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The influence of critical, creative, communication, collaboration thinking ability on the entrepreneurial ability and competency of Tefa vocational school teachers in East Java

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Abstract

This research analyzes the influence of 21st-century skills (4C: critical thinking, creativity, communication, and collaboration) and entrepreneurship on teacher competency in Vocational High Schools (SMK) through the Teaching Factory (TEFA) model in East Java. Using the path analysis method and a sample of 303 teachers from 40 vocational schools, the research found that these skills contributed significantly to entrepreneurial ability and directly increased TEFA teacher competency. The results show that communication skills have the greatest influence on entrepreneurship, while critical thinking skills are the main factor in increasing teacher competence. This research emphasizes the importance of implementing 4C and entrepreneurship skills training to improve the quality of education and students' readiness to face industrial challenges.

Keywords: Entrepreneurship, Teacher's competency, Teaching factory, Vocational high school.

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1. Introduction

Vocational High Schools (SMK) focus on producing graduates who are ready to work with competence in their fields through learning that includes normative, adaptive, and productive subjects. To improve the quality of learning, the government has implemented revitalization programs, teaching factories, and Centers of Excellence for Vocational Schools (SMKPK), which prioritize harmony with the industrial world. The teaching factory (TEFA) is a learning model that involves students in real production, honing their work and entrepreneurial skills. However, applying 21st-century skills (4C: critical thinking, creativity, communication, and collaboration) is still a challenge for teachers, who play a dual role as managers and

facilitators in TEFA. This research aims to analyze the influence of the application of 4C skills and entrepreneurship by teachers in improving learning effectiveness and teaching factory performance in vocational schools.

The problem formulation in this research includes an analysis of the direct and indirect influence of four 21st-century skills—critical thinking, creative thinking, communication, and collaboration—on the entrepreneurial abilities and competencies of TEFA teachers in East Java Vocational Schools. The research questions include how each of these skills influences the entrepreneurial ability and competency of TEFA teachers, both directly and through entrepreneurial ability as an intermediary variable, in order to understand the factors that encourage improvements in the quality of factory-based learning.

The aim of this research is to describe the influence of various 21st-century skills—critical thinking, creative thinking, communication, and collaboration—on the entrepreneurial ability and competency of TEFA teachers in East Java Vocational Schools, both directly and indirectly through entrepreneurial ability as an intermediary variable. This research aims to identify the role of each skill in improving teachers' entrepreneurial abilities, as well as understanding the overall contribution of these skills to TEFA teacher competency, in order to provide insight into improving the quality of factory-based teaching.

The benefits of this research are expected to provide teachers with an overview of the quality of entrepreneurial abilities and 21st-century (4C) skills, as well as function as feedback to improve their competence. For researchers, this research adds insight and experience in compiling scientific work. The assumptions underlying this research include equal quality of schools and learning activities in taking the population, the seriousness of respondents in filling out questionnaires, and the objectivity of researchers as observers. The scope of the research is limited to the competency of TEFA teachers who run programs at vocational schools in East Java. This research offers novelty by exploring the influence of 4C skills on TEFA teacher competency directly and indirectly through the intervening variable of entrepreneurial ability, which has not been studied much in previous research.

2. Review of Related Literature

2.1. Previous Research

Several studies show the importance of 4C skills in improving entrepreneurial abilities. Kumar and Shukla [1] found that creativity has a positive impact on entrepreneurial ability, with self-efficacy as a mediator. Hilmi et al. [2] concluded that 4C skills can increase vocational school students' entrepreneurial readiness, which can be achieved through improving 21st-century skills. Zunaedy et al. [3] identified factors that influence students' interest in entrepreneurship, such as desire, feelings of joy, and active learning, which have an impact on interest in entrepreneurship. Satyantoro and Andayani [4] also found a significant influence between self-efficacy, entrepreneurship education, and income expectations on entrepreneurial interest. Hendro [5] added that critical thinking, communication, collaboration and creativity skills are the main capital for an entrepreneur who is tenacious and never gives up.

2.2. Critical Thinking Ability

Critical thinking skills are reflective and productive thinking, focused on evaluating evidence to determine appropriate beliefs or actions. According to experts, critical thinking includes awareness, purpose, and intellectual standards such as clarity and relevance. Santrock [6] and Zubaedi [7] emphasize that the goal of critical thinking is making wise decisions through analyzing information, while Martinis [8] sees it as a tendency to assess conclusions based on evidence. Ennis [9] and Watson and Glaser [10] compiled the components of critical thinking, including inference, assumption, deduction, interpretation, and evaluation. In conclusion, critical thinking involves the ability to explain, interpret, analyze, evaluate and conclude information, as seen in Table 1.

Table 1.
Indicators of Critical Thinking Ability.

Variable		Indicator
Critical thinking skills	1.	Ability to explain
	2.	Interpretation ability
	3.	Ability to analyze
	4.	Ability to evaluate
	5.	Ability to conclude

2.3. Creative Thinking Ability

The ability to think creatively is part of the ability to think at a higher level (HOTS), which is characterized by the emergence of new ideas as a result of the thinking process [11]. According to Silver [12], the assessment of creativity in "The Torrance Tests of Creative Thinking" (TTCT) is based on fluency, flexibility, and novelty. In the context of problem-solving tasks, the Multiple Solution Task (MST) helps students develop diverse solutions, where both conventional and unconventional solutions can be evaluated in individual and collective solution spaces [13]. Fluency, flexibility, and novelty scores in MST measure students' creativity levels based on guidelines from [14]. It was concluded that creative thinking ability includes sub-indicators of fluency, flexibility, novelty and detail as shown in Table 2.

Table 2.
Indicators of Creative Thinking Ability.

Variable		Indicator
Creative thinking ability	1.	Fluency
	2.	Flexibility
	3.	Novelty
	4.	Detailing/elaboration

2.4. Communication Skills

Communication skills are important skills for students to convey what they know and do through speech, writing, gestures, or broadcasting so that they can exchange thoughts and feelings with other people [15]. According to Santrock [6], communication includes speaking in front of the class and interacting with friends assertively without judgment. Trilling and Fadel [16] added that communication skills involve clarity of expression, effective listening, and the use of media and technology in various contexts. Cangara [17] differentiates communication in verbal and nonverbal codes, with their respective functions in conveying ideas and emotions. To be effective, communication must be easy to understand and include motivation, knowledge and competence [18]. In conclusion, communication skills include the ability to send messages, listen, give feedback, and have emotional interaction. The indicators above appear in Table 3.

Table 3.
Indicators of Communication Skills.

Variable		Indicator
Communication skills	1.	Ability to send messages
	2.	Ability to listen to Conversations
	3.	Ability to give feedback
	4.	Emotional Interaction Ability

2.5. Collaboration Capabilities

Collaboration ability is an important skill that involves two or more individuals working together to achieve goals by respecting differences, sharing power, and gathering knowledge from others. According to Murawski [19], collaboration is a style of professional interaction that emphasizes working together, while Woolfolk [20], states that collaboration is a philosophy about how to relate to other people. Greenstein [21] added that collaboration in the classroom involves planning, discussing, listening, and supporting one another. Trilling and Fadel [16] state that collaboration skills include the ability to work effectively, flexibility, and shared responsibility. Chiocchio et al. [22] identified characteristics of collaboration such as team communication, synchronicity, and contextual performance. Based on this, the sub-indicators of collaboration ability include the ability to work together, flexibility, interaction, and processes in groups as mentioned in Table 4.

Table 4.
Collaboration Ability Indicators.

Variable		Indicator
Collaboration capabilities	1.	Ability to Collaborate
	2.	Flexibility Ability
	3.	Interaction ability
	4.	Ability to process in groups

2.6. Entrepreneurial Ability

Entrepreneurship is the ability to create new value through effort, skills, and knowledge that involves managing limited resources to achieve profit and progress. According to Kasmir [23] an entrepreneur has creativity and high enthusiasm, while Hendro [5] defines entrepreneurship as the science and art of managing resources to earn income. Hisrich et al. [24] mentions entrepreneurship as a process of finding new value, while Frinces [25] adds that entrepreneurs must be ready to face risks and innovate. Entrepreneurial readiness is influenced by internal factors such as mental and motivation, as well as external factors such as family support and infrastructure [26, 27]. Entrepreneurial ability includes indicators such as self-confidence, future orientation, courage to take risks, creativity, and the ability to plan and manage a business, as mentioned in Table 5.

Table 5.
Indicators of Entrepreneurial Ability.

No	Variable	Indicator
	Entrepreneurial Ability	1. Believe in your own abilities
		2. Oriented to the future
		3. Courage to take risks
		4. Creativity and innovation
		5. Work hard
		6. Responsibility
		7. Knowledge of the field of business to be carried out
		8. Ability to plan, run and control a business
		9. Human resources
		10. Financial resources
		11. Information resources

2.7. TEFA Teacher Competencies

Competence, according to the General Indonesian Dictionary, means the authority to determine or decide something. Sudiyono [28] defines competence as rational behavior to achieve required goals, while Sudiyono [28] states that teacher competence is the ability to carry out obligations responsibly. According to Mulyasa [29], teacher competency describes meaningful behavior, and in the Minister of National Education Regulation Number 16 of 2007, teacher competency includes four main competencies: pedagogical, personality, social, and professional. The Law of the Republic of Indonesia Number 14 of 2005 also states that competence is the knowledge, skills, and behavior that must be mastered by teachers. Machmuda et al. [30] and Mulyasa [29] emphasize that competencies include tasks, skills, attitudes, and values that are important for job success, and Shivakumar [31] adds that the application of this knowledge, skills, and attitudes in work is the most important thing. Based on this explanation, TEFA teacher competencies can include professional, pedagogical, social, and personality competencies, which are integrated into teacher performance, as stated in Table 6.

Table 6.
TEFA Teacher Competency Indicators.

Variable		Indicator
TEFA Teacher Competencies	1.	Professional Competency
	2.	Pedagogical Competence
	3.	Social Competence
	4.	Personality Competencies

3. Research Methodology

This research uses an ex post facto design with path analysis methods to test the relationship between variables. Path analysis aims to evaluate the direct and indirect influence of a set of exogenous variables on endogenous variables [32]. Exogenous variables are variables that influence or cause changes in the dependent variable [32]. This variable can also be interpreted as the cause of fluctuations in the value of a latent variable in a model, where changes in the value of the independent variable are not explained in the model but are considered to influence other factors outside of it, Riadi [33]. In this research, exogenous variables include critical thinking abilities (X1), creative thinking abilities (X2), communication abilities (X3), and collaboration abilities (X4). Meanwhile, endogenous variables are variables that are influenced by or are the result of independent variables [34]. This variable is also defined as a variable that influences the model, either directly or indirectly, where fluctuations in the value of the dependent variable are explained by the model specification, which includes all latent variables that influence them [33]. In this research, the endogenous variable is TEFA teacher competency (Z). The last one is an intervening variable, which is a variable that theoretically influences the relationship between the independent and dependent variables, making it an indirect relationship that cannot be observed and measured [35]. The intervening variable in this research is entrepreneurial ability (Y).

The population in this study includes all vocational school teachers in East Java, totaling 906 teachers. The probability sampling technique is used because it provides an equal opportunity for each member of the population to be selected as a sample. The sample in this study was not divided into strata because the population came from the same level of education, namely secondary education. Therefore, the sampling technique used is random sampling. Based on the population size, the required sample size is calculated using the formula developed by Isaac and Michael [36].

Information:

s = number of samples
λ2 = Chi Square (value 3.841 for 5% error rate)
N = total population
P = true chance
Q = probability of being wrong
d = difference between the sample mean and the population mean (0.05)

The research procedure in this study includes a series of stages carried out from the implementation to the preparation of the research report. These stages include preparation, implementation, data analysis, and the preparation of research results

reports. In this research, data collection techniques were carried out using questionnaires to measure all the variables studied. Before the instrument is used, validity and reliability tests are conducted to ensure that the instrument used is valid and reliable. After the data is collected, assumption tests are conducted (such as tests for normality of distribution, multicollinearity, heteroscedasticity, and autocorrelation) before testing the hypothesis.

Data analysis in this research uses Structural Equation Modeling (SEM), which combines factor analysis and simultaneous equation models. Prior to hypothesis testing, the data were tested to meet the assumptions of normality of distribution, sample size adequacy, multicollinearity, outliers, and model suitability. The variables analyzed include digital literacy, self-efficacy, learning outcomes, and TEFA products as intervening variables. SEM analysis steps include model specifications, model estimation using the Maximum Likelihood (ML) method, model evaluation using Confirmatory Factor Analysis (CFA) and Goodness of Fit (GOF) tests, as well as model modifications if necessary. The test results use the T-value, parameter value, and R-square (R2) test to measure the effect of the independent variable on the dependent variable, with validity and reliability analysis to ensure the accuracy of the model.

4. Results and Discussion

4.1. Results

This research was conducted in East Java Province, particularly in several vocational schools that have implemented teaching factories. Based on the data, 40 public and private vocational schools in East Java implement the teaching factory program. The number of samples in this research was 303 teachers, all of whom came from the TGG expertise program in vocational schools throughout East Java Province. The following is a description of the sample characteristics based on gender, age, parents' employment status, and school of origin.

Table 7.
Sample Characteristics.

Characteristics	Category	Amount	Percentage
Gender	Man	224	74
	Woman	79	26
Age	< 30 Years	45	15
	30 - 35 Years	76	25
	35 - 40 Years	164	54
	> 40 Years	18	6
Parental Employment Status	Entrepreneurship	48	16
	Not Entrepreneurial	255	84

Based on the results of the analysis in Table 7, information was obtained that the majority of the research sample were male teachers, namely 74%, while the remaining 26% were female teachers. In terms of age, most of the sample was in the 35 to 40 year age range (54%), with smaller numbers in other age groups. This is because the samples studied were teachers who had experience teaching in TEFA classes. Regarding parents' employment status, the majority of teachers come from non-entrepreneurial families (84%), while the other 16% are children of entrepreneurial parents.

This research sample came from 40 vocational schools in East Java. Based on the distribution of school origins, Figure 4.1 shows that the majority of the sample came from SMKN Kalibaru and SMKN Singgahan, each with 12 teachers. On the other hand, the smallest number of samples came from SMK Muhammadiyah Kedungpring and SMK Magetan YKP, with 2 and 3 teachers, respectively.

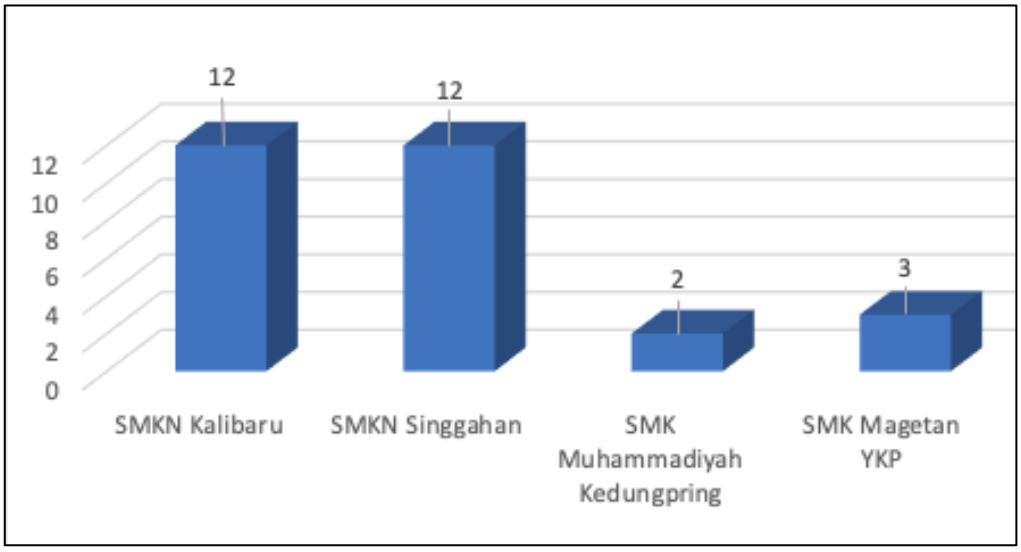

Figure 1.
Distribution of Respondents by Vocational School in East Java.

4.2. Convergent Validity Test

The convergent validity test is carried out by examining the loading factor value of each indicator on the construct in question. In confirmatory research, the accepted loading factor value is 0.7, while for exploratory research, the minimum accepted loading factor value is 0.6, and for development research, the accepted loading factor value is 0.5. Because this research is confirmatory, the loading factor value used is 0.7. The following is the loading factor value for each indicator in the research model based on the results of the PLS model estimation using algorithm techniques.

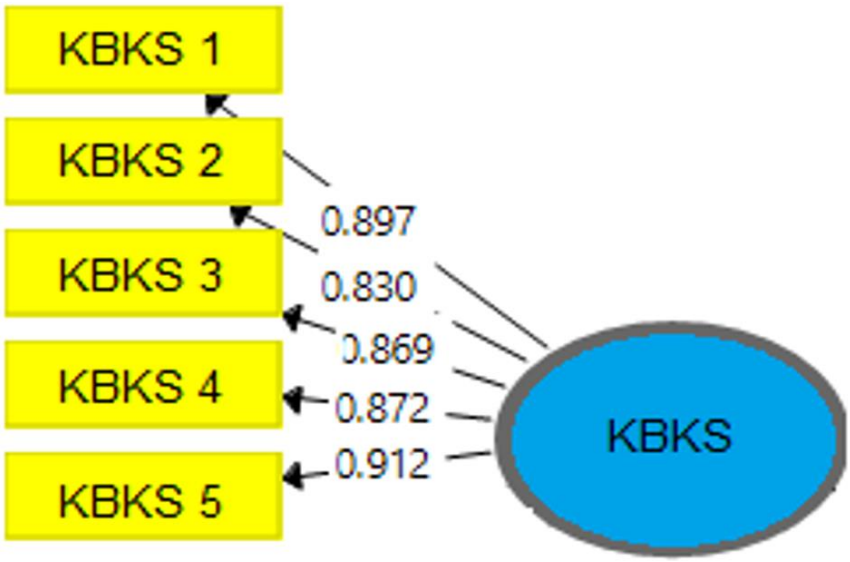

Figure 2.
Measurement Model for the KBKS Variable.

4.3. Measurement Model for the KBKS Variable

Based on the results of the analysis in the image above, the results obtained show that all indicators in the KBKS variable have values *loading factor > 0.7*, which means that all indicators can be used to measure the construct. No indicators must be excluded because all indicators have met the required validity criteria. The loading factor values are presented in the following table.

Table 8.
Loading Factor Value in the Convergent Validity Test of the KBKS Variable.

Variable	Indicator	Loading Factor	Cut Value	Reliability
Critical Thinking Ability	Kbks1	0.897	0.7	Reliable
	Kbks2	0.830	0.7	Reliable
	Kbks3	0.869	0.7	Reliable
	Kbks4	0.872	0.7	Reliable
	Kbks5	0.912	0.7	Reliable

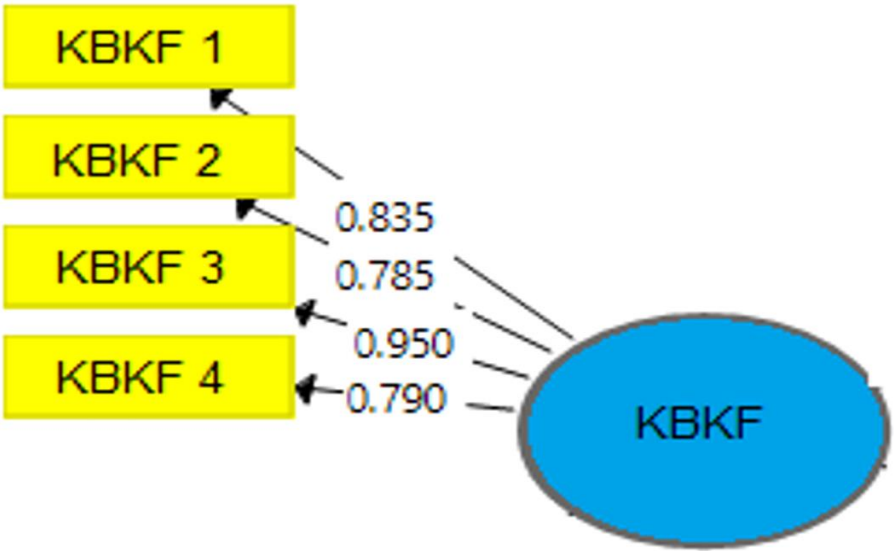

Figure 3.
Measurement Model for the KBKF Variable.

Based on the results of the analysis in the image above, the results obtained show that all indicators in the KBKF variable have values *loading factor > 0.7*, which means that all indicators can be used to measure the construct; no indicators need to be excluded because all indicators have met the required validity criteria. The loading factor values are presented in the following table.

Table 9.
Loading Factor Value in the Convergent Validity Test of the KBKF Variable.

Variable	Indicator	Loading Factor	Cut Value	Reliability
Creative Thinking Ability	KBKF1	0.835	0.7	Reliable
	KBKF2	0.785	0.7	Reliable
	KBKF3	0.950	0.7	Reliable
	KBKF4	0.790	0.7	Reliable

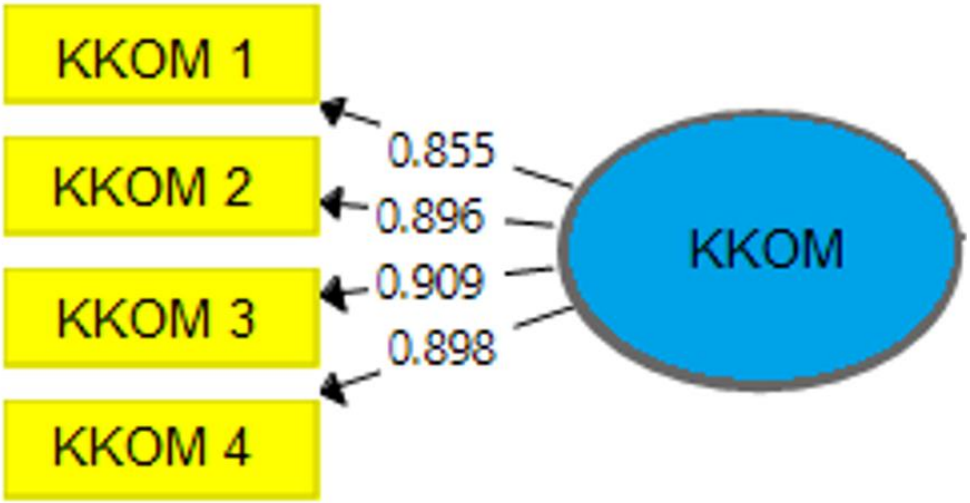

Figure 4.
Measurement Model for KKOM Variables.

Based on the results of the analysis in the image above, the results obtained show that all indicators in the KKOM variable have values *loading factor > 0.7*, which means that all indicators can be used to measure the construct. No indicators must be excluded because all indicators have met the required validity criteria. The loading factor values are presented in the following table.

Table 10.
Loading Factor Value in the Convergent Validity Test of the KKOM Variable.

Variable	Indicator	Loading Factor	Cut Value	Reliability
Communication Skills	KKOM1	0.855	0.7	reliable
	KKOM2	0.896	0.7	reliable
	KKOM3	0.909	0.7	reliable
	KKOM4	0.898	0.7	reliable

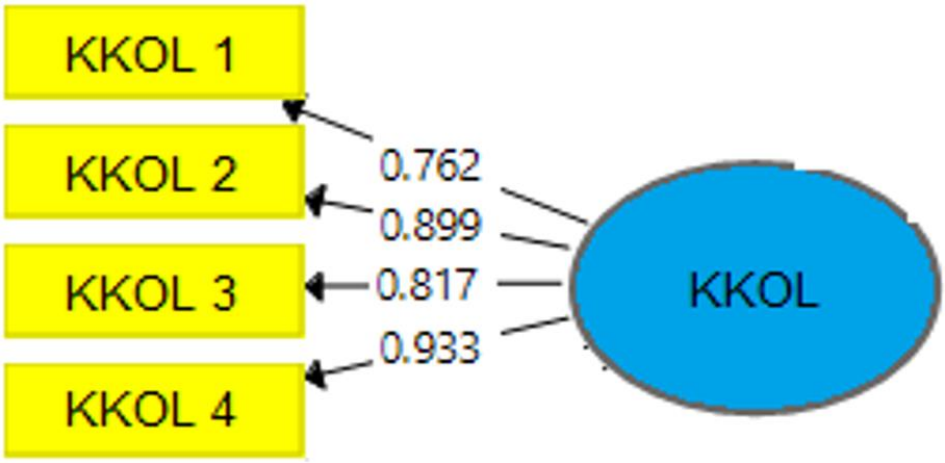

Figure 5.
Measurement Model for the KKOL Variable.

Based on the results of the analysis in the image above, the results obtained show that all indicators in the KKOL variable have values *loading factor > 0.7*, which means that all indicators can be used to measure the construct. No indicators must be excluded because all indicators have met the required validity criteria. The loading factor values are presented in the following table.

Table 11.
Loading Factor Value in the Convergent Validity Test of the KKOL Variable.

Variable	Indicator	Loading Factor	Cut Value	Reliability
Collaboration Capabilities	KKOL1	0.762	0.7	Reliable
	KKOL2	0.899	0.7	Reliable
	KKOL3	0.817	0.7	Reliable
	KKOL4	0.933	0.7	Reliable

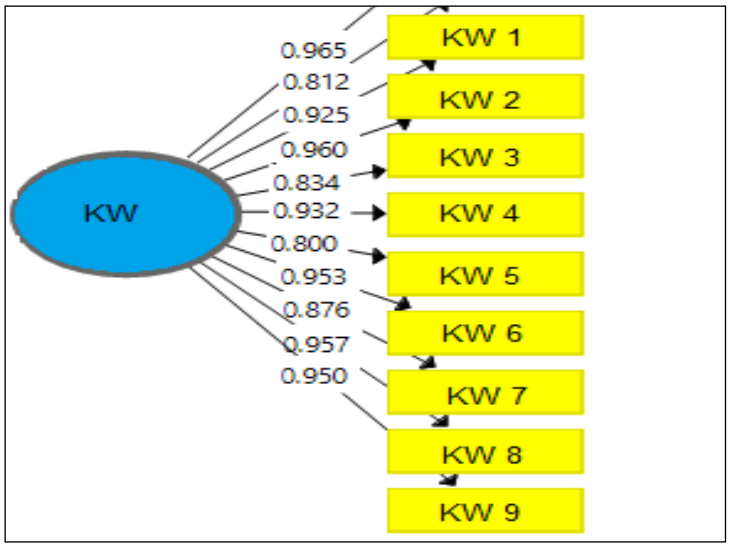

Figure 6.
Measurement Model for the KW Variable.

Based on the results of the analysis in the image above, the results obtained show that all indicators in the KW variable have values *loading factor > 0.7*, which means that all indicators can be used to measure the construct. No indicators must be excluded because all indicators have met the required validity criteria. The loading factor values are presented in the following table.

Table 12.
Loading Factor Value in the Convergent Validity Test of the KW Variable.

Variable	Indicator	Loading Factor	Cut Value	Reliability
Entrepreneurial Ability	KW1	0.965	0.7	reliable
	KW2	0.812	0.7	reliable
	KW3	0.925	0.7	reliable
	KW4	0.960	0.7	reliable
	KW5	0.834	0.7	reliable
	KW6	0.932	0.7	reliable
	KW7	0.800	0.7	reliable
	KW8	0.953	0.7	reliable
	Q9	0.876	0.7	reliable
	KW10	0.957	0.7	reliable
	KW11	0.950	0.7	reliable

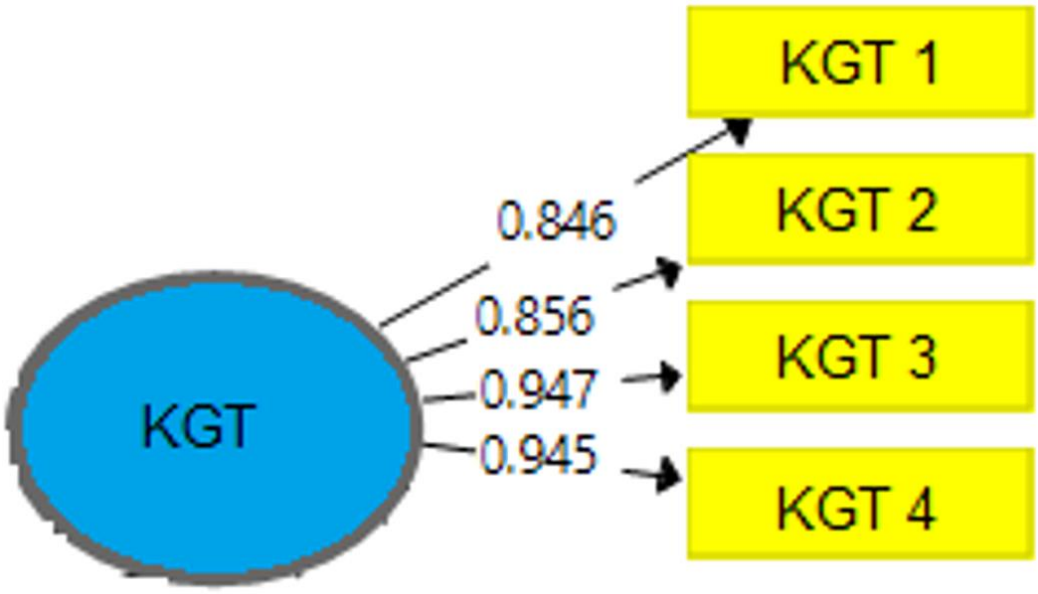

Figure 7.
Measurement Model for KGT Variables.

Based on the results of the analysis in the image above, the results obtained show that all indicators in the KGT variable have values *loading factor > 0.7*, which means that all indicators can be used to measure the construct. No indicators need to be excluded because all indicators have met the required validity criteria. The loading factor values are presented in the following table.

Table 13.
Loading Factor Value in the Convergent Validity Test of the KGT Variable.

Variable	Indicator	Loading Factor	Cut Value	Reliability
TEFA Teacher Competencies	KGT1	0.846	0.7	Reliable
	KGT2	0.856	0.7	Reliable
	KGT3	0.947	0.7	Reliable
	KGT4	0.945	0.7	Reliable

Apart from looking at the loading factor value of each indicator, convergent validity must also be assessed from the AVE value of each construct. All constructs in the PLS model are declared to have met convergent validity if the AVE value of each construct is > 0.5. The complete AVE value for each construct can be seen in the following table.

Table 14.
Construct AVE Value Table.

Variable	Average Variance Extracted (AVE)
KGT	0.824
KBKS	0.792
KBKF	0.777
KKOM	0.824
KKOL	0.750
KW	0.759

4.3. Structural Model Analysis

In this research, the analysis of the structural model goes through stages in the analysis using SEM PLS, which consists of: (1) assessing the goodness of fit of the model to ensure that the processed data fits with the estimated model so that the sample used can provide a picture of the actual condition of the population, and (2) conducting inner model testing, which is the stage of testing the influence between variables as a tool for testing research hypotheses.

Testing the *goodness of fit model* is a test carried out to ensure that the PLS model prepared fits the data being analyzed so that it can explain the actual condition of the population. *Goodness of fit model* PLS can be seen from the R Square and Q Square values of the model. The R Square value > 0.67 indicates that the PLS model is strong in predicting endogenous, R Square 0.33 – 0.67 indicates that the PLS model is in the quite strong (moderate) category and R Square 0.19 – 0.33 indicates that the PLS model is weak in predicting endogenous [37]. Meanwhile, the Q Square value shows a *predictive relevance* model, where the Q Square value of 0.02 – 0.15 indicates that the model has *predictive relevance* small, Q Square of 0.15 – 0.35 indicates that the model has *predictive relevance* medium and Q square > 0.35 indicates *predictive relevance* large model [37]. Besides that, *goodness of fit of* the model can also be assessed from the SRMR value of the model; the model is stated

perfect fit if the SRMR model value <0.08; Meanwhile, if the SRMR model is between 0.08 – 0.010, then the model is stated to be *fit* [38].

The analysis results in the table show that the R-squared value of the KGT variable model is 0.656 and the R-squared KW value is 0.702, which means that the model is in the strong category when used to predict entrepreneurial abilities and TEFA teacher competence. Furthermore, Q-squared KGT is 0.522 and Q-squared KW is 0.562; therefore, the model is stated to have *predictive relevance* large when used to predict entrepreneurial ability and TEFA teacher competency. Furthermore, the SRMR value of the model is also proven *perfect fit* because it has a model SRMR value <0.08.

Table 15.
R Square and Q Square Model Values.

Parameter GOF	Endogenous Variables	Mark	Criteria
R Square	KGT	0.656	Strong
	KW	0.702	Strong
Q Square	KGT	0.522	Big
	KW	0.562	Big
SRMR		0.055	Perfect Fit

4.3.1. Testing The Influence between Variables

In PLS analysis, after the model is proven to be fit, testing the influence between variables can be carried out. This influence testing includes direct influence testing, indirect influence testing, and total influence testing. Based on the estimation results of the SEM PLS model with the method *bootstrapping*, the following are the results of the PLS model estimation using the method *bootstrapping*. 500 samples will be used as a reference for testing the direct influence between variables in the PLS model.

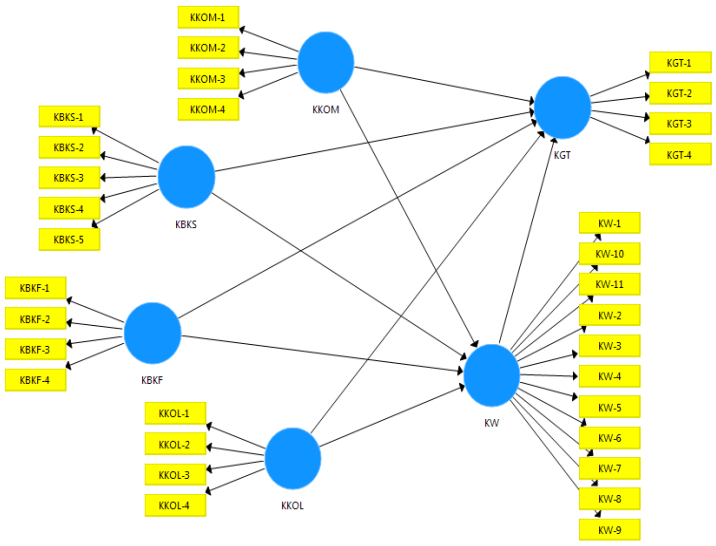

Figure 8.
PLS model estimation results with bootstrapping 500 sample.

Based on the results of the PLS model estimation using *bootstrapping* techniques of 500 samples, the results of testing the influence between variables were obtained as follows.

4.4. Direct Influence

Direct influence, often referred to as *direct effect*, is the influence of exogenous variables directly on endogenous variables. In SEM PLS analysis, the significance and direction of influence are directly seen from the values of *p value*, t statistics, and path coefficients connecting endogenous to exogenous variables. If the p value obtained is < 0.05 and the t statistic is > 1.65 (*one-tailed t value*), then it is concluded that the exogenous variable has a significant effect on the endogenous variable, with the direction of influence according to the sign attached to the path coefficient. Furthermore, if the p value obtained is > 0.05 and the t statistic < 1.96 (*one-tailed t value*), it is concluded that the exogenous variable has no significant effect on the endogenous variable.

Table 16.
Direct Effect Test Results.

Path	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	t Statistics (|O/STDEV|)	P Values
KKOM -> KGT	0.159	0.158	0.069	2.290	0.011
KKOM -> KW	0.411	0.409	0.051	8.096	0.000
KBKS -> KGT	0.267	0.265	0.064	4.168	0.000
KBKS -> KW	0.177	0.179	0.050	3.558	0.000
KW -> KGT	0.251	0.255	0.073	3.430	0.000
KKOL -> KGT	0.052	0.052	0.058	3.893	0.000
KKOL -> KW	0.164	0.163	0.045	3.674	0.000
KBKF -> KGT	0.183	0.182	0.052	3.479	0.000
KBKF -> KW	0.186	0.187	0.043	4.304	0.000

4.5. Indirect Influence

Indirect influence, often referred to as *indirect effect*, is the influence of exogenous variables on endogenous ones but through mediating variables (*intervening*). In this research, there is one mediating variable, namely the entrepreneurial interest variable. As in testing the direct effect, the significance of this indirect effect is assessed from the p-value and t statistic. A p-value < 0.05 and t statistic > 1.65 *(one-tail t statistics cut value)* shows that there is an intervening role in mediating exogenous and endogenous influences, while a p-value > 0.05 and the t statistic < 1.65 *(one-tail t statistics cut value)* shows that there is no intervening role in mediating exogenous and endogenous influences.

Table 17.
Indirect Effect Test Results.

	Original Sample (O)	t Statistics (|O/STDEV|)	P Values
KKOL -> KW -> KGT	0.041	2.851	0.002
KKOM -> KW -> KGT	0.103	3.054	0.001
KBKF -> KW -> KGT	0.047	2.635	0.004
KBKS -> KW -> KGT	0.044	2.321	0.010

Total influence is the sum of direct influence and indirect influence. The following figure shows a comparison of the total influence of all exogenous variables to endogenous variables.

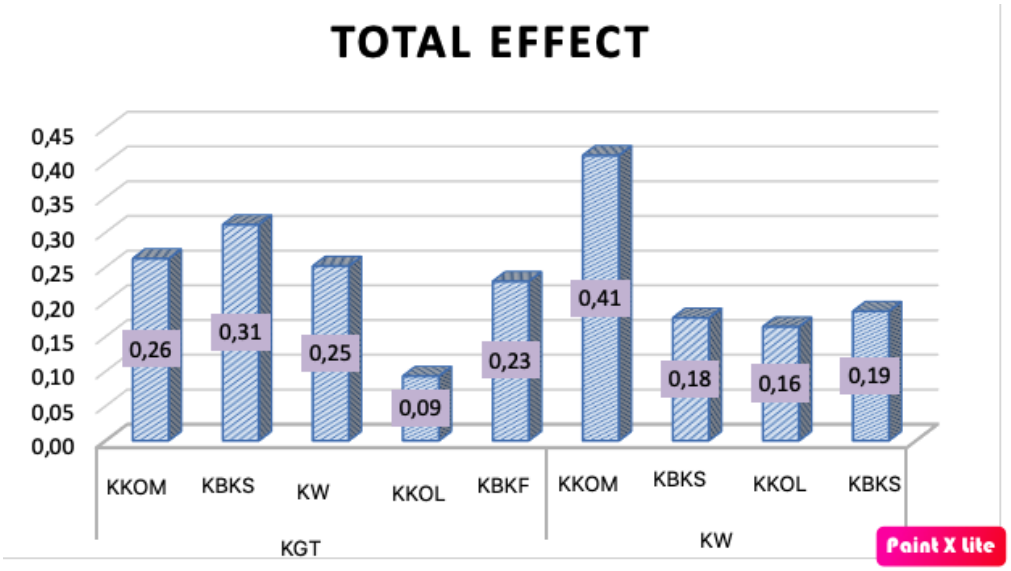

Figure 9.
Total Effect.

Based on the graph in Figure 9, the results of the analysis show that the most dominant factor influencing entrepreneurial ability is communication ability (total effect = 0.41), while the factors that most dominantly influence TEFA teacher competency are critical thinking skills, entrepreneurial skills, and communication skills.

4.6. Termination Coefficient

The coefficient of determination shows the magnitude of the influence of all exogenous variables on endogenous variables. The coefficient of determination can be seen from the value *R Square*. This value ranges between 0 – 1 or can also be interpreted in the form of a percentage (0 – 100%). The greater the coefficient of determination, the greater the endogenous

variance explained by the exogenous variables, while a small coefficient of determination indicates that the influence of the exogenous variables on the endogenous variables is still low. This is because there are still quite a lot of factors outside the exogenous variables that can influence the endogenous variables.

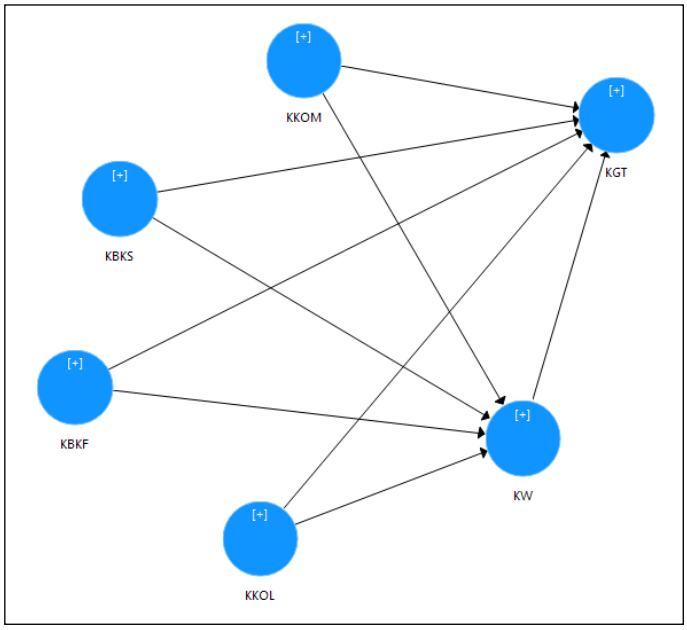

Figure 10.
Coefficient of Determination

The results of the analysis in Figure 10 above show that the R-squared value of entrepreneurial ability is 0.702; this means that 70.2% of entrepreneurial ability is influenced by critical thinking, creativity, communication, and collaboration skills, while the remaining 29.8% represents the variance in ability. Entrepreneurship is influenced by other factors beyond critical thinking, creativity, communication, and collaboration skills.

Furthermore, for the TEFA teacher competency variable, R square was obtained at 0.656, meaning that 65.6% of the variance in TEFA teacher competency was influenced by entrepreneurial abilities, critical thinking, creativity, communication, and collaboration abilities, while the remaining 34.4% of the variance in TEFA teacher competency was influenced by other factors beyond entrepreneurial ability, critical thinking, creativity, communication, and collaboration skills.

4.7. Hypothesis Testing

Testing hypothesis: This research was conducted based on the results of SEM PLS analysis. The following is a summary of the results of hypothesis testing in this research.

Table 18.
Summary of Hypothesis Testing Results.

No	Hypothesis	Results	Conclusion
1	There is a positive and significant influence of critical thinking skills on the entrepreneurial abilities of vocational school teachers in East Java.	Path Coef = 0.177; t Statistics = 3.558; p value = 0,000	accepted
2	There is a positive and significant influence of creative thinking abilities on the entrepreneurial abilities of vocational school teachers in East Java.	Path Coef = 0.186; t Statistics = 4.304; p value = 0,000	accepted
3	There is a positive and significant influence of communication skills on the entrepreneurial abilities of vocational school teachers in East Java.	Path Coef = 0.411; t Statistics = 8.096; p value = 0,000	accepted
4	There is a positive and significant influence of collaboration abilities on the entrepreneurial abilities of vocational school teachers in East Java.	Path Coef = 0.268; t Statistics = 3.758; p value = 0,000	accepted
5	There is a positive and significant influence of critical thinking skills directly on the competence of TEFA Vocational School teachers in East Java.	Path Coef = 0.267; t Statistics = 4.168; p value = 0,000	accepted

6	There is a positive and significant influence of creative thinking skills directly on the competence of TEFA Vocational School teachers in East Java.	Path Coef = 0.183; t Statistics = 3.479; p value = 0,000	accepted
7	There is a positive and significant influence of direct communication skills on the competence of TEFA Vocational School teachers in East Java.	Path Coef = 0.411; t Statistics = 2.290; p value = 0,011	accepted
8	There is a positive and significant direct influence of collaboration skills on the competence of TEFA Vocational School teachers in East Java.	Path Coef = 0.411; t Statistics = 2.290; p value = 0,011	accepted
9	There is a positive and significant influence of critical thinking skills indirectly on TEFA teacher competency through the entrepreneurial abilities of vocational school teachers in East Java.	t Statistics = 2.321; p value = 0,010	accepted
10	There is a positive and significant influence of creative thinking ability indirectly on TEFA teacher competency through the entrepreneurial ability of vocational school teachers in East Java.	t Statistics = 2.635; p value = 0,004	accepted
11	There is a positive and significant indirect influence of communication skills on TEFA teacher competency through the entrepreneurial abilities of vocational school teachers in East Java.	t Statistics = 3.054; p value = 0,001	accepted
12	There is a positive and significant indirect influence of collaboration ability on TEFA teacher competency through the entrepreneurial ability of vocational school teachers in East Java.	Path Coef = 0.575; T Statistics = 2.635; p value = 0.004	accepted
13	There is a positive and significant influence of entrepreneurial ability on the competency of TEFA Vocational School teachers in East Java.	Path Coef = 0.251; t Statistics = 3.430; p value = 0,011	accepted

5. Discussion

5.1. Positive and Significant Influence of Critical Thinking Ability on the Entrepreneurial Ability of Vocational School Teachers in East Java

Critical thinking skills positively and significantly influence teachers' entrepreneurial abilities. The better a teacher's critical thinking skills, the higher their entrepreneurial abilities. Conversely, teachers with low critical thinking abilities tend to have lower entrepreneurial abilities. Previous research, as found by Febiana et al. [39], Melese et al. [40] and Echeverri-Sánchez et al. [41], shows that critical thinking allows teachers to make better decisions, solve problems effectively, and create a conducive learning environment. This supports students' readiness to face challenges in the world of entrepreneurship. Therefore, it is important to provide training to develop teachers' critical thinking skills in order to form a generation that is ready for entrepreneurship.

5.2. Positive and Significant Influence of Creative Thinking Ability on Entrepreneurial Abilities of Vocational School Teachers in East Java

The ability to think creatively has a positive and significant effect on entrepreneurial ability. Creative teachers are better able to integrate innovative approaches in teaching and build extensive networks that support entrepreneurial development. Research by Widiasih and Darma [42] and Siyamto [43] reveals that teacher creativity plays an important role in equipping students with the skills needed to become successful entrepreneurs. Therefore, investment in developing teacher creativity is very important for creating a healthy and sustainable entrepreneurial ecosystem.

5.3. Positive and Significant Influence of Communication Skills on the Entrepreneurial Abilities of Vocational School Teachers in East Java

Good communication skills have a positive and significant effect on teachers' entrepreneurial abilities. Teachers who are able to communicate well are better equipped to establish relationships with other parties, expand networks, and solve problems in the world of entrepreneurship. Research by Rusman [44] and Alizar and Mariyanti [45] shows that communication skills are very important for long-term success in entrepreneurship. Developing communication skills should be a priority in entrepreneurship education.

5.4. Positive and Significant Influence of Collaboration Ability on Entrepreneurial Abilities of Vocational School Teachers in East Java

Collaboration ability has a positive and significant effect on entrepreneurial skills. Teachers who are skilled in collaboration can leverage existing resources, encourage innovation, and expand networks to increase competitiveness. Findings by Kuckertz and Wagner [46] and Phipps [47] show that collaboration is the key to optimizing opportunities and creating sustainable businesses. Therefore, teachers and entrepreneurs need to improve their collaboration skills in the world of entrepreneurship.

5.5. Positive and Significant Influence of Critical Thinking Ability Directly on the Competency of TEFA Vocational School Teachers in East Java

Critical thinking skills have a positive and significant effect on TEFA (Teaching Factory) teacher competency. Teachers with strong critical thinking skills can make more appropriate decisions in the educational context and enhance their competence in implementing more effective learning methods. Findings from Possin [48] and Thompson [49] show that critical thinking skills are essential for teachers to inspire students to face future challenges.

5.6. Positive and Significant Influence of Creative Thinking Ability Directly on the Competency of TEFA Vocational School Teachers in East Java

The ability to think creatively also has a positive and significant effect on TEFA teacher competency. Creative teachers can develop innovative approaches in the learning process and help shape students' character and skills needed in the workforce. Research by Foster [50] and Setiawan et al. [51] shows that fostering teacher creativity is very important to improve the quality of education in Indonesia.

5.7. Positive and Significant Influence of Direct Communication Ability on the Competency of TEFA Vocational School Teachers in East Java

Communication skills have a positive and significant effect on TEFA teacher competency. Teachers who are skilled at communicating can convey lesson material, manage the class well, and build positive relationships with students and parents. This aligns with the findings of Messersmith [52] and Cahyono and Danim [53], who stated that good communication supports teaching success and creates a conducive learning environment.

5.8. Positive and Significant Influence of Direct Collaboration Ability on the Competency of TEFA Vocational School Teachers in East Java

Collaboration skills have a positive and significant effect on TEFA teacher competency. Teachers who can collaborate well can improve the quality of teaching and build strong relationships with various parties. Findings by Wulansari and Sunarya [54] and Azmi and Rahmi [55] emphasize that effective collaboration is essential in creating an educational environment that supports holistic student development.

5.9. Positive and Significant Influence of Critical Thinking Ability Indirectly on TEFA Teacher Competency through the Entrepreneurial Ability of Vocational School Teachers in East Java

Critical thinking skills can have a positive and significant effect on TEFA teacher competency, mediated by entrepreneurial abilities. High critical thinking skills can increase teachers' entrepreneurial abilities, which in turn will enhance TEFA teacher competence. Research by Fayolle et al. [56] and Brunel et al. [57] shows that critical thinking skills can support the development of teacher competence in managing classes and creating innovative learning environments.

6. Conclusion

This research shows that critical thinking, creativity, communication, and collaboration skills positively and significantly influence the entrepreneurial abilities and competence of TEFA Vocational School teachers in East Java. Teachers who can think critically and creatively can develop innovative teaching methods and inspire students to become entrepreneurs. Communication and collaboration skills strengthen relationships and synergies with students, colleagues, and the community, creating a conducive learning environment and supporting the development of entrepreneurial skills. In addition, teachers' entrepreneurial abilities also strengthen their competence in TEFA learning, enabling them to design teaching that is more effective and adaptive to changes and challenges in education.

References

[1] R. Kumar and S. Shukla, "Creativity, proactive personality and entrepreneurial intentions: examining the mediating role of entrepreneurial self-efficacy," *Global Business Review*, vol. 23, no. 1, pp. 101-118, 2022. https://doi.org/10.1177/0972150919844395

[2] M. A. Hilmi, M. Munoto, and E. Hariyadi, "Entrepreneurial readiness of vocational high school students in the industrial revolution 4.0 era through improving 21st century skills," *Journal of Education Informatic Technology and Science*, vol. 2, no. 2, pp. 61-69, 2020. https://doi.org/10.37859/jeits.v2i2.1990

[3] M. Zunaedy, S. Aisyah, and T. Ayuningtyas, "Faktor-faktor yang mempengaruhi minat berwirausaha mahasiswa Pendidikan Ekonomi angkatan 2016 STKIP PGRI Lumajang tahun akademik 2020/2021," *Jurnal Riset Pendidikan Ekonomi*, vol. 6, no. 1, pp. 47-59, 2021. https://doi.org/10.21067/jrpe.v6i1.5294

[4] I. P. Satyantoro and E. Andayani, "Efikasi diri, pendidikan kewirausahaan dan ekspektasi pendapatan: pengaruh terhadap minat berwirausaha," *Jurnal Riset Pendidikan Ekonomi*, vol. 6, no. 1, pp. 78-86, 2021. https://doi.org/10.21067/jrpe.v6i1.5324

[5] Hendro, *Basics of entrepreneurship*. Jakarta: Erlangga, 2011.
[6] Santrock, *Life-span development: Life-span development*. Jakarta: Penerbit Erlangga, 2011.
[7] Zubaedi, *Character education design: Conception and application in educational institutions*. Jakarta: Kencana, 2012.
[8] Y. Martinis, *Strategies and methods in learning models*. Jakarta: Gaung Persada Press, 2013.
[9] R. H. Ennis, *Critical thingking test*. USA: Bright Minds, 2005.
[10] G. B. Watson and E. M. Glaser, *Watson-glaser critical thinking appraisal*. San Antonio: Harcourt Brace, 1980.
[11] T. Y. E. Siswono, *Mathematics learning model based on submitting and solving problems to improve creative thinking skills*. Surabaya: Unesa University Press, 2008.
[12] E. A. Silver, "Fostering creativity through instruction rich in mathematical problem solving and problem posing," *ZDM–Mathematics Education*, vol. 29, no. 3, pp. 75-80, 1997.
[13] R. Leikin and M. Lev, "Multiple solution tasks as a magnifying glass for observation of mathematical creativity," in *In Proceedings of the 31st International Conference for the Psychology of Mathematics education (Vol. 3, pp. 161-168)*, 2007.
[14] R. Leikin, *Exploring mathematical creativity using multiple solution tasks*. Haifa: Brill Publisher, 2009.
[15] H. Elisabet, *Developmental psychology a life span approach*. Jakarta: Erlangga, 2010.
[16] B. Trilling and C. Fadel, *21st century skills: Learning for life in our times*. John Wiley & Sons. https://doi.org/10.5860/choice.47-5788, 2009.
[17] H. Cangara, *Introduction to communication science*. Jakarta: PT Raja Grafindo Persada, 2011.
[18] S. Morreale, C. Staley, C. Stavrositu, and M. Krakowiak, "First-year college students' attitudes toward communication technologies and their perceptions of communication competence in the 21st century," *Communication Education*, vol. 64, no. 1, pp. 107-131, 2015. https://doi.org/10.1080/03634523.2014.978799
[19] W. Murawski, *Collaborative teaching in elementary schools: Making the co-teaching marriage work!* California: Corwin Press, 2010.
[20] A. Woolfolk, *Educational psychology*. Boston: Education, 2007.
[21] L. Greenstein, *Assessing 21st century skills: A guide to evaluating mastery and authentic learning*. California: Corwin Press, 2012.
[22] F. Chiocchio, S. Grenier, T. A. O'Neill, K. Savaria, and J. D. Willms, "The effects of collaboration on performance: A multilevel validation in project teams," *International Journal of Project Organisation and Management*, vol. 4, no. 1, pp. 1-37, 2012. https://doi.org/10.1504/IJPOM.2012.045362
[23] Kasmir, *Entrepreneurship*. Jakarta: PT Raja Grafindo Persada, 2010.
[24] R. D. Hisrich, M. P. Peters, and D. A. Shepherd, *Entrepreneurship Chriswan Sungkono & Diana Angelica, Trans*. New York: Mc-Graw-hill, 2008.
[25] Z. Frinces, *Be an entrepreneur*. Yogyakarta: Graha Ilmu, 2011.
[26] R. A. Supriyono, *Management accounting 3: Management control process*. Yogyakarta: BPFE UGM, 1991.
[27] M. Nitisusastro, *Entrepreneurship and small business management*. Bandung: Alfabeta, 2010.
[28] S. S. Sudiyono, "Teaching factory sebagai upaya peningkatan mutu lulusan di SMK," *Jurnal Penelitian Kebijakan Pendidikan*, vol. 12, no. 2, pp. 159-181, 2019. https://doi.org/10.24832/jpkp.v12i2.271
[29] Mulyasa, *Becoming a professional teacher creates creative and fun learning*. Bandung: PT Remaja Rosdakarya, 2015.
[30] A. Machmuda, M. A. Burhanudin, E. Ahman, and H. Mulyadi, "Teaching factory in vocational highschool: Bibliometric analysis," *Jurnal Pendidikan Ekonomi Undiksha*, vol. 14, no. 1, pp. 63-71, 2022. https://doi.org/10.23887/jjpe.v14i1.42385
[31] S. K. Shivakumar, "Digital factory for digital transformation," *Elements of Digital Transformation*, pp. 104–110, 2023. https://doi.org/10.1201/9781003390893-9
[32] K. Randolph and L. Myers, *Basic statistics in multivariate analysis*. New York: Oxford University Press, 2013.
[33] E. Riadi, *Research statistics manual analysis and IBM SPSS*. Yogyakarta: Andi Publisher, 2016.
[34] D. Harrington, *Confirmatory factor analysis*. New York: Oxford University Press, 2008.
[35] T. Raykov and G. A. Marcoulides, *A first course in structural equation modeling*. London: Lawrence Erlbaum Associates, 2006.
[36] S. Isaac and W. B. Michael, *Handbook in research and evaluation*. San Diego: Edits Publisher, 1982.
[37] W. W. Chin, *Commentary: Issues and opinion on structural equation modeling*. JSTOR, 1998, pp. 7-16.
[38] J. F. Hair, R. L. Tatham, R. E. Anderson, and B. William, *Multivariate data analysis*. Upper Saddle River: Prentice Hall, 1998.
[39] C. Febiana, L. Goenadhi, I. Suharto, and A. P. Wijayanti, "Formation of entrepreneurial character in Gen Z facing society 5.0," *Jurnal Ilmiah Universitas Batanghari Jambi*, vol. 23, no. 1, pp. 319-324, 2023. https://doi.org/10.33087/ekonomis.v7i1.1073
[40] S. Melese, D. P. Das, S. K. Ghadai, and A. Bajpai, "Entrepreneurial intentions among business students in Ethiopia," *International Journal of Innovative Technology and Exploring Engineering*, vol. 8, no. 10, pp. 1660-1663, 2019. https://doi.org/10.35940/ijitee.J8882.0881019
[41] L. Echeverri-Sánchez, A. Valencia-Arias, M. Benjumea-Arias, and A. B.-D. Toro, "Factors influencing university students' entrepreneurial intentions: A qualitative analysis," *Revista Electrónica Educare*, vol. 22, no. 2, pp. 160-178, 2018. https://doi.org/10.15359/ree.22-2.10
[42] N. P. S. Widiasih and G. S. Darma, "Millennial digital content creator on new normal era: Factors explaining digital entrepreneur intention," *Asia Pacific Management and Business Application*, vol. 10, no. 2, pp. 161-176, 2021. https://doi.org/10.21776/ub.apmba.2021.010.02.4
[43] Y. Siyamto, "Menumbuhkan jiwa wirausaha generasi muda di era pandemi dengan memanfaatkan teknologi digital," *Penamas: Journal of Community Service*, vol. 2, no. 2, pp. 112-119, 2022. https://doi.org/10.53088/penamas.v2i2.436
[44] R. F. N. Rusman, "The influence of material mastery, critical thinking, creativity, communication and collaboration on students' teaching ability," *Journal of Social Science Education*, vol. 4, no. 2, pp. 96-102, 2023. https://doi.org/10.23960/jips/v4i2.96-102
[45] S. N. Alizar and E. Mariyanti, "Why are entrepreneurial competencies and characteristics important?," *Jurnal Ekonomi Manajemen Dan Bisnis*, vol. 3, no. 2, pp. 232–238, 2024. https://doi.org/10.47233/jemb.v3i2.2047
[46] A. Kuckertz and M. Wagner, "The influence of sustainability orientation on entrepreneurial intentions—Investigating the role of business experience," *Journal of business venturing*, vol. 25, no. 5, pp. 524-539, 2010. https://doi.org/10.1016/j.jbusvent.2009.09.001
[47] S. T. Phipps, "Contributors to an enterprising gender: Examining the influence of creativity on entrepreneurial intentions and the moderating role of political skill controlling for gender," *Academy of Entrepreneurship Journal*, vol. 18, no. 1, p. 77, 2012.

[48] K. Possin, "Critique of the Watson-Glaser critical thinking appraisal test: The more you know, the lower your score," *Informal Logic*, vol. 34, no. 4, pp. 393-416, 2014. https://doi.org/10.22329/il.v34i4.4141

[49] C. C. Thompson, "Advancing critical thinking through learning issues in problem-based learning," *Medical Science Educator*, vol. 29, pp. 149-156, 2019. https://doi.org/10.1007/s40670-018-00649-2

[50] M. K. Foster, "Design thinking: A creative approach to problem solving," *Management Teaching Review*, vol. 6, no. 2, pp. 123-140, 2021. https://doi.org/10.1177/2379298119871468

[51] A. Setiawan, A. Malik, A. Suhandi, and A. Permanasari, "Effect of higher order thinking laboratory on the improvement of critical and creative thinking skills," presented at the IOP Conference Series: Materials Science and Engineering, 306(1). https://doi.org/10.1088/1757-899X/306/1/012008, 2018.

[52] A. S. Messersmith, "Preparing students for 21st century teamwork: Effective collaboration in the online group communication course," *Communication Teacher*, vol. 29, no. 4, pp. 219-226, 2015. https://doi.org/10.1080/17404622.2015.1046188

[53] S. Cahyono and S. Danim, "Promoting critical thinking, communication collaboration and creativity (4c) in teaching speaking using the fishbowl strategy," *Tadbir: Jurnal Studi Manajemen Pendidikan*, vol. 7, no. 2, pp. 434-446, 2023. https://doi.org/10.29240/jsmp.v7i2.8168

[54] K. Wulansari and Y. Sunarya, "Keterampilan 4C (critical thinking, creativity, communication, dan collaborative) guru Bahasa Indonesia SMA dalam pembelajaran abad 21 di era industri 4.0," *Jurnal Basicedu*, vol. 7, no. 3, pp. 1667-1674, 2023. https://doi.org/10.31004/basicedu.v7i3.5360

[55] U. Azmi and M. Rahmi, "Analysis of 4C skills (critical thinking, creativity and innovation, collaboration, and communication) of physics education students in facing the industrial revolution 4.0," *Jurnal Penelitian Pendidikan IPA*, vol. 10, no. 2, pp. 695-703, 2024. https://doi.org/10.29303/jppipa.v10i2.5584

[56] A. Fayolle, F. Liñán, and J. A. Moriano, "Beyond entrepreneurial intentions: Values and motivations in entrepreneurship," *International Entrepreneurship and Management journal*, vol. 10, pp. 679-689, 2014.

[57] O. Brunel, E. M. Laviolette, and M. Radu-Lefebvre, "Role models and entrepreneurial intention: The moderating effects of experience, locus of control and self-esteem," *Journal of Enterprising Culture*, vol. 25, no. 02, pp. 149-177, 2017. https://doi.org/10.1142/s0218495817500066