



## Research on the cultivation path of young teachers in higher vocational education based on competency modeling

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**SUMMARY:** *At present, China is in a critical period of digital transformation of education, and in order to fit the important idea of “strong teaching first, strong teachers”, the development of teacher competency analysis has become a key anchor point to meet the demands of this reality. The article takes some young teachers in higher vocational education as the research object, constructs a competency model of young teachers in higher vocational education based on PLS-SEM based on the four dimensions of achievement motivation, personality traits, cognitive ability and cultivating students, and puts forward the research hypotheses. Finally, the relationship between different competency elements and the cultivation of senior young teachers is explained empirically. The results show that achievement motivation, personality traits, cognitive ability, and training students have a significant positive effect on the training of senior young teachers, meanwhile, competency has an important mediating effect in the training of senior young teachers.*

**KEYWORDS:** *competency modeling; structural equation modeling; PLS algorithm; senior young teachers*

### 1 Introduction

In light of the fast-paced growth of the economy, increased competition in the market, and the adoption of staffing reforms in the higher vocational college and university sector, it becomes necessary for higher vocational colleges and universities to seek sustainable development in such a scenario. It has been observed that one of the aspects that must receive attention during the process of sustainable development is the development and training of teachers. The development of young teachers, who form the backbone of higher vocational colleges and universities, is crucial to the very existence of these institutions. Nevertheless, the training of young teachers in higher vocational colleges and universities today faces challenges such as unclear objectives, inappropriate training curriculum, and poor evaluation mechanisms. [1, 2]. For young teachers, what they need more is that the training content is compatible with the job demand, i.e., job competence [3].

The concept of "competency" was initially applied in enterprise human resource management, suggesting that the assessment of employees should be based on competency rather than intelligence. Competency is the most significant factor contributing to the performance differences between outstanding employees and ordinary employees in their positions, encompassing all measurable personal characteristics, work motivation, work attitude, emotional values, and certain knowledge, actions, and skills in specific professional fields [4-7]. "Competency of young teachers in higher vocational education" is the key quality

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<https://doi.org/10.65102/is2026418>

factors that support the professional growth of young teachers after they enter higher vocational institutions, including explicit and highly malleable competencies such as professional knowledge, practical skills and scientific and technological abilities, as well as implicit and firm competencies such as professionalism and work attitude [8-11]. This means that universities and higher vocational schools must create effective teacher training programs based on the competence model and systematically build teacher training techniques using an effective teacher competency standard system. [12, 13]. Therefore, the issue of solving the problem of low teaching skills and lack of teaching experience among young teachers needs to be addressed so as to help improve their professional skills.

Competence is an important prerequisite for improving the quality of teaching and learning, and for the application of the competence model in teacher training, literature [14] developed a competence-based training model for teachers of vocational high schools specializing in electric power, and by collecting data through the tools of validation forms, observations and questionnaires, it confirmed that the model meets the criteria in terms of validity, utility and training outcomes, and it is applicable to the activities of the relevant teachers' training. Literature [15], by analyzing student questionnaires, identified the key components of teacher training in the competency education model, compared their order of importance for professional activities, and provided recommendations for the development of research capacity in universities. Literature [16] developed a competency model for primary teachers based on expert interviews and literature analysis, identified the components of competencies, and suggested the proper competency framework, emphasizing the model's importance in improving teachers' credentials and academic performance. Literature [17] discusses the shift to competency-based teacher training, emphasizing the shift from process-oriented to result-oriented, and focusing on the cultivation of personal traits and problem-solving abilities, and using education information technology as a means to promote professional development. Literature [18] analyzed the competency model of initial teacher training in cross-cultural contexts through a literature review, explored its limitations in incorporating indigenous diversity, and pointed out the need to reconstruct the training model to integrate conceptual and relational elements of teaching, research, and practice to achieve professional performance in the context of socio-cultural diversity. Literature [19] emphasizes that the Educational Competencies program provides competency-based professional training for international educators to help them understand the German VET system through the design of customized programs and a variety of formats in order to achieve continuous professional improvement. Literature [20] analyzed the competency needs of teachers in technical colleges in the state of Bachai through a questionnaire survey, identified 25 key competencies, and constructed a competency model for teachers of vocational and technical education based on the data, which provided a preliminary analysis basis for subsequent training and application.

In addition to this, literature [21] explored the relationship between higher education teacher competency oriented teaching and teaching transformation, based on the analysis of survey data showed that teaching attitudes and willingness to teach positively influenced teaching identity, which in turn drove the transformation of teaching readiness and practice, and summarized three typical styles of teacher development. Literature [22] studied that the Australian VET reform focuses on changes in teacher competencies, analyzes the adjustment of teacher identity in the context of industry, and emphasizes its use of training package flexibility to develop apprenticeship practice. Literature [23] analyzed the limitations of the traditional teacher competency development model, pointed out through research the need to develop flexible pathways, and emphasized the need for structural support for alternative certification programs to ensure the effectiveness of the development. Literature [24] examined competency-based teacher development by analyzing the systemic competencies of teachers in

integrating teaching and research, pointing out that their development follows a nonlinear recursive model, and emphasizing that the model supports teachers in constructing individualized development paths. The literature review [25] highlights some issues in the process, such as teacher training and evaluation systems, while highlighting the significance of the competency-based approach in reforming vocational education. It also elaborates on curriculum design and delivery through the development of a competency model and the improvement of curriculum and instructional approaches, noting that this is an important route to produce competent workers. Literature [26] examined the impact of teacher competency on performance, and found through analysis that competency not only directly and significantly improves teacher performance, but also indirectly acts on this through positively influencing certification incentives, while emphasizing the direct contribution of job performance appraisal to performance. The experience of creating a curriculum based on competencies for teachers transitioning to a competency-based educational system is presented in the literature [27], and via team building, the experience of overcoming challenges encountered throughout the process is described. Literature [28] aimed to enhance teacher competence by establishing and evaluating a competency-based learning management training course, first analyzing expert assessments of the course content, then comparing training effectiveness through a single-group pre and post-test, and examining participants' satisfaction with the course.

The article first elaborates on the connotation of the competency model for young teachers in higher vocational education, and constructs a competency consisting of four dimensions of achievement motivation, personality traits, cognitive ability, and cultivation of students, as well as twelve competencies such as achievement orientation, information gathering, initiative, monitoring ability, self-regulation, flexibility, interpersonal comprehension, service organization, analytical ability, inductive ability, long-term cultivation plan, willingness to cultivate talents, and influence. A model for the development of young teachers in higher education. Then, questionnaires were distributed with senior young teachers as the research object to describe and analyze the overall characteristics of the research sample. At the same time, teaching competence was analyzed by clustering and discriminant analysis, and the PLS-SEM model was combined to explore the influence of teachers' competence on the training of young teachers in higher education.

## 2 Study design

### 2.1 Determination of the theoretical model of competence of young teachers in higher education

#### 2.1.1 Competency Model for Young Teachers in Higher Education

It is generally recognized that a given competency is an organic synthesis of certain characteristics. The so-called competency model is the optimal combination of competencies required for the job and closely related to high performance, reflecting the deep-seated characteristics possessed by individuals. Higher vocational young teachers competency is a collection of individual behavioral characteristics of higher vocational young teachers that can produce high performance. The competency model of high vocational young teachers is the best combination of high vocational young teachers' competency that matches with career development and job requirements, reflecting the deepest individual characteristics of high vocational young teachers. We mainly grasp the connotation of the competency model of young teachers in higher vocational education from the following aspects.

- (1) Higher vocational young teachers refer to practitioners engaged in professional teaching,

after-school training, after-school competitions, extracurricular activities and other activities, including teachers, coaches, instructors and related managers.

(2) According to the notion of the iceberg model of competency, the potentiality and stability of a person's unique qualities are related to the deep-level competencies of experienced teachers. They include social roles, motivation, personality, and attributes.

(3) In higher vocational education, the competency traits of young teachers may both predict performance and distinguish between high-performance and ordinary performances. This is important from a methodological standpoint when it comes to hiring, training, and assessing young instructors in higher vocational education.

(4) Not all behavioral characteristics of an individual are necessary for high vocational young teachers, it is specific, targeted, able to predict the behavioral style, and through these behavioral styles can be predicted high vocational young teachers performance.

### **2.1.2 Steps of Research on Competency Modeling of Young Teachers in Higher Education**

According to the specific requirements of this study, the following procedures were formulated:

(1) Through field visits to relevant experts and scholars, and on the basis of analyzing the positions of young teachers in higher vocational education, the criteria for high performance of young teachers in higher vocational education are determined, i.e., those who meet one of the following criteria can be regarded as high-performing young teachers in higher vocational education:

1) Through field investigations involving relevant experts and scholars, and based on an examination of the characteristics of outstanding teachers in higher vocational education, the criteria for identifying outstanding early-career teachers in higher vocational education were defined, namely, individuals who satisfy any one of the following conditions can be recognized as high-performing early-career faculty members in higher vocational education:

(1) Higher vocational early-career teachers who have received honors such as provincial-level and above backbone teachers, excellent (model) teachers, and teaching excellence awards.

2) Teachers whose teams have ranked within the top 3 in competitions at the local and municipal levels or within the top 6 in contests at the provincial level.

3) Teachers who have obtained the national certificate of backbone training for novice teachers.

(2) Drawing on the group discussion of relevant senior experts regarding the role of senior teachers, and by consulting McBer's Common Competency Dictionary, the proposed competency model for senior young teachers was developed and classified into 4 dimensions.

1) Achievement motivation family. Reflecting the teachers' action orientation in setting goals and realizing them, it is the source of motivation and effective guarantee that the other trait families can work.

2) Personality trait family. Personality traits are the unique psychological composition of an individual's self-cognition, self-experience and self-control, characterized by stability and consistency. This family determines the self-control and problem-solving behavioral efficacy of young teachers in higher vocational education when facing unexpected events or problems, and it also has an important supporting role for other family characteristics to play.

3) Cognitive ability family. This family consists of analytical ability and inductive ability, which is the basic ability of senior teachers to recognize the external world, and is closely related to the specific work of senior teachers.

4) Cultivating students family. This family reflects the willingness and influence of senior young teachers to make long-term cultivation plans on the basis of the analysis of the cultivation needs of senior young teachers, to actively adopt positive expectations and positive feedback

to the cultivated students, and to provide help.

(3) Based on the assumption of the competency model of senior young teachers, on the basis of further consulting senior 7 experts' opinions, the Likert 5-point questionnaire of the competency model of senior young teachers was finally formed, and the respondents were asked to score whether the gap between the high performers and the average performers of the senior young teachers was typical or not.

(4) A 360-degree questionnaire was administered to the participants to collect and analyze the data to validate the competency model of senior young teachers. The formal survey was conducted from April 30, 2024 to May 25, 2024, targeting some of the high school young teachers in the province, 650 electronic and paper questionnaires were distributed, 620 valid questionnaires were recovered, and the sample validity rate was 95.38%.

### **2.1.3 Establishment of a Competency Model for Young Teachers in Higher Education**

The data collected from the valid questionnaires were examined to identify the competency framework of early-career teachers in higher education according to the following criteria:

(1) On the basis of how closely each item corresponded to the research focus, question items with a correlation coefficient below 0.5 with the total score were removed;

(2) In line with the discrimination requirements of the study, the items were further tested, and those showing no significant difference between high-score and low-score groups were excluded;

(3) For each item, when the coefficient of variation, that is, the ratio of the standard deviation to the mean, exceeded 0.2, it suggested that respondents' views on that issue were relatively dispersed and lacked consistency, and therefore the item should be eliminated.

In conclusion, the competency model for early career academics working within higher education was set out in Table 1. The participants believed that the following 12 competencies would be sufficient in distinguishing high performing academics from ordinary ones: achievement orientation, information gathering, initiative, monitoring, self-control, adaptability, interpersonal sensitivity, customer orientation, analysis, induction, long-range planning, talent nurturing, and influence.

Table 1: Competency Model for Young Teachers in Higher Vocational Colleges

Primary indicator	Secondary indicators	Indicator observation point	Mean	SD	consistency
Achievement motive (A)	Achievement-oriented (A1)	Teachers have clear plans for their own achievement goals (A11)	4.07	0.8	0.1
		Teachers are very concerned about their own jobs (A12)	4.1	0.86	0.33
		Teachers are courageous in innovation in their work (A13)	3.92	1.14	0.15
	Initiative (A2)	Teachers are forward-looking when dealing with problems or facing opportunities (A21)	4.1	0.71	0.131
	Monitoring capability (A3)	The planning of teachers' campus football activities (A31)	4.14	0.77	0.22
	Information collection (A4)	Teachers' awareness and ability to take the initiative in learning (A41)	4.16	0.56	0.11
		Teachers' awareness and ability to obtain information (A42)	4.06	0.79	0.15
Personality characteristics (B)	Self-control (B1)	Teachers can regulate their own emotions and behaviors (B11)	4.05	0.88	0.25
		The independence of teachers' decision-making (B12)	4.06	0.72	0.16
	Flexibility (B2)	The awareness and ability of campus football teachers to update their thoughts and knowledge in a timely manner (B21)	4.12	0.83	0.17
		The ability of campus football teachers to respond to emergencies (B22)	4.17	0.75	0.04
	Influence (B3)	The influence of teachers on students' values and behaviors (B31)	3.65	0.98	0.1
	Interpersonal understanding (B4)	The teacher's understanding and grasp of the motivation of the students' motivation (B41)	4.14	0.72	0.23
	Service organization (B5)	The dedication of teachers to the sustainable development of campus football (B51)	4.15	0.94	0.13
Cognitive ability (C)	Analytical ability (C1)	The ability of teachers to analyze complex problems in their work (C11)	3.7	1.19	0.16
		Teachers' ability to identify potential football talents (C12)	4.27	0.85	0.33
		The ability of teachers to plan competitions and training (C13)	3.94	0.64	0.17
	Inductive ability (C2)	The ability of teachers to summarize and generalize experiences from teaching training, competitions, etc. (C21)	4.16	0.86	0.17
		The ability of teachers to handle key problems creatively (C22)	3.96	0.99	0.3
Train students (D)	Long-term culture plan (D1)	The ability of campus football teachers to develop a long-term, systematic reserve talent training program (D11)	3.97	0.62	0.12
	The will and influence of cultivating talents (D2)	The degree of clarity of a teacher's concept of student subjectivity (D21)	4.12	0.89	0.16
		Teachers' assessment of students and learning guidance can (D22)	4.23	0.69	0.06
		The depth and breadth of teachers' scientific and humanistic knowledge (D23)	3.81	0.74	0.41
		The differences in the purposes and intentions of teachers in cultivating students (D24)	3.56	1.17	0.36

### 2.1.4 Research hypotheses

The present research proposes the following hypotheses:

H1: Achievement motivation exerts a significant positive influence on the development of young teachers in higher education.

H2: Personality traits exert a significant positive influence on the development of young teachers in higher education.

H3: Cognitive ability exerts a significant positive influence on the development of young teachers in higher education.

H4: Developing students exerts a significant positive influence on the development of young teachers in higher education.

H5: Competence serves as a mediating variable linking the four elements with the development of young teachers in higher education.

## 2.2 Structural Equation Modeling and PLS Algorithm

### 2.2.1 Principles underlying structural equation modeling

In terms of variables, the SEM has two types of variables, such as latent and observed variables, together with endogenous and exogenous variables. Latent variables are those which are not directly measurable and hence are termed potential variables, while observed variables are those which are directly measurable and thus termed manifest variables or indicator variables. SEM is typically made up of two models, such as the measurement model and the structural model. While the former looks at the relationship between the unobservable latent variables and the directly measurable observed variables, the latter looks at the relationship between the latent variables. Measurement Model:

The expression of the measurement model is:

$$X = \Lambda_x \xi + \delta \quad (1)$$

$$Y = \Lambda_y \eta + \varepsilon \quad (2)$$

where

$X = (x_1, x_2, \dots, x_q)^T$  : a vector of exogenous explicit variables consisting of  $(q \times 1)$ .

$Y = (y_1, y_2, \dots, y_p)^T$  : vector of endogenous explicit variables composed of  $(p \times 1)$ .

$\Lambda_x$  : matrix of regression coefficients of  $X$  on  $\xi$ , reflecting the relationship between exogenous explicit variables and exogenous latent variables  $(q \times n)$ .

$\Lambda_y$  : matrix of regression coefficients of  $Y$  on  $\eta$ , reflecting the relationship between endogenous explicit variables and endogenous latent variables  $(p \times m)$ .

$\xi = (\xi_1, \xi_2, \dots, \xi_n)^T$  : a vector of exogenous latent variables constituting  $(n \times 1)$ .

$\eta = (\eta_1, \eta_2, \dots, \eta_m)^T$  : vector consisting of endogenous latent variables  $(m \times 1)$ .

$\delta = (\delta_1, \delta_2, \dots, \delta_q)^T$  : the vector of measurement errors of exogenous explicit variables  $X$  constituting the vector  $(q \times 1)$ .

$\varepsilon = (\varepsilon_1, \varepsilon_2, \dots, \varepsilon_p)^T$  : a vector of endogenous explicit variables  $Y$  composed of

measurement errors  $(p \times 1)$ .

The expression of the structural model is:

$$\eta = B\eta + \Gamma\xi + \zeta \quad (3)$$

where

$B$ : represents the matrix of regression coefficients between endogenous latent variables  $(m \times m)$ .

$\Gamma$ : represents the matrix of regression coefficients between exogenous and endogenous latent variables  $(m \times n)$ .

$\zeta$ : represents the vector consisting of the residual terms of the structural equations in the model  $(m \times 1)$ .

The above calculations are based on the assumptions:  $E(\delta) = 0$ ,  $E(\varepsilon) = 0$ ,  $E(\zeta) = 0$ .

$\varepsilon$  is uncorrelated with  $\eta$  and  $\xi$ ,  $\delta$  is uncorrelated with  $\eta$  and  $\xi$ ,  $\varepsilon$  is uncorrelated with  $\delta$ , and  $\zeta$  is uncorrelated with  $\xi$ ,  $\varepsilon$  and  $\delta$  are uncorrelated. There are 8 parameter matrices in SEM:  $\Lambda_x$ ,  $\Lambda_y$ ,  $B$ ,  $\Gamma$ ,  $\Phi$ ,  $\Psi$ ,  $\Theta_\varepsilon$ ,  $\Theta_\delta$ , and satisfied:

$$Cov(\xi) = \Phi (n \times n) \quad (4)$$

$$Cov(\zeta) = \Psi (m \times m) \quad (5)$$

$$Cov(\varepsilon) = \Theta_\varepsilon (p \times p) \quad (6)$$

$$Cov(\delta) = \Theta_\delta (q \times q) \quad (7)$$

The variance-covariance matrix of the vector  $Z = (Y', X')$  can be obtained from the measurement equation as:

$$\Sigma = \begin{bmatrix} \Lambda_y A (\Gamma \Phi \Gamma' + \Psi) A' \Lambda_y' + \Theta_\varepsilon & \Lambda_y A \Gamma \Phi \Lambda_x' \\ \Lambda_x \Phi \Gamma' A' \Lambda_y' & \Lambda_x \Gamma \Lambda_x' + \Theta_\delta \end{bmatrix} \quad (8)$$

where  $A = (I - B)^{-1}$ , and  $\Phi$ ,  $\Psi$ ,  $\Theta_\varepsilon$ , and  $\Theta_\delta$  are the covariance matrices of  $\xi$ ,  $\zeta$ , and  $\varepsilon$  with  $\delta$ , respectively.

The most basic assumption of structural equation modeling is that  $\Sigma = \Sigma(\theta)$ , and if the theoretical model is true, then  $\Sigma(\theta)$  is equal to the overall covariance matrix ( $\theta$  is the model parameter vector), and the variances and covariances of the explicit variables are functions of the model parameters.

### 2.2.2 Solving structural equation models

The specific construction steps of structural equation modeling are: (1) preliminary setting of model variables and paths (2) selecting appropriate modeling techniques according to the research object (3) identifying the model (4) parameter calculation (5) evaluating whether the model passes the test (6) modifying the model (7) determining the model. There are two common methods in this step of modeling technique selection, one is the covariance structure

analysis method (LISREL), and the other is the partial least squares (PLS). These two methods have different characteristics, different processes and different applications, and should be used in conjunction with the research problem to choose the corresponding method. The PLS algorithm is robust to the results of the data that deviate from the normal distribution, and there is no excessive requirements. The process of structural equation modeling is shown in Figure 1.

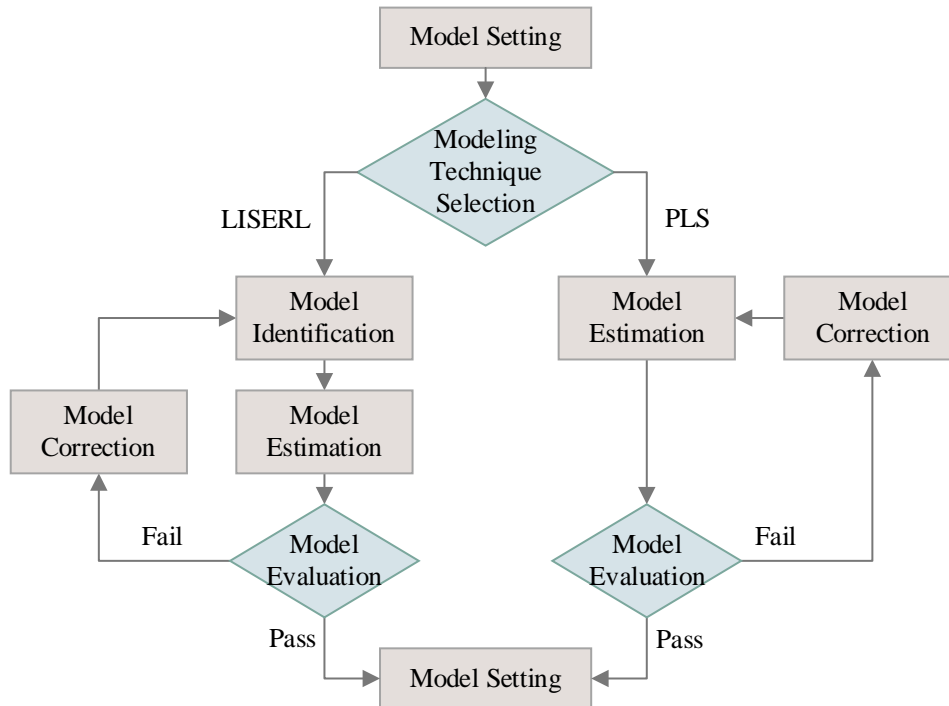


Figure 1: The process of constructing a structural equation model

### 2.2.3 Structural equation modeling based on PLS algorithm

#### (1) Principle of PLS structural equation modeling

The basic idea of the PLS algorithm is to have  $p$  dependent variable  $y$ , denoted as  $(y_1, y_2, \dots, y_p)^T$ , and  $q$  independent variable  $x$ , denoted as  $(x_1, x_2, \dots, x_q)^T$ , corresponding to endogenous and exogenous explicit variables, respectively, in structural equation modeling with a total of  $n$  sample points observed. The components are extracted in the variables  $(y_1, y_2, \dots, y_p)^T$  and  $(x_1, x_2, \dots, x_q)^T$  respectively  $\eta_1$  and  $\xi_1$ , these two extracted components are linear combinations of the corresponding sets of variables, which should contain as much information as possible about the variability in the corresponding data tables and the correlation between the two components should be maximized.

When the first components  $\eta_1$  and  $\xi_1$  are extracted, the regression analysis of  $X$  on  $\xi_1$  and  $Y$  on  $\eta_1$  are performed respectively. If the accuracy of the regression equation already meets the requirements, the calculation will be terminated, otherwise, the second round of component extraction will be carried out based on the remaining information after  $X$  is interpreted by  $\xi_1$  and the remaining information after  $Y$  is interpreted by  $\eta_1$ , and the cycle will be repeated until the accuracy of the regression equation meets the requirements. The final  $m$  components of  $X$  are obtained, and the regression of  $Y$  on  $X$  is computed by

regressing  $Y$  on  $m \xi$ .

Structural equation modeling elements are shown in Figure 2. Structural equation modeling comprises two main parts: the exogenous latent variable  $\xi$  and the endogenous latent variable  $\eta$ . There is one-way influence from these latent constructs, meaning that the exogenous latent variable  $\xi$  influences the endogenous latent variable  $\eta$ . In this case, the exogenous latent variable acts as an independent variable ( $\xi$ ), and the endogenous latent variable acts as a dependent variable ( $\eta$ ). Apart from the primary influence from the exogenous latent variable  $\xi$  to the endogenous latent variable  $\eta$ , there is also the residual term  $\zeta$  influencing the endogenous latent variable  $\eta$ . In the modeling process, each latent variable is related to its own manifest variables, where the exogenous latent variable  $\xi$  is related to exogenous manifest variables  $x_1$  and  $x_2$ , and the endogenous latent variable is related to endogenous manifest variables  $y_1$  and  $y_2$ .

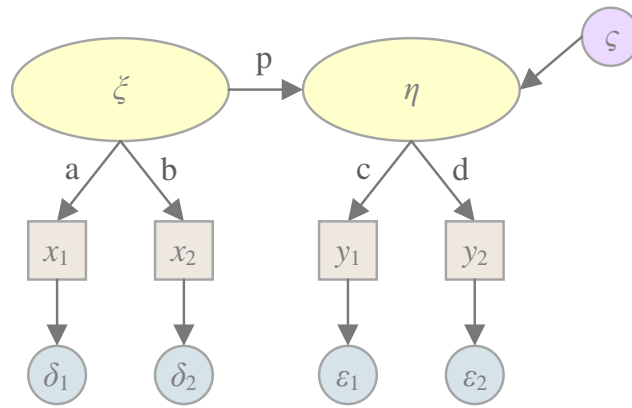


Figure 2: Structural equation model elements

The model parameters  $a, b, c, d$  as well as the path coefficients  $p$  and the residual term  $\zeta$  need to be estimated from the samples. The parameter estimation of PLS-SEM is based on the reduction of the variance of the residuals of the dependent variable, since the latent variables are represented by the corresponding explicit variables, and therefore evaluated based on the weighting of the explicit variables and on the evaluation of the latent variable components. In the figure, the scores of the components of  $\xi$  are generated based on  $x_1$  and  $x_2$  to make them better predictors of  $\eta$ , and for  $y_1$  and  $y_2$ , the weights are calculated so that both are better predictors of  $\eta$  and so that  $\eta$  can be effectively explained by  $\xi$ .

In the computation process, each variable is given the same initial weight before iteration, and each subsequent iteration considers the latent variable variance as the unit variance in order to compute new weights, this process is called external approximation. The completion of the external approximation process results in a proxy relationship between each latent variable and the other hypothetically related latent variables to obtain a proxy estimate. In the figure, two latent variables are proxies for each other, and the proxy estimation process can calculate the regression relationship between each latent variable and its respective explicit variable counterpart, and this regression result is the weight of the external approximation in the next round of iteration, which stops when the weights calculated by two neighboring rounds of iteration are lower than  $10^{-3}$ .

## (2) Estimation and testing criteria

The test of PLS structural equation modeling generally includes the unique dimension test, the reliability and validity test, and the significance test of the path coefficients. The unique dimension test is to ensure the uniqueness of the latent variables corresponding to each group

of explicit variables, which is judged by using the eigenvalues calculated by principal component analysis. Regarding the criterion of reliability, comprising internal consistency reliability and synthetic reliability, the former applies the coefficient as a measure index with an average standard higher than 0.6 or 0.7, while the latter utilizes CR as a measure index and needs to exceed 0.7 on average. The criterion for the measurement of validity is the Average Variance Extracted (AVE). The T-value will test the statistical significance of path coefficients, and  $T > 1.96$  shows that the statistical test is passed by path coefficients at a confidence interval greater than 5%. Average commonality represents the predictive capacity from the latent variable to the observed variable and needs to exceed 0.5, whereas the explained capability of structural models is indicated by  $R^2$ .

### 3 Empirical findings

#### 3.1 Descriptive analysis of sample characteristics

##### 3.1.1 Sample characteristics

The descriptive statistical characteristics of the valid sample in the study are shown in Table 2. From the table, it can be seen that the number of young teachers aged 35 to 40 years old is higher, accounting for 47%. This proves that most of the teachers among the respondents already have some teaching experience and are able to mentor more young teachers and risk more teaching experience and opinions.

*Table 2: Statistics of descriptive characteristics of the sample*

Sample Characteristics	Category	Number	Percentage
Gender	Male	255	41%
	Female	365	59%
Age	25~30	202	33%
	30~35	124	20%
	35~40	294	47%
Educational Attainment	Undergraduate	116	19%
	Master	147	24%
	Doctor	357	57%
Professional Title	Primary	78	12%
	Intermediate	166	27%
	Subrank	190	31%
	Advanced	186	30%
Job Sequence	Teaching	305	49%
	Teaching And Auxiliary	92	15%
	Administration	223	36%
Years Of Working Experience/Years	1~5	166	27%
	6~10	86	14%
	11~15	145	23%
	16~20	96	15%
	>20	127	21%

### 3.1.2 Data processing results

SPSS software used for statistical analysis was used for the analysis of data in this study. Reliability analysis was carried out using Cronbach's  $\alpha$  test with 0.7 as the threshold value. The Cronbach's  $\alpha$  test values for the variables are listed in Table 3. The results revealed that the value of the Cronbach's  $\alpha$  test value for the questionnaire was 0.942, while for all the dimensions separately, it was above 0.8. This reveals that the questionnaire had good reliability.

*Table 3: The Cronbach's  $\alpha$  values of each variable*

Variable	Cronbach's $\alpha$ value
Achievement motive	0.815
Personality characteristics	0.915
Cognitive ability	0.951
Train students	0.927
The overall questionnaire	0.942

The scale created by this research is to some extent based on previous studies; thus, it has content validity. This essay concentrates on the construct validity of this instrument. The construct validity of the scale can be evaluated using the KMO measure of sampling adequacy and Bartlett's test of sphericity in factor analysis. The findings from the KMO test and Bartlett's test are provided in Table 4. From Table 4, it can be seen that the data sample for this study is suitable for factor analysis and the scale as a whole is valid.

*Table 4: KMO and Bartlett's test*

Measurement project	Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.876
Approx. Chi-Square	3855.698
Bartlett's Test of Sphericity df	32
Sig	0.000

Based on the results obtained from the above analysis, the factors in the survey were analyzed using factor analysis, and the rotated factor loading matrix of each variable shows that the loading value of the extracted principal components is presented in Table 5 below. The factor loadings of each survey question are more than 0.6, implying that the survey is highly reliable and valid.

*Table 5: The principal component factor extraction load value*

Measurement project	Load coefficient
A1	0.663
A2	0.862
A3	0.828
A4	0.693
B1	0.639
B2	0.919
B3	0.804
B4	0.968
B5	0.8
C1	0.877
C2	0.882

D1	0.915
D2	0.718

### 3.2 Characterization of Teaching Competence of Young Teachers in Higher Education

#### 3.2.1 Overall analysis of teachers' teaching competencies

The descriptive statistics of senior young teachers' competence are shown in Table 6. In the distribution of the mean values of the first-level dimensions, the achievement motivation score is 3.71, the personality traits score is 3.919, the cognitive ability score is 3.864, and the cultivation of students score is 3.905. In terms of the importance of the mean values, although the personality traits>cultivation of students>cognitive ability>achievement motivation, the mean scores of the four first-level indicators are relatively close to each other, which indicates that the degree of attention to the four first-level indicators is relatively close to each other as well. The mean scores of the four primary indicators are relatively close, indicating that the degree of attention to the four primary indicators is also relatively close.

Table 6: Descriptive Statistics on the Competency of Young Teachers

		Average value (E)		Standard deviation	Variance
		Statistics	Standard error	Statistics	Statistics
(A)	(A11)	4.007	0.036	0.857	0.652
	(A12)	3.638	0.04	0.945	0.862
	(A13)	3.655	0.04	0.945	0.821
	(A21)	3.827	0.038	0.999	0.875
	(A31)	3.789	0.038	0.927	0.752
	(A41)	3.817	0.037	0.881	0.861
	(A42)	3.847	0.038	0.854	0.864
	(A1)	3.71	0.038	0.993	0.854
(B)	(B11)	3.793	0.037	0.901	0.762
	(B12)	3.961	0.037	0.899	0.888
	(B21)	3.787	0.036	0.825	0.746
	(B22)	3.96	0.037	0.931	0.832
	(B31)	3.812	0.036	0.818	0.617
	(B41)	3.906	0.037	0.976	0.775
	(B51)	3.92	0.046	0.87	0.725
	(B1)	3.919	0.036	0.828	0.844
(C)	(C11)	3.781	0.038	0.986	0.901
	(C12)	3.879	0.037	0.843	0.787
	(C13)	3.839	0.047	0.859	0.691
	(C21)	3.778	0.041	0.915	0.981
	(C22)	4.016	0.037	0.974	0.816
	(C1)	3.864	0.037	0.862	0.784
	(C2)	3.905	0.037	0.864	0.784
(D)	(D11)	3.979	0.047	0.854	0.751
	(D21)	3.898	0.036	0.872	0.787
	(D22)	3.97	0.035	0.71	0.652
	(D23)	3.837	0.031	0.999	0.867
	(D24)	3.824	0.036	0.881	0.692
	(D1)	3.905	0.037	0.77	0.826

### 3.2.2 Clustering and Discriminant Analysis of Teaching Competencies Based on Level Segmentation

The concept of cluster analysis is based on dividing and clustering classification outcomes considering the features of samples. In accordance with the SPSS analysis conducted, two types of cluster analysis have been identified, namely systematic cluster analysis and K-mean cluster analysis. In this paper, K-mean cluster analysis was chosen as a tool for clustering the teaching competence of young teachers in higher vocational education into three groups, where the initial centroid of the classes had been determined automatically by SPSS. ANOVA of cluster analysis has been presented in Table 7. According to the table, there are considerable differences in the mean variance, mean error and F-value obtained after the three classifications were completed. Considering the four factors of teaching competence of young teachers in higher education institutions,  $P < 0.05$ , thus one may conclude that there are significant differences between these clusters.

Table 7: Cluster analysis ANOVA

	Clustering		Error		F	Significance
	Equal square	df	Equal square	df		
A	159.178	2	0.237	579	597.594	0.000
B	160.435	2	0.168	579	855.868	0.000
C	158.097	2	0.176	579	741.558	0.000
D	162.351	2	0.273	579	692.296	0.000

The Fisher discriminant function was chosen for the study to establish the discriminant function equation. The coefficients of the classification function are shown in Table 8. As can be seen from the table, the following discriminant function can be constructed for the four first-level dimensions of teaching competence of young teachers in higher education:

$$Y1(\text{Low level}) = -10.134 + 1.994*A + 3.164*B - 1.207*C + 0.774*D \quad (9)$$

$$Y2(\text{Medium level}) = -30.226 + 3.977*A + 5.164*B + 2.864*C + 3.016*D \quad (10)$$

$$Y3(\text{High level}) = -58.568 + 5.846*A + 8.145*B + 2.885*C + 5.782*D \quad (11)$$

Table 8: Classification function coefficient

	Case cluster number		
	1	2	3
A	1.994	3.977	5.846
B	3.164	5.164	8.145
C	-1.207	2.864	2.885
D	0.774	3.016	5.782
(Constant)	-10.134	-30.226	-58.568
Fisher's linear discriminant function			

As a result, the discriminant equation constructed by the study can be used to assess the development level of teaching competence of young teachers in higher education. The joint distribution of discriminant effects is shown in Fig. 3, which reveals that the three classifications of teachers' teaching competence can be significantly independent of each other with good classification effects.

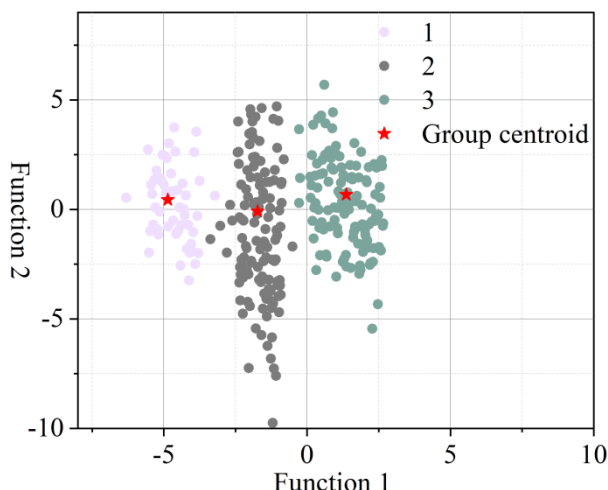


Figure 3: The joint distribution map of the discrimination effect

### 3.3 Model fitting and analysis

#### 3.3.1 Correlation analysis

The correlations between variables are shown in Table 9,  $**P < 0.01$ . This shows that the correlation coefficients between Achievement Motivation, Personality Characteristics, Cognitive Ability, Fostering Students, and Higher Education Young Teachers' Development, the correlation coefficients are all positive and significant at the level of  $P < 0.01$ . The results of this descriptive statistical analysis initially support the hypothesis proposed by the author.

Table 9: Correlation between variables

	A	B	C	D
A	1			
B	0.168**	1		
C	0.121**	0.235**	1	
D	0.156**	0.288**	0.306**	1

#### 3.3.2 Structural Equation Model Fitting and Correction

The overall fit of the structural equation model can be expressed by  $\chi^2$ ,  $\chi^2 / df$ , GFI and other indicators. AMOS software was used to analyze the data of the constructed initial model for the cultivation of young teachers in higher vocational education, and the running results and preliminary fit are shown in Table 10. As can be seen from the table, the model still has room for correction, that is, the overall fit of the structural equation model of  $\chi^2$ ,  $\chi^2 / df$  can be made by  $\chi^2$ ,  $\chi^2 / df$ , with larger values. After re-estimating the model and adding the error correlation path to obtain the modified model, the  $\chi^2$ ,  $\chi^2 / df$  fitting indices have been significantly improved, respectively, 1988.597, 6.639. Because  $\chi^2$  is susceptible to the influence of the sample capacity, in recent years, the RMSEA is mostly adopted this stability index.  $\chi^2 / df$  is easily affected by the sample size, and is not very meaningful for evaluating individual models, so it is usually used for model comparison. Combined with other fitness indicators, it can be seen that the model fitting results are better, indicating that the fit between the hypothetical model and the actual data is high and the model results are convincing.

Table 10: Preliminary fitting results of the structural equation model

Indicator	Recommended value	Fitting value
$\chi^2$	The smaller, the better	3236.594
$\chi^2 / df$	<3	10.265
GFI	>0.9	0.965
AGFI	>0.8	0.96
RMSEA	<0.08	0.038
NNFI	>0.9	0.945
IFI	>0.9	0.943
CFI	>0.9	0.939

Based on the principle of minimum change for structural equation modeling correction, the final model is shown in Figure 4.

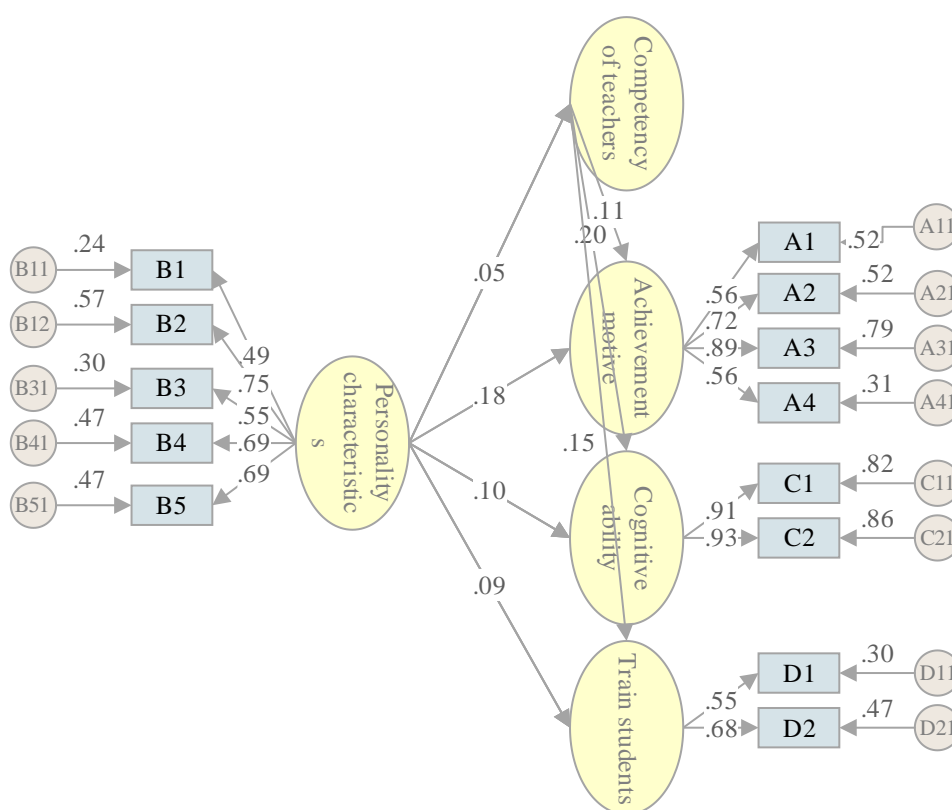


Figure 4: Final model

### 3.3.3 Summary and analysis of empirical results

The structural relationships of the latent variables with the estimation of their standardized path coefficients are highlighted, among other things, to provide a more thorough understanding of the results of the model's hypotheses validation. Table 11 below shows both the path coefficients and the hypotheses validation. As can be observed from the above table, the development of young instructors in higher vocational institutions is significantly positively impacted by success motivation, personality, cognitive capacity, and nurturing pupils; thus, H1~H4 are validated. Furthermore, it is clear from the mediating effect analysis that competence mediates senior young instructors' development, proving H5 to be true.

*Table 11: Path coefficients and hypothesis verification status*

Hypothesis	Variable relationship	Standardized path coefficient.	S.E.	C.R.	P	Verification conclusion
H1	Teacher culture←Achievement motive	0.225	0.008	11.688	***	Support
H2	Teacher culture←Personality characteristics	0.185	0.012	9.619	***	Support
H3	Teacher culture←Cognitive ability	0.089	0.056	4.452	***	Support
H4	Teacher culture←Train students	0.214	0.045	8.797	***	Support
H5	Train students←Competence	0.182	0.065	8.639	***	Support

## 4 Conclusion

The article selects some young high school teachers as its target sample, and drawing upon the theoretical framework of teacher competence, it develops a competence model for young high school teachers and empirically tests the relevant findings. The main research results are presented as follows:

(1) The competency of senior youth teachers is divided into three categories: low level, medium level and high level, and the three classifications have significant differences. The three competency discriminant equations are shown below:

$$Y1 \text{ (low level)} = -10.134 + 1.994*A + 3.164*B + -1.207*C + 0.774*D$$

$$Y2 \text{ (medium level)} = -30.226 + 3.977*A + 5.164*B + 2.864*C + 3.016*D$$

$$Y3 \text{ (high level)} = -58.568 + 5.846*A + 8.145*B + 2.885*C + 5.782*D$$

Based on the above discriminant equation results, it confirms the validity of the model of high level young teachers' competence, based on which the assessment of high level young teachers' competence can be effectively realized.

(2) As per the analysis of correlation, the correlation coefficients among these factors were found to be positively and significantly correlated at  $P < 0.01$ . From the analysis above, it is clear that factors such as achievement motivation, personality characteristics, cognitive ability, and student grooming have important roles in shaping the career development of senior young teachers.

In summary, teacher education acts as an effective tool for developing a competent teaching faculty and upgrading the level of teaching. By analyzing the connection between the components of higher vocational competence of young teachers and young teachers' education in an objective manner, and optimizing the structure of these components with relevant measures, the goal of achieving a high level of teaching quality and efficiency can be realized.

## About the Author

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## Project Funding

This article is a phased achievement of the Hunan Province New Era Moral Education Project funding program “Practical Research on Collaborative Development of Ideological and Political Course Teachers in Vocational Schools under the Integrated Concept” (No. 25C40).

## References

- [1] Wang, N. (2019). Research on the Development Strategy of Young Teachers in Vocational Colleges under the Background of Professional Development. In 2019 9th International Conference on Education and Management (ICEM 2019) (pp. 399-407).
- [2] Ismail, K., Nopiah, Z. M., & Rasul, M. S. (2018). Challenges faced by vocational teachers in public skills training institutions: A reality in Malaysia. *Journal of Technical Education and Training*, 10(2).
- [3] Gümüs, A. (2022). Twenty-first-century teacher competencies and trends in teacher training. *Y. Alpayd*, 243-267.
- [4] Wong, S. C. (2020). Competency definitions, development and assessment: A brief review. *International Journal of Academic Research in Progressive Education and Development*, 9(3), 95-114.
- [5] Chouhan, V. S., & Srivastava, S. (2014). Understanding competencies and competency modeling—A literature survey. *IOSR Journal of Business and management*, 16(1), 14-22.
- [6] Chen, C. C., Wei, C. C., Chen, S. H., Sun, L. M., & Lin, H. H. (2022). AI predicted competency model to maximize job performance. *Cybernetics and Systems*, 53(3), 298-317.
- [7] Ismail, A., Kasman, Z., Sumarwati, S., Yunus, F. A. N., & Abd Samad, N. (2019). The development of job competency for skilled technical worker towards green technology. *GEOMATE Journal*, 17(59), 216-221.
- [8] Abykanova, B., Tashkeyeva, G., Idrissov, S., Bilyalova, Z., & Sadirbekova, D. (2016). Professional Competence of a Teacher in Higher Educational Institution. *International Journal of Environmental and Science Education*, 11(8), 2197-2206.
- [9] Riswandi, R., NOPIANA, N., & Suryadi, S. (2020). Model on the Job Training Based on the Increasing of Teachers Competence Basic School. *International Journal of Advanced Science and Technology*, 29(05), 1103-1113.
- [10] Osorio Vanegas, H. D., Segovia Cifuentes, Y. D. M., & Sobrino Morrás, A. (2025). Educational technology in teacher training: A systematic review of competencies, skills, models, and methods. *Education Sciences*, 15(8), 1036.
- [11] Javidan, L., Aliesmaili, A., & Shojaee, A. A. (2017). Explaining Competency model of teacher. *Iranian journal of educational Sociology*, 1(6), 71-81.
- [12] Hartini, S., Bhakti, C. P., Hartanto, D., & Ghiffari, M. A. N. (2018, December). Teacher

- pedagogic competency development model: a literature review. In 5th Asia Pasific Education Conference (AECON 2018) (pp. 211-215). Atlantis Press.
- [13] Chavdarova-Kostova, S. (2025). THE COMPETENCY-BASED APPROACH IN THE PRE-SERVICE TEACHER TRAINING-CHALLENGES IN THE IMPLEMENTATION OF THE BULGARIAN MODEL. In EDULEARN25 Proceedings (pp. 2539-2548). IATED.
- [14] Malik, M. N., Soenarto, S., & Sudarsono, F. X. (2018). The competency-based training model for vocational high school teachers from electrical expertise programs. *Jurnal Pendidikan Vokasi*, 8(3), 313-323.
- [15] ALIMOVA, S., & Ushakova, N. M. (2021). MODELING THE EDUCATIONAL PROGRAM OF A TEACHER TRAINING WITHIN THE COMPETENCY-BASED APPROACH. *Bulletin of Kazakh National Women's Teacher Training University*, (1), 156-163.
- [16] Bahmannia, H., Malaki, H., & Khosravi, M. (2020). Designing a model for teacher competencies in elementary education. *Iranian journal of educational sociology*, 3(3), 123-131.
- [17] Kharkivska, A. (2020). The competency-based approach as methodology of professional training of future teachers in the conditions of education informatization. *Problems of Engineer-pedagogical Education*, (67), 27-35.
- [18] Blanco-Figueroa, L., & Arias-Ortega, K. (2023). Competency-based training versus teacher training in professional performance: a debate in educational sciences programs. *Journal of ethnic and cultural studies*, 10(3), 190-212.
- [19] Ahmed, A., & Sayed, K. (2021). An extensive model for implementing competency-based training in technical and vocational education and training teacher training system for Assiut-Integrated Technical Education Cluster, Egypt. *The Journal of Competency-Based Education*, 6(2), e01245.
- [20] Hamisu, M. A., Salleh, K. M., Sern, L. C., Adamu, B. Y., & Gambo, K. (2017). Proposed competency model for Technical and Vocational Education and Training (TVET) lecturers teaching in Technical Colleges, Bauchi State in perspective. *Traektoriâ Nauki= Path of Science*, 3(9), 5001-5009.
- [21] Lin, T. C., Lee, Y. S., & Ye, J. H. (2024). A study on Taiwan's vocational senior high school teachers' teaching identity and teaching transformation when facing a new competency-based curriculum. *Frontiers in psychology*, 15, 1290551.
- [22] Southren, M. (2015). Working with a competency-based training package: A contextual investigation from the perspective of a group of TAFE teachers. *International journal of training research*, 13(3), 194-213.
- [23] Millen, C. D. (2025). Competency-Based Apprenticeship Models & Alternative Assessments in Teacher Preparation Programs. *Pennsylvania Teacher Educator*, 24(1), 53-61

- [24] Melekhina, M. B. (2015). Recursive model of a methodical competency formation of a high school teacher in the context of competency-based education. *International Education Studies*, 8(2), 142-150.
- [25] Qin, C. (2024). Discussion on the curriculum design and implementation of competency-based vocational education. *Journal of Modern Educational Theory and Practice*, 1(2).
- [26] Lubis, S. A. M., Lumbanraja, P., & Absah, Y. (2024). The Influence Of Competency And Job Achievement Assessment On Teacher Performance Through Certification Incentives As An Intervening Variable In Medan Islamic Education Park. *Jurnal Ekonomi Teknologi dan Bisnis (JETBIS)*, 3(1), 656-668.
- [27] Defa, R., Napper, A., Heiser, E., Fogg, S., Sellers, L., Skinner, C., ... & Reddoch, J. (2016). The development and evolution of a faculty competency-based education training course. *The Journal of Competency-Based Education*, 1(2), 78-84.
- [28] Klomim, K., & Kuayngern, B. (2023). Development of competency-based learning management training curriculum to enhance teachers' competency. *Community and Social Development Journal*, 24(2), 56-70.