number and names of the dimensions remain the same, namely there are 5 (five) with 21 (twenty one) indicators. (2) There is a change in the number and name of the indicator. The number of indicators for each dimension are: (a) Dimensions of creative thinking ability, there are 4 (four) indicators; (b) Dimensions of working creatively with other people have 3 (three) indicators; (c) There are 6 (six) indicators to interpret a failure; (d) Dimensions of implementing idea innovation into innovation for success, there are 5 (five) indicators; (e) Dimensions of thinking outside the habit there are 3 indicators. Suggestion: Research can be followed up by using dimensions and indicators of 21st century learning creativity skills in students and teachers, with various sample characteristics. The results of the assessment can be used to measure the level of existing creativity skills.

Keywords
creativity; creative of the process; innovative; collaborative; 21st century learning

I. Introduction

21st century learning demands the growth of creative skills for all components of education. The world of education is encouraged to produce graduates with the creative and problem-solving skills needed in the 21st century, (Coate & Boulos , 2012, p. 129; Watson, 2018). Successful learning, is an individual who is confident, responsible, open to new thoughts and ideas, and applies critical thinking in new contexts. (Education Scotland, 2013). The creative process is at the core of innovation. The creative process generates thinking that allows students to apply imagination to generate ideas, questions, hypotheses, experiment with alternatives and evaluate their own and their colleagues' ideas, as well as the final product and process., (Kaufman and Beghetto, 2009, p. 6; Kampylis and Berki, 2014, p. 6).

Teachers need to encourage students to explore their own creative processes and develop a broader understanding of creativity. The need for understanding for teachers related to the journey of the creative process. Learners are involved in risk taking, exploration and choice, work collaboratively and receive feedback, and encourage them to approach their professional practice more creatively, (Watson, 2018).

Teachers need to conduct action research and reflection on their own classroom practice, and conducive classroom interactions using ICT and assessment (Davies, at al, 2013; Watson, 2018; Loveless, 2015, p. 130). Need to be prepared from the start, availability of resources/materials, flexibility in the physical and pedagogical environment, effective and flexible use of time, students have control over their learning and ownership of their activities, varied physical environment in the school and allow students to work at speed on their own without pressure, and accommodate the direction students might want to take a project (Davies, at al, 2013). All students have the potential to be creative if they are provided with innovative learning experiences and open-ended assessment assignments. Observation results obtained findings, that students are more motivated and engaged when they have access to alternative, creative assessment opportunities that involve experimentation and risk taking in a supportive learning environment.

Teachers need to develop an understanding of what creativity means, in order to emphasize learning with a more interactive and interesting approach, more attention is paid to the development of students' creativity, (Biggs & Tang, 2007; Nygaard, Courtney & Holtham, 2010). The need for teachers to have the ability to act spontaneously regarding this creative learning model (Jeffrey, 2004). This encourages teachers' skills to create learning with various problem-based learning models, such as problem based learning (PBL), Project Based Learning (PjBL), Inquiry, discovery learning, etc.

Project Based Learning (PBL) is an innovative approach to learning that teaches multiple strategies. Students are encouraged to learn on their own through inquiry, as well as work collaboratively to research and create projects that reflect their knowledge, to advanced problem solving (Bell, S, 2010). collaboration.

II. Review of Literature

The results resarch suggest that students' creativity is closely linked to opportunities to work collaboratively with their peers, which can productively extend to peer and self-assessment. Creative learning environments in students can increase self-confidence and resilience, increase motivation and engagement, develop social, emotional and thinking skills, and increase school attendance rates, (Davies, at al, 2013). Scager, et al., (2016), conveyed the results of their research that the factors that generate effective collaboration are student autonomy and self-regulating behavior, combined with challenging, open, and complex group assignments that require students to create something new and original. Students value their achievements, their learning process, and the products they do more than their grades (Watson, 2018). The results showed that the creativity skills acquired by students influenced their self-perceptions of creativity, they transferred their creative skills into their team work, leading to a positive impact on the perception of team support for innovation, (Gundry, Ofstein, & Kickul, 2014). This is based on the fact that the results of creative activities will be optimal if they are carried out collaboratively, based on problems.

The creative process will describe how students process various information and experiences to be constructed into a product or project. Creative work will strengthen critical thinking (CT) in students, (Jansen, at al, 2012). Based on the research results, teachers' understanding is still lacking about CT and how they can teach it, Li, L. (2016). (Pascarella, Blaich, Martin, & Hanson, 2011; Abrami et al., 2008, Choy & Cheah, 2009; Stedman & Adams, 2012). Teachers must have a positive attitude towards their teaching (Klassen & Tze, 2014; Van Aalderen-Smeets & Walma van der Molen, 2013).

State of the Art

According to Sitorus (2020) creativity is a very important thing for children, through a pleasant atmosphere the child. Research related to creativity is urgently needed, based on several things as follows: first, creativity activities produce creative work, think creatively and critically, produce intellectual discipline processes that actively and skillfully conceptualize, apply, analyze, synthesize, and/or evaluate the information collected from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to beliefs and actions, (Watson, 2018). Creativity skills enable students to discover new ideas and opportunities that contribute to innovation. Gundry, Ofstein, & Kickul (2014).

Second, creativity encourages teamwork. Creativity skills strengthen self-perceptions which encourage them to transfer their skills to team work. The pedagogical approach effectively stimulates and strengthens students' ability to fully participate in their work teams, Gundry, Ofstein, & Kickul, (2014). Collaborative work encourages the implementation of the creative process, to produce creative products/projects.

Third, creativity has been shown to be an integral part of a wide range of skills, including scientific thinking, entrepreneurship, design thinking, and mathematics. The results of the study reinforce that creativity is referred to as the most important leadership quality to meet the challenges of increasing complexity and uncertainty in the world, (Education Scotland, 2013) (Craft, 2005; Cunningham, 2005).

III. Research Methods

This study uses a Mixed Method approach. The model approach used is Exploratory Sequential Design. This research model is characterized by qualitative data collection and analysis in the first stage, followed by quantitative data collection and analysis in the second stage. The aim is to strengthen the research results.

Data retrieval and processing techniques:

1. In the first stage, data were obtained from theoretical studies related to creativity skills from various literatures, experiences and future needs. Qualitative data to produce dimensions and indicators of creativity skills, obtained with a literature review approach,
2. The second stage: the data obtained are validated by experts and practitioners in the FGD forum.
3. The third stage is compiling a questionnaire that has been validated, and distributed to 198 teachers both in Lampung and Central Java.
4. The fourth stage: questionnaire data obtained in rotation through Explanatory Factor Analysis (EFA). The results were tested for construct validity through the Confirmatory Factor Analysis (CFA) test.

The aim is to test whether the indicators are valid as a measure of latent constructs, from "21st Century Learning Creativity Skills".

IV. Discussion

The purpose of this study was to validate the creativity Skills instrument. This research is part of a larger study on the 4 Characteristics of learning skills for the 21st century including creativity. Respondents consisted of 198 teachers at SD/MI, SMP/MTs, SMA/MA, and SMK in the provinces of Central Java and Lampung.

The distribution of the data is as follows: the number of female respondents is 126 people (64.21%) while the male respondents are 72 people (35.89%). Respondents of

SMA/SMK/MA teachers were 135 people (63.13%), elementary/MI teacher respondents were 56 people (28.28%), SMP/MTs teacher respondents were 17 people (8.58%). A total of 198 questionnaires were distributed through the google form platform and processed with SPSS 16 for Exploratory Factor Analysis (EFA) followed by Confirmatory Factor Analysis (CFA).

4.1 Development of 21st Century Creativity Instruments

a. Determination of Indicators and Dimensions through Literature Review

According to Siahaan (2020) educators have a very big role, in addition to being facilitators in student learning, as well as guiding and directing students. The 21st century creativity skill instrument, obtained from various literatures, especially from journals and previous research. The instrument was developed from indicators and dimensions, through a literature review approach. The literature review is carried out by means of a search that focuses on creativity in 21st century learning. Each manuscript is studied for its contents to get its contextual relationship, analyze and integrate scientific writing related to creativity, creative process, creative performance, and creative thinking. The pattern of relationships obtained is searched for then analyzed and concluded to obtain indicators of creativity, based on a deductive approach (general to specific).

This is in line with what was conveyed by Snyder (2019: 333), who said that literature review is a research method that aims to collect and extract the essence of either from previous research findings or from experts according to the context of creativity. The activity was continued with validation by experts and practitioners through the Focus Group Discussion (FGD) forum. Determination of dimensions is based on sentence analysis of each indicator. Indicators that have the same meaning and meaning are included in 1 (one) dimension. The results of the factor analytic study resulted in 5 main dimensions to be explored in Table 1.

Table 1. Creativity in Learning for Exploatory

Dimension	Indicator	No Item
Creative Thinking Skills. (CTS)	Able to use various ideas creation techniques (such as brainstorming)	CTS 1
	Able to create new ideas (through modifications or new concepts).	CTS 2
	Have the rigor to refine, analyse and evaluate ideas.	CTS 3
	Increase and maximize creative efforts	CTS 4
	Critically evaluate their work at the right point	CTS 5
	apply their imagination to generate ideas, questions and hypotheses, experiment with alternatives	CTS 6
	Be able to evaluate their own ideas, end products and processes.'	CTS 7
	Able to combine various creative ideas to become new ways	CTS 8
Work creatively with others. (WCO)	Able to develop, implement and communicate ideas to others.	WCO 1
	Be open and responsive to new and diverse perspectives	WCO 2
	Able to incorporate group input and feedback into work.	WCO 3

Dimension	Indicator	No Item
	Able to show originality and expertise in work	WCO 4
	Always responsive and adaptive to various developing issues	WCO 5
	Understand the real world in adopting new ideas	WCO 6
Dealing with a failure (DWF)	Can interpret a failure as a lesson,	DWF 1
	Understand that creativity and innovation are long term	DWF 2
	Work competitively to get better results	DWF 3
	not afraid to make and learn from mistakes	DWF 4
	Dare to take risks,	DWF 5
	Believe in yourself through hard work	DWF 6
	Thinking of different approaches (alternative thinking) in response to a problem or question (seeing things from a different perspective).	DWF 7
	If needed dare to change to a different approach	DWF 8
Implementing Innovation ideas for success. (IIS)	.Able to apply creative ideas as a real and useful contribution to the development of innovation.	IIS 1
	Offers strategies to successfully cultivate creativity	IIS 2
	Have many new ways of implementing ideas	IIS 3
	Applying imagination to generate ideas	IIS 4
	Produce Products that have value from new solution processes	IIS 5
	Doing experiments to get products	IIS 6
	Productive	IIS 7
	Taking into account the creative and reflective process in innovating	IIS 8
Think out of the ordinary (TOO)	Willingness to take reasonable risks or get out of comfort zone	TOO1
	Have knowledge and skills in different ways.	TOO2
	Applying judgments that 'challenge habitual ways'	TOO3
	Have unusual questions if you find a problem	TOO4
	Able to explore cognitive aspects with a variety of new ways of thinking	TOO5

b. Testing through Exploratory Factor Analysis (EFA)

The creativity factors resulting from the reduction of the theory are grouped into: (1) Creative thinking ability (KBK), (2) Working creatively with others (BKO) (3) Interpreting a failure (MSK), (4) Applying idea innovation into innovation for success (MIK) and (5) Think outside the box (BDK).

c. Factor Proof

Dimensional data and indicators that have been obtained from the literature review above need to be rotated to obtain data with basic construction or dimensions and indicators that are assumed to underlie the original variables. Explanatory Factor Analysis (EFA), is used to measure aspects of the same basic dimensions and indicators, and are interrelated (Gorsuch, 1983). Explanatory Factor Analysis (EFA) is another way to determine the centrality of the functioning of creativity indicators in 21st century learning. EFA is used to test the extracted factors. This is in line with the pattern of Lynam and Miller (2014) in conducting a factor analysis of the exploration of various creativity factors. EFA uses the principal axis factor with direct oblimin rotation, the analysis produces 5 factors that utilize the KMO value of the total variance, as shown in Table 2.

Tabel 2. KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.935
Bartlett's Test of Sphericity	Approx. Chi-Square	5.138E3
	Df	561
	Sig.	.000

d. KMO Test Results and Bartlett Test of Sphericity

The results of KMO are used to measure the adequacy of sampling (sampling adequacy). The test result value of 0.935 indicates that the comparison of the observed correlation coefficient is greater than the partial correlation coefficient. The results of the KMO value of 0.935 indicate that the correlation between pairs of variables can be explained by other variables (Keiser, 1970). The results of Bartlett's test obtained a Chi-square value of 5.13 x103 with a Df of 561 and a significance of 0.000. This means that the correlation matrix calculated is an identity matrix so that the variable dimension shrinkage becomes simpler and more useful without losing much of the previous information. Then the shrinkage of the dimensions of the variable is meaningful for principal component analysis to be carried out. In other words, reducing the creativity variable in the EFA will have meaning and use.

e. Extraction Result

The results of the feasibility of each dimension of creativity were analyzed by factors, using the Measure of Sampling Adequacy (MSA) criteria. It is used to measure the intercorrelation between the dimensions of creativity and suitability of factor analysis. Extraction of creativity factor using the Principal Component Analysis model.

From these results obtained a minimum reduction factor of creativity. The reduction of creativity factors uses orthogonal rotation, namely varimax or variance of maximum, this will result in a factor structure containing the loading squared value as stated by Johnson and Wichern, (2002). The results obtained are stated in Table 3.

Table 3. The Results of Communality and the Loading Factor of Creativity

	Rotated Component Matrix(a)
Communalities	Component

	Initial	Extraction	1	2	3	4	5
CTS 1	1.000	.526	.661				
CTS 2	1.000	.629	.709				
CTS 3	1.000	.740	.643				
CTS 4	1.000	.651	.586				
CTS 5	1.000	.746					.759
CTS 6	1.000	.593	.506				
CTS 7	1.000	.697					.659
CTS 8	1.000	.752	.703				
WCO 1	1.000	.546	.601				
WCO 2	1.000	.695				.664	
WCO 3	1.000	.750				.748	
WCO 4	1.000	.598				.455	
WCO 5	1.000	.603				.648	
WCO 6	1.000	.692				.633	
DWF 1	1.000	.720		.828			
DWF 2	1.000	.723		.793			
DWF 3	1.000	.687		.747			
DWF 4	1.000	.546		.587			
DWF 5	1.000	.699		.776			
DWF 6	1.000	.637		.572			
DWF 7	1.000	.582		.482			
DWF 8	1.000	.711					.701
IIS 1	1.000	.629					.732
IIS 2	1.000	.790					.823
IIS 3	1.000	.696					.657
IIS 4	1.000	.752					.792
IIS 5	1.000	.648					.726
IIS 6	1.000	.674		.524			
IIS 7	1.000	.708	.726				
IIS 8	1.000	.789		.524			
TOO1	1.000	.805	.647				
TOO2	1.000	.750			.789		

TOO3	1.000	.785	.805
TOO4	1.000	.583	.750
TOO5	1.000	.584	.785

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

The results of the EFA analysis are continued by reducing several indicators that can be analyzed confirmatory. There are some indicators that are reduced. The indicators that are still used for the next analysis consist of 19 indicators from 5 dimensions or determinants of creativity in 21st century learning. One of the factors of thinking out of the ordinary (TOO) is only included in the two creativity subscales that represent it, because there are other indicators that have a weak correlation (0.16). The CTS factor contains 4 factors, because the other 4 factors are weakly correlated (0.15, 0.11.0.23 and 0.34). The WCO factors received are WCO 2 (0.64), WCO 3 (0.74) and WCO 5 (0.64)

f. Analysis Confirmatory Factor Analysis (CFA)

The results of the exploratory factor analysis were then confirmed based on the results of statistical tests and factor adequacy. The results are then processed with the help of smart PLS and the final data is obtained according to Figure 1.

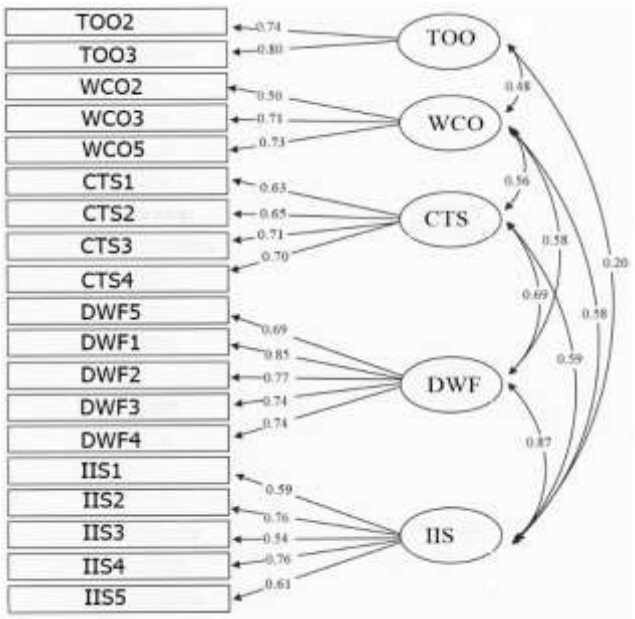

Figure 1. *CFA Results of Learning Creativity*

The results of the CFA analysis include the parameters of the degree of freedom (df), The goodness of fit index (GFI), The adjusted goodness of fit index (AGFI), Comparative Fit Index (CFI), Root-Mean-Square Error of Approximation (RMSEA).), and the Tucker-Lewis index (TLI). GFI, AGFI, TLI, CFI values usually range from 0 to 1.0, and a value of 0.90 or

greater is considered evidence of good model fit (Schumacker & Lomax, 1996). RMSEA value less than 0.06 indicates a good fit model (Hu & Bentler, 1999; Schumacker & Lomax, 1996,). All the above mentioned GOF measures were used in this study. In addition, TLI is also calculated with the one-factor model as a reasonable nested model as an alternative (Schumacker & Lomax, 1996). When the model is fully nested, meaning that the models are subsets of each other, the Chi-squared difference test can be used. The difference between the Chi-squared of the two models is evaluated as a Chi-square statistic using the degrees of freedom which is the difference between the degrees of freedom of the two models (Bollen, 1989). The results are presented in Table 4.

Table 4. Fit indice for confirmatory Factor Analysis Models

Index	CFA Model		
	5 factor	5-factor model	1-factor
Chi-square	1200.67	1200.67	1200.67
df	554	554	360
probability	0.000	0.000	0.000
chi-sq/df ratio	2.02	2.02	2.02
GFI	0.84	0.81	0.84
AGFI	0.82	0.82	0.42
CFI	0.85	0.95	0.55
RMSEA	0.85	0.85	0.11
TLI (null)	0.81	0.81	0.41
TLI (1 factor)	0.83	0.83	-
Sig. residuals	12%	7%	21%

*compare for 19 item creativity for learning process

The aim of exploratory factor analysis was to investigate the factors underlying 21st century learning creativity. The principal axis factoring analysis with oblimin rotation was performed using SPSS 6.1 (Norusis, 1993). Nineteen factors with eigenvalues greater than 1.0 were extracted; after oblimin rotation, these three factors have only two items with loadings above 0.30. Examination of the scree plot shows that the greatest change in slope is within five factors. The results of the analysis show that 19 indicators developed from 5 dimensions are the best and can represent creativity in learning.

4.2 Qualitative Validation of Dimensional Data and Indicators

Qualitative data of dimensions and indicators as a result of the literature review then confirmed through the FGD forum obtained: 5 dimensions with 35 indicators. After the EFA and CFA tests were carried out, 5 dimensions were obtained with 19 indicators. The number and name of the dimensions are still the same, but the number of indicators has changed. The indicator data is analyzed qualitatively in the FGD forum, as a confirmation and validation forum. The complete results are in table 5:

Table 5. Qualitative Data Analysis

No	Indicator data before being tested by EFA and CFA	No Item	EFA and CFA test results	Qualitative analysis results
Dimension 1: Creative Thinking Skills. (CTS)				
1.	Able to use various ideas creation techniques (such as	CTS 1	CTS 1	

	brainstorming)			
2.	Able to create new ideas (through modifications or new concepts).	CTS 2	CTS 2	
3.	Have the rigor to refine, analyse and evaluate ideas.	CTS 3	CTS 3	
4.	Increase and maximize creative efforts	CTS 4	CTS 4	
5.	Critically evaluate their work at the right point	CTS 5		Already summarized in CTS 3
6.	apply their imagination to generate ideas, questions and hypotheses, experiment with alternatives	CTS 6		Already summarized in CTS 1
7.	Be able to evaluate their own ideas, end products and processes.'	CTS 7		Already represented by CTS 3
8.	Able to combine various creative ideas to become new ways	CTS 8		Already represented by CTS 2
Dimension 2: Work creatively with others. (WCO)				
1.	Able to develop, implement and communicate ideas to others.	WCO 1		Already summarized in WCO 2
2.	Be open and responsive to new and diverse perspectives	WCO 2	WCO 2	
3.	Able to incorporate group input and feedback into work.	WCO 3	WCO 3	
4.	Able to show originality and expertise in work	WCO 4		Already represented by WCO 3
5.	Always responsive and adaptive to various developing issues	WCO 5	WCO 5	
6.	Understand the real world in adopting new ideas	WCO 6		Already represented by WCO 5
Dimension 3: Memaknai sebuah kegagalan (MSK)				
1.	Can interpret a failure as a lesson,	DWF 1	DWF 1	
2.	Understand that creativity and innovation are long term	DWF 2	DWF 2	
3.	Work competitively to get better results	DWF 3	DWF 3	
4.	not afraid to make and learn from mistakes	DWF 4	DWF 4	

5.	Dare to take risks,	DWF 5	DWF 5	
6.	Believe in yourself through hard work	DWF 6		Already summarized in DWF 5
7.	Thinking of different approaches (alternative thinking) in response to a problem or question (seeing things from a different perspective).	DWF 7		Both indicators DWF 7 and DWF 8 merged into "Thinking alternatives from a different perspective".
8.	If needed dare to change to a different approach	DWF 8		
Dimension 4: Implementing Innovation ideas for success.(IIS)				
1.	.Able to apply creative ideas as a real and useful contribution to the development of innovation.	IIS 1	IIS 1	
2.	Offers strategies to successfully cultivate creativity	IIS 2	IIS 2	
3.	Have many new ways of implementing ideas	IIS 3	IIS 3	
4.	Applying imagination to generate ideas	IIS 4	IIS 4	
5.	Produce Products that have value from new solution processes	IIS 5	IIS 5	
6.	Doing experiments to get products	IIS 6		Already represented by IIS 5
7.	Productive	IIS 7		Already represented by IIS 5
8.	Taking into account the creative and reflective process in innovating	IIS 8		Already represented by IIS 1
Dimension 5: Think out of the ordinary (TOO)				
1.	Willingness to take reasonable risks or get out of comfort zone	TOO1		Already represented by TOO 3
2.	Have knowledge and skills in different ways.	TOO2	TOO2	
3.	Applying judgments that 'challenge habitual ways'	TOO3	TOO3	
4.	Have unusual questions if you find a problem	TOO4		Already represented by TOO 3
5.	Able to explore cognitive aspects with a variety of new ways of thinking	TOO5		It is maintained on the grounds that

				a new way of thinking is not the same as a "different way". The sentence becomes “Able to explore diverse cognitive aspects with new ways of thinking”

V. Conclusion

The results of the research findings obtained conclusions:

a. The results of the analysis using a literature review approach obtained 5 dimensions of data and 35 (thirty five) indicators. After conducting the EFA and CFA tests, 5 dimensions were obtained with 19 (nineteen) indicators. After conducting a qualitative analysis through the FGD forum, 5 (five) dimensions were obtained with 21 (twenty one) indicators.

b. The names of 5 (five) dimensions and 21 (twenty one) indicators are as follows:

(1) Dimension 1, Creative Thinking Skills. (CTS): (a) Able to use various ideas creation techniques (such as brainstorming ; (b) Able to create new ideas (through modifications or new concepts); (c) Have the rigor to refine, analyse and evaluate ideas ; (d) Increase and maximize creative efforts

(2) Dimension 2, Work creatively with others. (WCO): (a) Be open and responsive to new and diverse perspectives; (b) Able to incorporate group input and feedback into work; (c) Always responsive and adaptive to various developing issues..

(3) Dimension 3, Dealing with a failure (DWF): (a) Can interpret a failure as a lesson; (b) Understand that creativity and innovation are long term; (c) Work competitively to get better results; (d) not afraid to make and learn from mistakes; (e) Dare to take risks; (f) Thinking alternatives from a different perspective.

(4) Dimension 4, Implementing Innovation ideas for success. (IIS): (a) Able to apply creative ideas as a real and useful contribution to the development of innovation; (b) Offers strategies to successfully cultivate creativity; (c) Have many new ways of implementing ideas; (d) Applying imagination to generate ideas; (e) Produce Products that have value from new solution processes.

(5) Dimension 5, Think out of the ordinary (TOO): (a) Have knowledge and skills in different ways; (b) Applying judgments that 'challenge habitual ways'; (c) Able to explore diverse cognitive aspects with new ways of thinking”.

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