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Development of Teacher Innovativeness Instruments in the Face of Educational Innovation

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Abstract: Teachers had different responses in facing top-down educational innovation. Hence, policymakers must create a map to implement a more effective strategy for innovation success. This study aimed to develop a teacher innovativeness instrument through theoretical development methods. Based on the synthesis of the theoretical research, five indicators were obtained and expanded into 25 four-scale Likert statements. Content validity was proven by eight experts and then quantified by the Aiken formula, resulting in a coefficient of 0.84 or a high category. The trial was conducted on 85 teachers from various levels and regions in Indonesia to get empirical data. Construct validity was proven by Exploratory Factor Analysis (EFA) and resulted in four factors with Eigenvalue > 1 which were factors that underlie the level of teachers innovativeness, namely volition, coverage novelty, structural obedience, and environmental communication. The Principal Component Analysis (PCA) extraction and Varimax rotation proved that all items had good criteria because their factor loading was> 0.4, proving the construct validity. The instrument reliability estimated by the Cronbach Alpha formula resulted in a reliability coefficient of 0.954, or a very high category. Thus, this instrument qualifies as a good instrument and could be utilized singly or with the addition of supporting instruments.
Keywords: construct validity; educational innovations; exploratory factor analysis; teachers innovativeness

Pengembangan Instrumen Pengukuran Keinovatifan Guru dalam Menghadapi Inovasi Pendidikan

Abstrak: Guru memiliki respons yang berbeda-beda dalam menghadapi inovasi pendidikan yang bersifat *top-down* sehingga pemangku kebijakan perlu memetakan tingkat keinovatifan guru untuk menyukseskan inovasi. Penelitian ini bertujuan untuk mengembangkan instrumen keinovatifan guru melalui metode pengembangan teoretik. Berdasarkan sintesis dari kajian teoritis, diperoleh lima indikator yang selanjutnya dikembangkan menjadi 25 butir pernyataan model Likert empat skala. Pembuktian validasi isi dilakukan oleh delapan *expert* untuk kemudian dikuantifikasi dengan formula Aiken dan menghasilkan koefisien sebesar 0,84 atau berkategori tinggi. Uji coba dilakukan terhadap 85 guru lintas jenjang dari berbagai daerah di Indonesia dengan bantuan Google Form untuk mendapatkan data empiris. Pembuktian validitas kontruk dilakukan melalui *Exploratory Factor Analysis* (EFA) dan menghasilkan empat faktor bernilai Eigen lebih dari 1, yang merupakan faktor penentu tingkat keinovatifan guru, yaitu faktor kemauan, kebaruan cakupan, kepatuhan struktural dan komunikasi lingkungan. Faktor-faktor tersebut dapat diidentifikasi empat faktor yang mendasari tingkat keinovatifan guru. Ekstrasi *Principal Component Analysis* (PCA) dan rotasi Varimax membuktikan bahwa seluruh butir berkriteria baik karena memiliki muatan faktor > 0,4 sehingga validitas konstruk terbukti. Reliabilitas instrumen diestimasi dengan formula Cronbach Alpha dan menghasilkan koefisien reliabilitas sebesar 0,954 sehingga berkriteria sangat tinggi. Dengan demikian, instrumen ini memenuhi syarat sebagai instrumen yang baik dan dapat digunakan secara tunggal maupun bersama instrumen pendukung.
Kata Kunci: analisis faktor eksploratori; inovasi pendidikan; keinovatifan guru; validitas konstruk

1. Introduction

Education needs to improve every time as a form of adaptation to changes in all aspects of life. The urgency of educational innovation was rooted in at least four reasons, namely: efforts to solve educational practice problems, providing satisfaction to educational stakeholders, the importance of providing quality education and

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accountable administration, and the importance of education anticipating external changes (Syarafuddin, Asrul, & Mesiono, 2012). Therefore, innovation in the field of education was essential to be able to create a better world of education.

Innovation was a new change towards improvement that was different from the existing one and carried out intentionally and planned (Usmayadi, Hardhienata, & Hidayat, 2020). However, the scope of innovation could be much more than that. According to Nasierowski & Arcelus (2012) innovation does not only describe innovation as an invention or technological improvement but also includes implementing new ideas, processes, and methods to optimize ideas, technologies, or existing inventions. Likewise, in innovation in the education world, new ideas could be top-down from policymakers then instructed to lower ranks, or bottom-up where innovation ideas came from below or field actors, in this case, were teachers. Top-down took time so that the teacher, as the implementer, understood the intent and technical instructions for implementing the innovation (Hardianto, Hidayat, & Zulkifli, 2021).

One of the inhibiting factors for educational innovation in the top-down model was the emergence of rejection by the implementers, one of which was the teacher. Many teachers wanted to maintain a system or method that had been applied for years because it gave them a sense of security and satisfaction, so they didn't want to change it (Rusdiana, 2014). That depended on the term how high the innovative work behavior is or the level of teacher innovativeness. Innovative work behavior could create new ideas and put them into practice (Asbari, Santoso, & Purwanto, 2019; Schermerhorn, Hunt, Osborn, & Uhl-Bien, 2010). At the same time, the term innovativeness was a relatively new term with the same concept as innovative work behavior. More specifically, teacher innovativeness could be interpreted as processing and implementing new things in the form of ideas, products, and services to realize a change in learning activities to be of higher quality (Sunardi, Sunaryo, & Laihad, 2019). Teacher innovativeness was also necessary when an urgent change in the world of education happened because it impacted teacher readiness. In the current pandemic era, teacher readiness is still lacking in responding to online learning policies (Andarwulan, Fajri, & Damayanti, 2021).

The description above indicates that the success of educational innovation was closely related to innovative behavior or teacher innovativeness. Hence, it was necessary to measure the level of teacher innovativeness so that policymakers could develop strategic plans, especially regarding top-down innovation dissemination patterns, so that innovation runs to the lowest level of implementation.

These measurement activities had consequences for the availability of a measuring instrument because the results of a measurement were closely related to the measuring instrument or instrument used. A good measuring instrument was expected to produce valid and reliable data (Mardapi, 2012). These two specifications gave birth to the validity and reliability of the terms. Validity concerning the objectives of this innovativeness instrument included content and construct validity. Content validity means the extent to which the ability to be measured was represented by the instrument items (Retnawati, 2016). While construct validity indicates the degree to which an instrument measures the trait or theoretical construct to be measured (Azwar, 2016).

There were two methods often used to prove to construct validity. It was under Retnawati (2016) statement that proving the instrument's construct validity could be done in two ways, namely Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). Both were factor analyses, namely statistical analysis used to reduce or summarize several independent variables into fewer variables (Baroroh, 2013). EFA was carried out to find out or search for the construct of an instrument and was used when the instrument construct model was still being sought, or exploration was carried out. In comparison, CFA was used if the construct of an instrument was clear and the researcher wanted to test the hypothesis (truth) of the construct made.

The term reliability has various other names, such as consistency, reliability, trustworthiness, stability, constancy, etc. Still, the main idea contained in the concept of reliability was the extent to which the results of a measurement process could be trusted. Anderson et al. in Istiyono (2018) stated that the reliability was related to the problem of the test results determination and the extent to which the results could be trusted. While according to Retnawati (2016), reliability was the constancy or stability of the measurement results when a measuring instrument was used to measure the same thing at different times. Thus, reliability was the consistency of measurement results by instruments at other times so that the measurement results could be trusted.

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The development of innovativeness measurement instruments in education was more often aimed at students. The measured attributes include innovative character (Yulanda, 2021), innovation, and creativity skills (Mukhlis & Tohir, 2019). The measurement of teacher innovativeness was carried out by Zainal et al. (2020). Still, the innovativeness in that research was the innovative behavior of teachers within the scope of their organization and not concerning the teacher's innovativeness in responding to top-down innovation. The study that aimed to develop instruments for measuring teacher innovativeness, especially in facing top-down educational innovations, still needs to be found (Waliyuddin & Suliswor0, 2022).

Based on the problems above and the need for more research on the development of valid and reliable teacher innovativeness instruments to date, it was necessary to develop an instrument that was valid in content and constructs and reliable to measure teacher innovativeness in facing top-down educational innovations. The instrument could be used by policymakers, principals, or researchers, especially concerning educational innovations. Specifically, regarding construct validity, the proof was carried out using EFA because there was no strong theory yet regarding how many factors underlie the scope of innovativeness, so construct validity was proven by identifying the relationship between variables without determining the model first.

2. Method

This research was development research with a focus on instrument development. The instrument development method used was a theoretical development model where the framework of thinking was based on relevant theories and supported by empirical data. The development steps were; (a) Conducting theoretical studies to formulate indicators of teacher innovativeness, (b) Compiling instrument items, (c) Content validating through expert judgment, (d) Conducting trials, (e) Conducting analysis, (f)) Carrying out revision and (g) Formulating the final instrument of research results. The entire steps of this research was completed in December 2021.

This innovativeness instrument was developed based on indicators synthesized from innovation theories. Each indicator was developed into several items in the form of four-scale Likert statements. The options provided stated the frequency of respondents responding to educational innovations in four choices, namely Never, Rarely, Often, and Always. The option Sometimes was not used in this instrument to prevent the respondent from neutral answering, or the respondent's position was unclear in responding to the statement.

Content validity was proven by the expert judgment method, which involved eight personnel consisting of lecturers and education practitioners and then quantified using the Aiken formula with the help of Excel. The instrument trial to obtain empirical data for estimating the instrument reliability and proving construct validity was conducted on 85 teachers from various levels and several regions with the help of Googleform. The reliability estimation was based on the Cronbach Alpha formula. At the same time, the construct validity was proven through Exploratory Factor Analysis (EFA) followed by the extraction of the Principal Component Analysis (PCA) method and rotation using the Varimax method. Both reliability estimation and construct validity verification were carried out with the help of the SPSS program.

3. Result and Discussion

Formulating Innovativeness Indicators

According to Rogers (1995) innovativeness is the extent to which a person adopts new ideas more quickly than others in his social system. Innovativeness was a continuous variable, and its categorization was a simplification that can help people understand. Based on their innovativeness, adopters could be categorized into five groups; (a) The Innovator (brave and adventurous, interested in new ideas, and able to spark new ideas in a system, (b) The Early Adopter (part of a social system more numerous than innovators and was seen by many as "checkers" before using innovation and had the most significant opinion leaders), (c) The Early Majority (adopted new ideas slightly faster than the average member of the system, often interacted with the press but were rarely in a high position regarding opinion leaders), (d) The Late Majority (adopted new ideas slightly below the average rate of system members), and (e) The Laggard (had almost no opinion leaders, had the narrowest insight of all adopter categories, isolated in the social network in their system. Their innovation-decision process was relatively long, and they adopted it with little knowledge about it. Resistance to innovation almost always occurred in this group, and they needed to be convinced that the innovation would not fail before they were willing to adopt it).

Rogers also argued that the process of deciding to accept or reject an innovation, from now on referred to as the innovation-decision

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process, had the stages; (a) Knowledge Stage (when a person opens up to an innovation and wants to know how the innovation functions), (b) Persuasion Stage (when a feeling of liking or disliking an innovation is formed), (c) Decision Stage (when a person carries out activities that lead to a determination to accept or reject the innovation), (d) Implementation Stage (when someone uses or implements an innovation), and (e) Confirmation Stage (when a person seeks reinforcement of the innovation-decision he had made). In this stage, decision-makers could retract their decisions if information about the innovation were obtained that contradicted the information previously obtained.

According to Wilkie (1990), the process of an innovation adoption threw the following stages; awareness, knowledge, liking, trial, evaluation dan adoption. While according to Wells & Prerisky (1996), the process of an innovation adoption threw the following stages; awareness, interest, evaluation, trial dan adoption.

Based on the description above, it could be synthesized that innovativeness was the level of acceptance of a person towards an innovation compared to other members of the social system. Innovativeness indicators could be summarized into; (a) Caring (tends to be open and pays attention to innovation, and doesn't close oneself to outside information), (b) Curious (trying to find knowledge about innovation from various sources), (c) Learning (trying to understand an innovation which includes its weaknesses and strengths and comparing it with the previous situation), (d) Visualization (gave rise to a description of the result that would be achieved if an innovation was implemented based on liking, agreement, or interest), and (e) Implementing (an act of implementing or using an innovation).

According to Syarafuddin et al. (2012), educational innovation includes updates in curriculum, teaching materials, and content. Under the conditions in the field, innovations or educational reforms diffused to teachers were curriculum revision, learning methods or approaches, and subject matter scope.

Instrument Items

Based on the indicators of innovativeness and scope of innovation above, the items of the teacher's innovativeness instrument were arranged in Table 1. The Indicators and Items of Teacher's Innovativeness Instrument below.

Table 1. The Indicators and Items of Teacher's Innovativeness Instrument

Aspecs	Indicators	Item Number	Statement
Curriculum	Caring	1	When there was news about changes or revisions to the curriculum, I paid attention to it.
	Curious	2	When there was a change or revision of the curriculum, I discussed it with my fellow teachers.
		3	When there was a change or revision of the curriculum, I found out and read from various sources about it.
	Learning	4	When there was a change or revision of the curriculum, I studied the content and related matters.
		5	When there was a change or revision of the curriculum, I tried to find the advantages and disadvantages.
		6	When there was a change or revision of the curriculum, I compared it with the old curriculum.
	Visualization	7	When there was a change or revision of the curriculum, I visualized improving the quality of education after implementing the curriculum.
	Implementing	8	When there was a change or revision of the curriculum, I applied it in the classroom.
Learning Methods/ Approaches	Caring	9	When there was news about a new learning method/approach, I paid attention to it.
	Curious	10	When there was a new learning method/approach, I discussed it with my fellow teachers.
		11	When there was a new learning method/approach, I sought and read from various sources about it.
	Learning	12	When there was a new learning method/approach, I studied the underlying concepts/theories.

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Aspecs	Indicators	Item Number	Statement
		13	When there was a new learning method/approach, I learned its syntax and related stuff.
		14	When there was a new learning method/approach, I tried to find its advantages and disadvantages.
		15	When there was a new learning method/approach, I selected any suitable material to be taught with that method/learning.
	Visualization	16	When there was a new learning method/approach, I visualized the competency improvement students would achieve when using the method/approach.
	Implementing	17	When there was a new learning method/approach that matched the characteristics of the material I was teaching, I applied it in the classroom.
Subject Matter Scope	Caring	18	When there was news about a change in the subject matter scope, I paid attention to it.
	Curious	19	When there was a change in the subject matter scope, I discussed it with my fellow teachers.
		20	When there was a change in the subject matter scope, I searched and read various sources.
	Learning	21	When there was a change in the subject matter scope, I studied its content and limitations.
		22	When there was a change in the subject matter scope, I tried to find its advantages and disadvantages.
		23	When there was a change in the subject matter scope, I compared it with the old material scope.
	Visualization	24	When there was a change in the subject matter scope, I visualized increased student achievement in meeting the Graduate Competency Standards when applying the material content.
	Implementing	25	When there was a change in the subject matter scope, I applied it in the classroom.

Reliability

The reliability coefficient used in this instrument was the Cronbach Alpha reliability coefficient based on several reasons. To estimate the reliability of a non-cognitive instrument, the formula that could be used is Cronbach Alpha (Mardapi, 2012). In additiom, according to Retnawati (2016), the Cronbach Alpha formula could be used to estimate instruments whose scores were not only 1 and 0 but also on a polytomous scale, for example, a questionnaire (1-2-3-4-5 Likert scale). The reliability coefficient was calculated based on empirical data derived from the responses of 85 respondents to the instrument through field testing activities. The results of the calculation of the Alpha reliability coefficient using SPSS gave the following output.

Table 2. Reliability Statistics

Cronbach's Alpha	N of Items
,954	25

Based on Table 2. Reliability Statistics above, the reliability coefficient of this instrument was 0.954, or the Very High category. It was under the classification according to Gilford in Istiyono (2018), which classified the level of reliability based on the interpretation of the reliability index in Table 3. Realiability Category as follows.

Table 3. Reliability Category

Reliability Coefficient (r)	Category
$0,80 \leq r \leq 1,00$	Very High
$0,60 \leq r < 0,80$	High
$0,40 \leq r < 0,60$	Moderate
$0,20 \leq r < 0,40$	Low
$0,00 \leq r < 0,20$	Very Low

Content Validity

Content validity quantification was carried out on the assessment of 8 experts using the Aiken formula. The average Aiken'V obtained based on these calculations was 0.84, so it had high criteria. It was based on Istiyono's (2018) statement that if the value of V was less than 0.4. It can be said that the validity was low. If it was between 0.4 and 0.8, the validity was said to be moderate, and if it was more than 0.8, it was categorized as high.

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Table 4. KMO and Bartlett's Test Output

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,889
Bartlett's Test of Sphericity	Approx. Chi-Square	1607,615
	df	300
	Sig.	,000

Construct Validity

Construct validity was proven through Exploratory Factor Analysis (EFA) to find the instrument construct with the help of SPSS. In the Table 4. KMO and Bartlett's Test Output above, the Chi-Square value in the Bartlett test was 1,607.615 with 300 degrees of freedom and a significance value of 0.000 (less than 0.05 and 0.01). Thus the sample of 85 used in this analysis was sufficient so that the EFA analysis could be carried out. Besides the Chi-Square value in the Bartlett test, the sample adequacy was also confirmed by the KMO of 0.879, where the value was higher than 0.5. Thus it could be concluded that the requirements for conducting an EFA analysis were met.

Anti-Image Correlation (AIC) calculations provided data that all variables were predictable and feasible for EFA analysis because they had a Measure of Sampling Adequacy (MSA) > 0.50. Furthermore, all variables could explain the factor based on the output of Communalities because the Extraction value was > 0.50 as shown in the Table 5.

The following output from the factor analysis series was the Total Variance Explained table. The Table 6. Total Variance Explained explains that this innovative instrument contained four eigenvalues greater than 1; in other words, this instrument had four factors that could represent variables. There was a total of 67.23% of the explained variance for these factors. The following output was a scree-plot of the Eigenvalues.

Table 5. Communalities

Variable	Initial	Extraction
VAR00001	1,000	,480
VAR00002	1,000	,660
VAR00003	1,000	,538
VAR00004	1,000	,674
VAR00005	1,000	,677
VAR00006	1,000	,685
VAR00007	1,000	,645
VAR00008	1,000	,495
VAR00009	1,000	,602
VAR00010	1,000	,625
VAR00011	1,000	,776
VAR00012	1,000	,769
VAR00013	1,000	,636
VAR00014	1,000	,760
VAR00015	1,000	,715
VAR00016	1,000	,749
VAR00017	1,000	,648
VAR00018	1,000	,678
VAR00019	1,000	,560
VAR00020	1,000	,710
VAR00021	1,000	,730
VAR00022	1,000	,853
VAR00023	1,000	,864
VAR00024	1,000	,532
VAR00025	1,000	,746

Extraction Method: Principal Component Analysis.

Table 6. Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12,004	48,014	48,014	12,004	48,014	48,014	6,467	25,869	25,869
2	1,965	7,859	55,873	1,965	7,859	55,873	3,902	15,607	41,476
3	1,526	6,105	61,978	1,526	6,105	61,978	3,636	14,543	56,019
4	1,314	5,256	67,234	1,314	5,256	67,234	2,804	11,214	67,234

Extraction Method: Principal Component Analysis.

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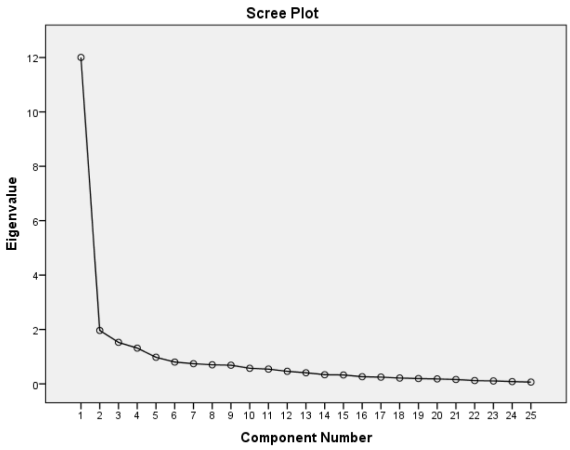

Figure 1. Scree-plot of Eigen-value Output

The Figure 1. Scree-plot of Eigen-value Output above strengthened the Total Variance Explained table, where the components that had Eigen values > 1 were four components or four factors. Factor 1 became the dominant factor because the line connecting the first and second factors produced the most extreme steepness.

The next output was the Output Rotated Component Matrix which ensured that all variables or instrument items were included in one of the factors (components). The magnitude of the factor load was also the basis for which a variable belonged to which factor. In each variable, the largest factor load indicated the tendency of the variable to be included in a factor. Another benchmark was if the correlation between a variable and a factor, from now on referred to as factor loading, had a value > 0.4. Thus the variable or instrument item was a good item.

The Rotated Component Matrix table above illustrates that each item had a factor loading value > 0.4. Several experts put forward opinions regarding the minimum limit of factor loading so that an indicator or item could be said to form a construct. Nurosis (1986) stated that the validity of the instrument was determined by the factor load value greater than 0.3. stated that the instrument's validity was determined by the factor load value greater than 0.3. Meanwhile, according to Hair et al. (2010), factor loading was considered to have strong enough validity to explain the latent construct if it weighted 0.50 or more. Meanwhile, according to Sharma (1996) the weakest factor loading that could be accepted was 0.40. Some of these opinions could be synthesized to produce limitations, namely that factor loading was considered sufficient if it was more than 0.4. Thus, as presented in Table 7, it could be concluded that all items were good items because they had a factor loading value > 0.4.

Table 7. Rotated Component Matrix[a]

	Component			
	1	**2**	**3**	**4**
VAR00011	,809	,030	,203	,282
VAR00015	,776	,129	,310	,008
VAR00012	,755	,224	,259	,284
VAR00004	,712	,031	,203	,354
VAR00016	,710	,398	,293	,019
VAR00007	,698	,369	-,146	,018
VAR00017	,638	,089	,411	,255
VAR00014	,633	,567	,049	,189
VAR00013	,601	,257	,261	,375
VAR00009	,570	,035	,483	,206
VAR00003	,558	,207	,370	,217
VAR00005	,549	,345	-,074	,501
VAR00020	,536	,450	,461	,092
VAR00023	,077	,862	,254	,226
VAR00022	,268	,850	,221	,108
VAR00021	,187	,674	,460	,166
VAR00019	,114	,455	,385	,439
VAR00024	,428	,449	,381	,050
VAR00025	,134	,281	,805	,043
VAR00018	,264	,258	,686	,267
VAR00008	,281	,118	,523	,359
VAR00001	,359	,277	,473	,224
VAR00002	,107	,122	,342	,719
VAR00010	,281	,026	,303	,674
VAR00006	,234	,445	-,115	,647

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 10 iterations.

Furthermore, based on the ratio of the factor loading of each item to factors 1, 2, 3, and 4 above, it could be grouped and named as shown in Table 8. Result of Grouping Items Against Factors below.

Table 8. Results of Grouping Items Against Factor

Factor	Variable/Item Number	Factor Name
1	3, 4, 5, 7, 9, 11, 12, 13, 14, 15, 16, 17, 20.	Volition
2	19, 21, 22, 23, 24.	Coverage Novelty
3	1, 8, 18, 25.	Structural Obedience
4	2, 6, 10	Environmental Communication

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The next output was Component Transformation Matrix which described correlation inter factors.

Table 9. Component Transformation Matrix

Component	1	2	3	4
1	,673	,457	,449	,370
2	-,683	,661	,306	,056
3	-,238	-,596	,695	,325
4	-,153	-,015	-,471	,869

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

The Table 9. Component Transformation Matrix above showed that the correlation factors 1, 2, 3, and 4 contained in the main diagonal of the matrix above were all > 0.5. Thus, it could be said that the four factors could accurately summarize the overall items of the instrument. Based on the series of exploratory analyzes above, it could be concluded that all items in this innovativeness instrument were constructively valid.

Disscuccion

The grouping of variables into the four factors as presented in table 8, and based on the similarity of the characteristics of the variables referring to the naming of the factors, could be related to the findings in table 6. That was the volition factor that could explain the variance of the innovativeness of 48.104%, followed by the coverage novelty factor of 7.859%, structural obedience factor of 6.105%, and environmental communication factor of 5.256%. This indicated that teacher innovativeness in facing top-down educational innovations was successively determined by the volition of teachers to accept innovations, the novelty of the scope of innovations that were being diffused, structural obedience teacher with the authority above, and teacher communication with peers or the related environment.

The teacher's volition belongs to the intrinsic category which was closely related to motivation. Motivation was the main driver of teacher discipline (Afandi, MS., & Neolaka, 2021) and further expected to succeed the innovation. The volition factor was the dominant factor because it was revealed to explain almost 50% of the variance of innovativeness. The indicators of innovation included in this factor were indicators of caring, curiosity, learning, visualization, and implementation. This volition factor also had representative items/variables in the three aspects of innovation, namely curriculum, learning methods/approaches, and subject matter scope. Thus, both in terms of proportion and completeness of the indicators and their constituent variables, it could be concluded that volition was the dominant intrinsic factor in shaping teacher innovativeness in facing top-down educational innovations.

Measurement of how high the level of innovativeness, especially with the subject of teachers, was strongly influenced by the characteristics of innovation and the expected goals. The various categories in innovation increasingly showed that innovation was subjective for validation both internally and externally (Goel & Agarwal, 2019). In addition, the factors that influenced the adoption of innovations needed to be studied and followed up to minimize the risk of rejection. Innovation regarding e-learning, for example, was proven to be constructively influenced by factors of relative advantage, compatibility, complexity, trialability, and observability (Suarta & Suwintana, 2012). Although it had a high variation and was subjective validity, a fit innovativeness measurement and informative measurement results would produce an appropriate mapping and support a more effective innovation scheme.

In line with efforts to map teacher innovativeness, efforts to create and develop teacher innovativeness still needed to be carried out continuously to succeed in the diffusion of innovations that were being conducted. And one of the main things was increasing teacher knowledge about these innovations which could be achieved by training. Training or learning strategies that supported the creation of creative and innovative education must focus on a systems approach (Seechaliao, 2017). Training or socialization on innovation could also apply the concept of online project-based learning that was proven to meet the criteria as a strategy that supported increasing innovativeness (Cholifah et al., 2019). Another thing that needed to be improved was the digital teaching competence of teachers, a pillar of innovation in learning methods that still need to be developed (Artacho, Martinez, Martin, Marin, & Garcia, 2020).

Research that aimed to design an application that made it easier for universities to measure the level of innovation readiness was carried out by Wardhana & Fitriana (2021) who produced a Katsinov application prototype. The development of similar applications needed to be inspired and explored further to produce instruments and even relevant applications to measure teacher innovativeness where top-down innovations were often diffused by policymakers.

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Although this innovative instrument had high reliability and validity in both contents and construct, it still needed to be reviewed or tested further considering that empirical data collection was only done once on 85 respondents. To improve the consistency of the results of the reliability estimation and prove construct validity, it was necessary to conduct several trials with more respondents. In addition, the use of supporting instruments both test and non-test also needed to be done to produce more comprehensive measurements.

4. Conclusion and Suggestion

Based on the findings and discussion above, several conclusions could be drawn, namely: (1) The indicators of teacher innovation instruments that could be compiled through theoretical studies were caring, curious, learning, visualizing, and applying, (2) All instrument items developed from the five indicators it had a very high-reliability category and valid in terms of content and constructs, (3) Thus, this instrument was suitable to be used in measuring teacher innovativeness. Suggestions that could be put forward regarding the development of this instrument were the need for further review, the addition of supporting instruments, and testing with more respondents to achieve consistency in the characteristics of the instrument.

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