# The Core Competencies of Vocational High School Teachers
## In 21st Century Learning

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**ABSTRACT**
This research suggests a mixed method that combines quality and quantitative approaches for defining the core skills of Vocational High School (VHS) teachers. The research method comprises of two phases. The first phase is qualitative method, and the second phase is quantitative method. It comprises of three research phases, namely (1) collecting the competencies standard of VHS teachers, (2) determining the framework competencies by Fuzzy Delphi technique, (3) managing skill priorities using the method of analytical hierarchy process. Seven experts from industry, academics, government and 50 VHS teachers from different regencies in Bali Province, Indonesia participated in this study. This research suggests which the core competencies of VHS teachers are pedagogical, vocational, professional and technological competencies aspect.

***Keywords:*** *Vocational High School (VHS) Teachers, Core Competencies, Competency Framework*

## 1. INTRODUCTION

Vocational education in the 21st century is an education that aims at sustainable survival with an emphasis on the growth of life skills, job skills and learning skills [1]. It requires teachers and students' constructive and persuasive positions. Each student faces complex life situations in the 21st century, full of opportunities and challenges and uncertainties. In today's constellation of life, students need the skills to live in order to improve themselves, their community efficiently, productively and with integrity.

Highly skilled education is required for the qualifications of graduates who are ready to compete and take up jobs in the world of work and who can achieve satisfaction with career choices equipped with mastery of employability skills, so that they can compete in DUDI (Workplace). Vocational education includes instructors who are aware and able to absorb, re-learn and unlearn professional materials that are important to the needs of the field of work. The contribution to vocational education consists of students, vocational teachers and trainers. This study would concentrate on one of the inputs of vocational education by educators. Educators in vocational schools are called vocational teachers. Teachers are an important factor in the development of VHS graduates who are ready to work and willing to succeed in DUDI with their unique skills. Vocational teachers are student leaders in learning and practicing world-class work and working techniques that are both effective and efficient [2,3].

Vocational education in Indonesia is divided into two, namely high school education (VHS) and higher education (Diploma). The focus of this study is on vocational teachers. VHS teachers are categorized into three groups, namely adaptive, normative and productive teachers. Adaptive teachers are teachers who teach adaptive subjects or in other words, subjects that are fundamental and that can be created, such as mathematics, physics and chemistry. Normative teachers are teachers who teach normative teaching such as faith and citizenship. In the meantime, productive teachers are teachers who teach subject areas of expertise (vocational) such as computer and network engineering (TKJ), multimedia (MM) and software engineering (RPL). This research focuses more on productive teachers.

Vocational teachers have different roles and functions when compared to teachers in general schools. Vocational teachers have a heavier burden in terms of producing graduates who are not only smart in terms of

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theory, but the most important thing is to have special skills in accordance with the competency of skills taken in vocational schools. VHS is currently faced with very dynamic work challenges and must be able to adapt to DUDI's needs. Some researchers state that teacher quality has a significant positive impact on work professional performance [4]. The quality of vocational teachers is very much determined by their identification clearly and comprehensively related to the core competencies of vocational teachers in carrying out their professional work. Vocational teachers must be able to carry out learning and job training for students, while teachers in public schools only focus on the implementation of learning.

Vocational teachers have a very significant difference compared to general school teachers, therefore it is very important and necessary to identify the main competencies of a vocational teacher. The same thing was conveyed by Estriyanto [5] that there is no specific competency standard for vocational teachers in VHS, which comprehensively describes the specific work competencies of productive teachers in VHS (occupational-specific competency). Not yet explained in a clear, detailed and comprehensive manner have an impact on the quality of the professional development of vocational teachers' work. Vocational teachers clearly have specific competency standards and are not the same as teacher competency standards in public schools, this can be seen from the learning objectives they carry out, DUDI's involvement in the implementation of learning and job training, cooperation patterns with DUDI, work skills (hands-on on practice), communication, and required working knowledge (vocational knowledge) that is relevant and integrated with the material being taught.

Several strategic issues related to improving the quality of vocational education are: (1) increasing the skills and quality of learning by educators; (2) improving teacher qualifications by teacher guidance; (3) reinforcing the vocational teacher management system. The situation in the field shows that vocational teachers come from instructors who teach non-productive subjects. This is a problem of the central government, on the pretext of continuing to obtain certification as teachers so that they receive the responsibility of teaching productive subjects which actually need professional insight and expertise. According to Estriyanto [5] , the State of Indonesia is urged to formulate standards of competency that are applicable to the vocational education in its country.

On the basis of the above described problems (empirical research analysis), this study is define and clearly and comprehensively describe the core skills of vocational teachers (productive teachers in the VHS) in every aspect, domain and competency indicator which is adjusted to be implemented. Vocational education in the 21st century. We defined the problem from the issues described above:

a. The competence structure for skilled teachers specifically for effective teachers is not transparent and comprehensive.

b. The skills criteria outlined in the Instruction of the Minister of National Education are still general and do not define the specifications of the standards of professorial skills

c. The competence requirements still in use today do not correspond to the technical demands of professional teachers in the 21st century.

## 2. LITERATURE REVIEW

In this study, a vocational teacher is called, namely someone who professionally organizes teaching, learning and work practice (TLP) in vocational schools (VHS). The implementation of quality vocational education must be able to be in line with developments in science and technology as well as the dynamics of labor needs. The success of vocational education depends on the quality of vocational teachers who have occupation-specific skills [6,7]. Vocational teacher professionalism is categorized on three types of expertise: mastery of vocational knowledge (vocational knowledge), methods of teaching students [8]. The duties and functions of vocational teachers in VHS consist of three main types of activities, namely teaching, learning and work training / practical work [9,10,11]. Mastery of vocational knowledge is divided into mastery of concepts, structure and concept theory. The mastery of professional knowledge is not only a matter of mastery of material, but most importantly teachers need to understand job knowledge, mastery and competence in professional skills [12].

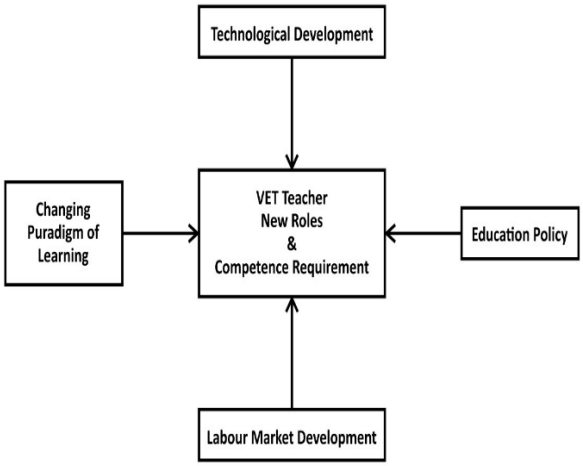


**Figure 1.** Factors cause changes in vocational teacher competencies

Vocational teacher competency standards are very different from teacher competency standards in general

schools. Vocational teachers' competency standards are more complex for teachers in public schools [13]. Professional vocational education teachers must have integrity, adequate knowledge in accordance with their fields, a commendable character, competence, and even have to follow good education, not just training (not only trained but educated).

## 3. METHOD

In this analysis, the combined methodology comprises qualitative and quantitative methods used in a study to make the data collected more detailed accurate, reliable and objective[14]. The first order in this analysis uses qualitative approaches and the second order in this study employs quantitative methods. Additional research designs and extension are used in the qualitative process. The replication extension research architecture is generally called free and expansion in qualitative methods. In qualitative research, vocational teacher competency criteria was be determined using complementary and expansionary design analysis, namely the existence of replication [15]. This research was be conducted in all vocational schools in Bali province, especially VHS with ICT expertise competency. The implementation of this research has been estimated for 8 (eight) months, starting from April to early November 2020.

### *3.1 Analysis and Data Sampling*

In accordance with the methods used in this study, namely AHP and Fuzzy Delphi, it is stated that the sample used is a sample that is considered an expert in accordance with its field. AHP and Fuzzy Delphi require an expert as a sample who gave weight to the proposed criteria. The sampling method suitable for this method is purposive sampling. From the total population of vocational teachers, there are 557 people. Purposive sampling was be taken from this population for sampling. Purposive sampling is used to obtain factual data that is adjusted to the study of the problems in this study.

Some of the criteria that were be the subject of this research are as follows:

a. Experts from academia, local government (Education Authorities of Bali Province), outstanding vocational teachers as informants. The number of informants who were be involved in this research is eight (8) experts from academia, local government, and vocational teachers who have high credibility.

b. Productive ICT teachers at VHS in Bali province, who have the following criteria with a minimum rank of III / b and 5 years of teaching experience and have participated in teacher certification, are named the head of the MGMP for each skill competency. With a total of about 20 vocational teachers.

### *3.2 Data Collecting*

Data collection techniques in this study are divided into data collection techniques in the first phase, namely the qualitative approach stage (literature study, Focus Group Discussion (FGD) and in-depth interviews) and data collection techniques at the quantitative approach stage (instrument / questionnaire).

### *3.3 Data analysis technique*

In the first phase, a qualitative approach was be carried out using taxonomy (Hierarchical classification based on levels) and domain analysis techniques (taxonomy and domain analysis). The data analysis techniques used in the second stage using a quantitative approach are as Fuzzy Delphi and AHP formulas as tools. Carrying out the filtering process and determine the priority / ranking of vocational teacher competencies through Fuzzy Delphi and AHP questionnaires. This formula uses only one survey round, and uses a specific question type for each survey item (pairwise comparison technique). Fuzzy Delphi and AHP techniques, use the opinion of experts to confirm how important the competencies needed by vocational teachers in VHS. Experts were invited to fulfil the Fuzzy Delphi questionnaire. This study analyses the importance of the items in the draft competency standards that have been produced for vocational teachers by referring to the total score generated from the defuzzification calculation, and then assigns each of the most important competency score weights through a panel discussion. The AHP technique calculates the weight to reconfirm the competency criteria that have been generated from the Fuzzy Delphi calculation. Researchers used the expert choice v.11 software to calculate the competency of priority.

#### *3.3.1. Fuzzy Delphi Method*

In the first phase, the survey were accumulated by feedbacks to decide if adjustments are required. Thus the triangular fuzzy numbers are employed to approximate and identify the following.

$$\widetilde{w}ij = (lij, mij, uij) \quad {}^{L\text{-}R} \tag{1}$$

$$lj = Min\,(lij), i = 1, \dots n; \quad j = 1, \dots m \tag{2}$$

$$mj = \frac{\left(\prod_{i=1,j=1}^{n,m} mij\right)1}{n}, i = 1, \dots n; \quad j = 1 \dots m \tag{3}$$

$$uj = Max\,(uij), i = 1, \dots n; \quad j = 1, \dots m \tag{4}$$

While n is the total quantity of experts and represent the quantity of vocational teacher skills requirements. Then the fuzzy weight number obtained from second step cannot be applied for direct comparison. This analysis therefore used the varying mean and spread method,[18] translating the findings into a limited number of $Of_j$

$$Of_j = \frac{uj+mj+lj}{3} \quad (5)$$

The experts subsequently set a criterion. The level is defined to r = 0,7 [18] for evaluating the required teacher skills. If $O f_j$ < r, the requirements of professional teachers' competence must be chosen and if $Of_j$ < r, then the parameters for professional teacher competence must be omitted.

### 3.3.2. Analytic Hierarchy Process (AHP)

A framework of hierarchy is also formed based on the skills configuration of educators built into the Fuzzy Delphi technique, and afterwards the research aim was proposed. The goals are to pick the best skilled instructor skills. For the first step of the AHP process, the input is given by pair comparisons and the proportional weight of each variable is generated at levels 1 and 2[19]. $W = (W1, W2, \dots, Wn)^T$ , where $W$ is the specific proportional weight vector and represents the number of components.The matrix of the pairwise comparisons is presented below.

$$AW = \begin{bmatrix} \frac{W1}{W1} & \cdots & \frac{W1}{Wn} \\ \vdots & \ddots & \vdots \\ \frac{Wn}{W1} & \cdots & \frac{Wn}{Wn} \end{bmatrix} x \begin{bmatrix} W1 \\ \vdots \\ Wn \end{bmatrix} \quad (1)$$

$n$ and $W$ are referred to as the eigenvalue value in the matrix algebra and the right eigenvector of matrix A. The measured matrix A therefore includes contradictions. The estimate of $W$ (referred to as $\overline{W}$) is identical to

$$\overline{A} \text{ x } \overline{W} = \lambda_{max} \text{ x } \overline{W} \quad (2)$$

Where $\overline{A}$ is the pairwise comparison of the matrix examined, ¯max is the highest value of $\overline{A}$ and $\overline{W}$ is its right eigenvector. The Consistency Index (CI), the first measure of the accuracy of pair comparisons, is thus developed for the second stage in order to make sure test reliability. Below is the method for calculating the index.

$$CI = \frac{\lambda_{max} - n}{n-1} \quad (3)$$

The last step of further analysis is its consistency ration (CR), in which ACI is the average index of random weights[20]:

$$CR = \frac{CI}{ACI} \; x \; 100\% \quad (4)$$

If the CR value is less than 0.1, it is eligible for the consistency ration[20]. The paired comparison must be adjusted.

## 4. RESULTS AND DISCUSSION

The competence of vocational teachers consists of pedagogical, professional knowledge and skills related to the delivery of vocational subjects, vocational learning and competencies and utilizing technology in their work and life to make gradual improvements and continue professional development [16,17]. Review literature studies related to the competency framework of VHS instructors and offer four attributes, namely: pedagogical, professional, vocational and technological competences. Each of attributes covers several domains and each domain is separated by sub-domains. Attribute of pedagogical competence cover 13 domain areas and 34 sub domain measures, aspects of professional competence include 3 domain areas and 7 sub domain criteria, aspects of vocational competence cover 3 fields and 8 sub domain measures, aspects of technological competence cover 4 fields. The results of these steps are called the draft VHS teacher competency framework. From Figure 2 below, then it determines the sub-domain criteria in each domain: (1) pedagogical; (2) professional; (3) vocational; (4) technology using domain analysis and taxonomic analysis.

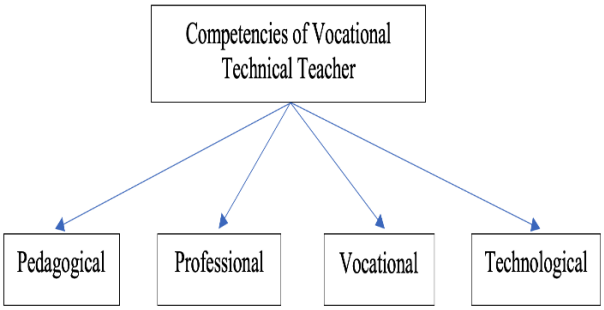


**Figure 2.** Initial Construction of Vocational Teacher Competencies

In competency structure, it gives a comprehensive and detailed review of the competencies for VHS educators involving pedagogical experience and skills. In this study proposed: (1) vocational competence; (2) technological competence as an aspect of the vocational teacher competency framework. It also proposes: (1) a learning environment based on industrial settings; (2) guidance and supervision internship program; (3) administration; (4) application; (5) vocational experience and skills; (6) entrepreneurship; (7) networking & collaboration.

In this analysis, the Analytical Hierarchy Process (AHP) uses the competence dimensions of skilled teachers to define the significance of each area. The outcomes of AHP analysis show the four aspects that are classified from the most important to the slightest important are: pedagogic competence (0.466), vocational competence (0.300), professional competence (0.172) and technological competence (0.063). Pedagogical skill

is a primary qualification in vocational education and training.

**Table 1**. Competency Weight

| Aspect | Weight | Ranking |
|---|---|---|
| Pedagogical | 0.466 | 1 |
| Vocational | 0.300 | 2 |
| Professional | 0.172 | 3 |
| Corresponding | 0.063 | 4 |

Based on the assessment of expert opinion, it is concluded that the pedagogical aspect is the most important competency aspect for VHS teachers. Teaching skills, instructional skills, communication and language, self-reflecting and developing skills, administration, teaching knowledge such as (finding goals, content, strategies, media, evaluation and assessment), based on curricula knowledge on industry needs. The technical competence of the experts is the most important. This means that additional experience and abilities in technical training are technological skills. Technology as a method in teaching and learning is only additional but also essential.

For VHS teacher competencies, pedagogical competence is considered the most important aspect of VHS teachers. Among the pedagogic competencies, the most important domain aspects are the implementation of teaching and learning and practical work skills (0.131), mastery of the head of vocational learning (0.123), facilitating the development of the potential of students (0.113), the learning atmosphere (0.096), evaluation and assessment. (0.089), industry-based curriculum (0.086). Among vocational competencies (0.300), the most important domain aspects are vocational knowledge and skills (0.513), networking and collaboration (0.278) and entrepreneurship (0, 209). In professional competence (0.172), the most important domain aspects are mastery of content application (0.447), mastery of content knowledge and concepts (0.323) and continuous professional development (0.230). Finally, the least important aspect is technological competence, including the use and utilization of ICT to improve learning (0.678) is the most important.

In the vocational aspect, the most important competence is technical experience and competence. Regarded on the assessment of experts, it is stated that vocational teachers must have good knowledge related to work knowledge which includes: (1) factual work knowledge such as work culture, work challenges in the future world of work; (2) conceptual work; (3) work procedure in the form of work instructions, providing an explanation regarding the mechanism for using work tools; (4) technical skills. In this competency, it does not only emphasize the delivery of theory but the most important thing is how to provide industry experience in teaching and learning activities. Vocational teachers must be successful as role models in technical and practical mastery.

In the professional aspect, specialization is not only a dominance of concept-knowledge but the most important thing is how the implementation of material can be guided and integrated with the industrial context. This competency also emphasizes responsiveness and being proactive with changing skills demands in the industry. Vocational teachers must update and improve their knowledge and skills related to the demands of skills in the industry, so that they can always develop content that is oriented, connected and integrated with the industry.

In the technological aspect, the core competency is utilizing and using ICT as a learning aid. VHS teachers must be familiar and have good skills in using ICT. ICT in vocational education can serve as a reference source material and as a teaching aid. For example: using and utilizing network system installation software applications and administrators to help students understand the backbone network system. By using ICT, students and teachers can learn more flexibly, ICT allows anyone to access information and learning materials from anywhere and anytime. In addition, the use of ICT as a teaching aid and a source of reference material will provide an effective learning experience for students.

## 4. CONCLUSIONS

Vocational school teacher competency standards cover four competency aspects: (1) pedagogical aspects; (2) professional aspects; (3) vocational aspects; (4) technological aspects. There are many domains in every aspect.

Aspects of pedagogy are: (1) the ability to recognize student personalities; (2) mastery of acquiring in vocational training; (3) mastery of curriculum development based on industrial needs; (4) mastery of learning environment implementation; (5) mastery of teaching, learning and practical work; (6) ability in assistance and supervision internship program; (7) the ability to accelerate the improvement of student potential; (8) communication skills; (9) mastery of evaluation & assessment; (10) ability to perform reflective actions; (11) administration.

Professional aspects include: (1) mastery of content knowledge; (2) mastery of content application; (3) able to carry out self-development in a sustainable manner. Vocational aspects of the field are: (1) mastery of vocational knowledge & skills; (2) entrepreneurship; (3) the ability to network and collaborate. Technological aspects are: (1) capacity to access and exploit ICT for learning; (2) capacity to use and employ of ICT for assessment and evaluation; (3) capacity to employ and utilize ICT to communicate; (4) capacity to employ and utilize of ICT for self-development. There are also multiple subdomains for each domain.

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