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Challenges of initial TVET teacher training in Indonesia: Empirical Analysis of Skills Deficit of Mechanical Engineering Teachers

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Abstract
The fulfillment of competent secondary vocational school (SMK) teachers needs in accordance with the requirements and standards of teacher competence in Indonesia has not yet been carried out according to expectations. This research seeks to find out more about what skills deficit are possessed by prospective vocational teachers who have just graduated from university and to find out more deeply what are the factors that influence these skills deficit. Prospective vocational teachers who will serve in secondary vocational schools (SMKs) at this time need a long adaptation process before being able to teach at each level of competence according to their competence. Based on the research question, "what kind of skills deficit and its factors influence, owned by prospective mechanical engineering teachers related to the school needs for competent teachers in West Java?" the implementation of the teaching internship program for prospective vocational teachers as well as the learning process carried out at the TVET faculty will be the starting point for this research. Problem-Centred Interviews (PCI) have been conducted with the supervisor teachers in the teaching internship program (n=10) and lecturers who teach practical courses at the TVET faculty (n=10) with an approach to the process carried out on teaching internship program activities for prospective vocational teachers in SMKs and an approach to the practical learning process carried out at the TVET faculty in order to prepare prospective vocational teachers according to the needs of SMKs. These interviews have been evaluated using the methods of inductive category formation, the forms of analysis of qualitative content analysis about kind of skills deficit and its factors influence reconstructed, interpreted and summarized in a catalogue of criteria. From the result of the analysis, it is found out that the prospective teachers ready to teach in basic competence subjects at schools are not yet ready for advanced levels of competence in respective subjects. The interview results also show that there is no systematic approach to assure the quality of the graduates based on the standard until now since there is no third-party assessment for university students. For that reason there is no assurance that the prospective teachers have enough competence for becoming a TVET teacher in SMKs.

Keywords: Initial TVET Teacher training, Skill deficit, Teaching internship, empirical research

1. Introduction

The rapid development of the economic and technological sectors in this era of globalization increasingly demands the availability of qualified and competent Human Resources (HR) in all business sectors, to be able

to face increasingly sharp competition, causing the need to increase the capacity of local human resources so that they are recognized as having competence in their respective fields. Technical and vocational education with regards to individual occupational preparation in addition to national development is well recognized worldwide today. (TVET) has an important role to play in preparing young people for the jobs of tomorrow (Atchoarena/Delluc 2002). In Indonesia Vocational education and training tends to be fragmented, even at school level. Responsibility for vocational education and training shared across two ministries (Ministry of Education and Culture (MOEC) and Ministry of Labour and Transmigration. The Central Bureau of Statistics (BPS) stated that Secondary Vocational School (SMK) graduates dominate the number of unemployed people in Indonesia, with an unemployment rate of 6.88 million people in February 2020. SMK graduates contributed to the Open Unemployment Rate (TPT) according to education reaching 8.49 %, decreasing from the year 2019 which reached 8.63 % (Persentase Tenaga Kerja). The problems that occur every year urge the government to make improvements that are deemed necessary. However, to change SMKs to reach the quality assurance expected by the industry, radical policies are needed to solve the problems that occur. Therefore in 2016, the president as the holder of the highest government power in Indonesia issued Presidential Instruction Number 9 of 2016 concerning Revitalization of Secondary Vocational Schools (SMK's) in the Context of Improving the Quality and Competitiveness of Human Resources in Indonesia, and specifically instructed the governor to carry out vocational restructuring which includes vocational programs that were opened and vocational locations, develop superior vocational schools and provide facilities for the community to obtain vocational education services in accordance with the potential of their respective regions.

Revitalization is a process or method and action to revive something that was previously empowered, therefore revitalization means making something or action vital, while the word vital has a very important meaning or is very necessary for life and so on. According to government evaluation, there are six problems in revitalizing SMK. First, the implementation of the curriculum for SMK level is still rigid because the curriculum prepared is based on standards but is generic, often fails to be understood by curriculum implementers at the educational unit level. As a result, it is difficult to meet the needs for a workforce that is ready for use by the business and industrial world. Many people think that the curriculum and syllabus at SMK are determined unilaterally by the Ministry of Education and Culture. Second, the availability and competence of teachers are not in accordance with the subjects being handled in each expertise program (miss match). Third, cooperation between SMK and the business world as well as the industrial world (DU/DI) as a place of practice for students is not optimal. Fourth, the results of the competency test conducted for SMK graduates have not been able to meet the needs of related industry. Fifth, the ratio of students to the tools or the availability of facilities and infrastructure for practice is far from ideal according to the requirements. Sixth, the polemic of SMK financing is another problem, both in terms of budget sources from the government and from the community (Dilema Program Revitalisasi SMK). This hinders statistical generalizations and sector analysis. Nevertheless, in line with trends worldwide, access to vocational secondary education is affected by the demand for its programmes and the level of resourcing available.

Regarding to the increasing interest of young people to entering vocational school, quality of the vocational teachers is one thing we have to consider seriously. TVET Teachers training has been the most important thing to be developed recently in Indonesia, TVET teacher training in Indonesia is in the responsibility of Ministry of Education and Culture under Directorate General of Higher Education for initial TVET Teacher Training with several Bachelor Degree programs in University and Directorate General of Vocational Education responsible for further training for TVET teachers with several programs in TVET teacher training institutions.

Until now there have been many students who have graduated from the university as prospective teachers, but the facts prove that these graduates still have a practical skill deficit which results these graduates still cannot teach properly in practical subjects at school. On this basis this research is conducted to determine the factors of skill deficit of prospective teachers in the field of mechanical engineering. Until now, no study has been made on the skill deficits from prospective TVET teachers graduated from university. There are several problems faced in the learning process in initial vocational teacher programs implemented at universities. The problem identification in this research is, there is a discrepancy between the study programs at the Technical Vocational Education Faculty in the Mechanical Engineering Department at Indonesia University of Education (UPI) and the study programs in vocational high schools. With this difference in the study programs, how can prospectively graduates from university teach in relevant fields in vocational high schools in Indonesia?

Thus, this research is focused on comprehending one main research question: "What kind of skills deficit and its factors influence, owned by prospective mechanical engineering teachers related to the school needs for competent teachers in West Java?"

For a large country like Indonesia, the challenge in education and training prospective vocational teachers always arises from time to time. It will need the consistency of continuous development following the schools and industry demands. In other words, the challenge to guarantee the quantity and quality of vocational teachers is a serious challenge faced by Indonesia now and in the future. The development of initial vocational teacher training is defined as an effort to improve the level or professional degree of a vocational teacher related to their ability to master teaching materials or teaching methodologies, as well as the professionalism of teachers in learning technical competence following their areas of expertise, motivation, and commitment in carrying out their duties as teachers. Professional teachers are teachers who realize that they are individuals who are called to assist students in the learning process so that they continually need to develop their knowledge and skills about how students should learn to achieve maximum results.

The implementation of pre-service TVET Teacher training in Indonesia has been carried out in Indonesia since the 60s along with the growing number of schools throughout the country. Especially in the vocational field, Indonesia has several times changed the education system and training of prospective vocational teachers to meet the needs of schools. In practice, the implementation of pre-service for prospective vocational teachers is the responsibility of the university in accordance with its authority. Currently, the number of universities in Indonesia that has study programs in the field of vocational teacher training is still very limited due to several factors, such as the high cost of facilities and infrastructure that must be provided, supporting human resources, and the lack of interest of young Indonesians to become vocational teachers as a career choice.

2. Method

To answer the research questions, a suitable research method is needed, which should meet the characteristics of the research. In this research, empirical research is conducted, and the methods and steps used are qualitative methods and data analysis methods developed by Philip Mayring. The purpose of the empirical research conducted is to explore the skills deficiencies of future TVET teachers in West Java. Empirical research is research based on observation and measurement of phenomena directly experienced by researchers. The data collected in this way can be compared with theory or hypothesis, but the results are still based on actual experience. The data collected are all primary data, although auxiliary data from the literature review may constitute the theoretical background. The author uses this method with the consideration that the subject of this research requires direct approach; he does not use a numerical approach. Then the next reason is the approach with qualitative methods that makes it easier for researchers when dealing with realities in the field, and the most important thing is the close emotional relationship between the researcher and the respondent, both regarding the physical and mental aspects so that it can produce authentic and in-depth data.

The research was conducted with a conceptual approach and analysis of the problems taken by comparing the data obtained from interviews in the field with good concepts from books, studies, journals, papers, applicable regulations, and other sources. The type of this research provides an overview of all forms of phenomena in the field to obtain information about incident currently. The researcher here does not test the hypothesis, but only describe the information as it is. Results of the research are illustrated in the chart, table and image models based on factual data support.

This study was used to find out how the learning process carried out by prospective teachers in teaching internship program at Secondary Vocational Schools (SMK's) in accordance with their areas of competence conducted related with kind of skill deficit held by prospective teachers can be implemented. A practical learning process was carried out at the Universitas Pendidikan Indonesia (UPI), Vocational Technology Education Faculty in the Mechanical Engineering Department, to find out the factors which influence the skills deficit held by prospective teachers.

In this context, it should be noted that the researcher and the research subject act in an interaction process that is constantly developing and changing. Especially with the target group addressed in the study, it is very important to create a basis of trust, respect, and acceptance in order to counteract possible refusal tendencies on the part of vocational teacher and lecturer and TVET faculty, which could seriously impair the data recording. The respondents both supervisor teachers and lecturers react very sensitively, sometimes suspiciously, to a purely formal interest in themselves and their experiences.

2.1 Design of the Study

Assuming that there is little knowledge about the objects to be checked before the investigation, to systematically develop the research objects, an exploratory, discovery-based method was chosen as part of this research. The research process begins with the discovery of research gaps. On this basis, the author evaluated the existing literature and concluded that these gaps are worth to take a closer look at. This has been followed by formulating the respective research questions. In this step, one research question with two sub-research questions emerged. Both require empirical work. The next step in the research process was the conduction of empirical qualitative research, namely problem-centred interviews with supervisor teachers at respective Secondary vocational schools that have been a place for teaching internship for answering sub-research question one and with lecturers at TVET faculty at UPI Bandung for answering sub-research question two. At the same time, theoretical research has been done to complement the literature review as well as to complete the answers. In the final step, the results of the empirical and theoretical research will be presented, and conclusions will be drawn. With the method for data collection and the use of guideline-based interviews for data collection as well as category-based evaluation procedures in content analysis for generating results, qualitative methods of social research are used for data collection and data evaluation within the scope of the investigation. The investigation is divided into two parts. In both cases, a document analysis precedes the interview, which primarily serves to prepare and to create guidelines, and supplement the interviews. The first part focuses on prospective vocational teachers (objects of investigation) in teaching internship program (at 7th semester of the bachelor's degree study) from Universitas Pendidikan Indonesia (UPI) in Bandung West Java. This results in a catalogue of skills deficit shown by mechanical engineering prospective teachers in teaching internship program. The second step focuses on lecturers at TVET Faculty Universitas Pendidikan Indonesia (objects of investigation) in practical learning process activity in TVET faculty. The result were the factors influence of skills deficit of mechanical engineering prospective teachers. The collected problem-centred interviews are analysed and evaluated after the transcription with the help of inductive category formation, a form of analysis of the qualitative content analysis for this purpose, ten interviews with supervisor teacher in teaching internship program and ten interviews with lecturer in practical learning activity at TVET faculty of Universitas Pendidikan Indonesia (UPI) were carried out.

After the translation and transcription, the interviews are analysed and evaluated with the help of the nominal inductive category application, a form of analysis of the qualitative content analysis. This results in the main categories of skills deficit and its factors influence of the practical skills deficit from prospective mechanical engineering teachers. From the answers to the questions of the empirical investigation, recommendations for action for a development of initial TVET teacher education and training are then derived. Figure 1 shows the methodical approach and the results of the study.

2.2 Methodic procedures

The focus of the study are twenty guideline-based, problem-centred interviews with ten supervisor teachers at secondary vocational schools who have a role as supervisor for prospective teachers in teaching internship program and ten lecturers at university who have tought the prospective teachers at TVET faculty in Universitas Pendidikan Indonesia (UPI) Bandung-West Java at the time the interview was carried out (Figure 1). The interviews took place in Bandung West Java between February and October 2019.

Universitas Pendidikan Indonesia (UPI) was selected as object because it is the only university in west java that hasthe initial TVET teacher education and training program (Bachelor Degree), in other hand the number of schools selected is up to selection by prospective teacher which is: (1) SMKN 1 Cimahi (2) SMKN 2 Bandung and (3) SMKN 12 Bandung. The other interviews conducted before real interview were used as sample interviews to test the interview guidelines, which were then modified and adapted. Most of the problem-centred interviews took place directly in the SMK and UPI in a familiar atmosphere for the supervisor teachers and lecturers.

The interview duration varied between 45 and 60 minutes, with all respondents willing to answer the questions asked. All interviews were recorded with a recording device with the knowledge and consent of the respondents surveyed and the postscript was made. The recorded interviews were then transcribed. The investigation was divided into two phases. In the first investigation phase, the interviews with the supervisor teachers who supervise the prospective teacher in teaching internship program, and the second part of the investigation phase the interviews with the lecturers at university who teach the prospective teachers in practical learning process at university were used to inductively develop a catalogue of categories, as shown in (Figure 1).

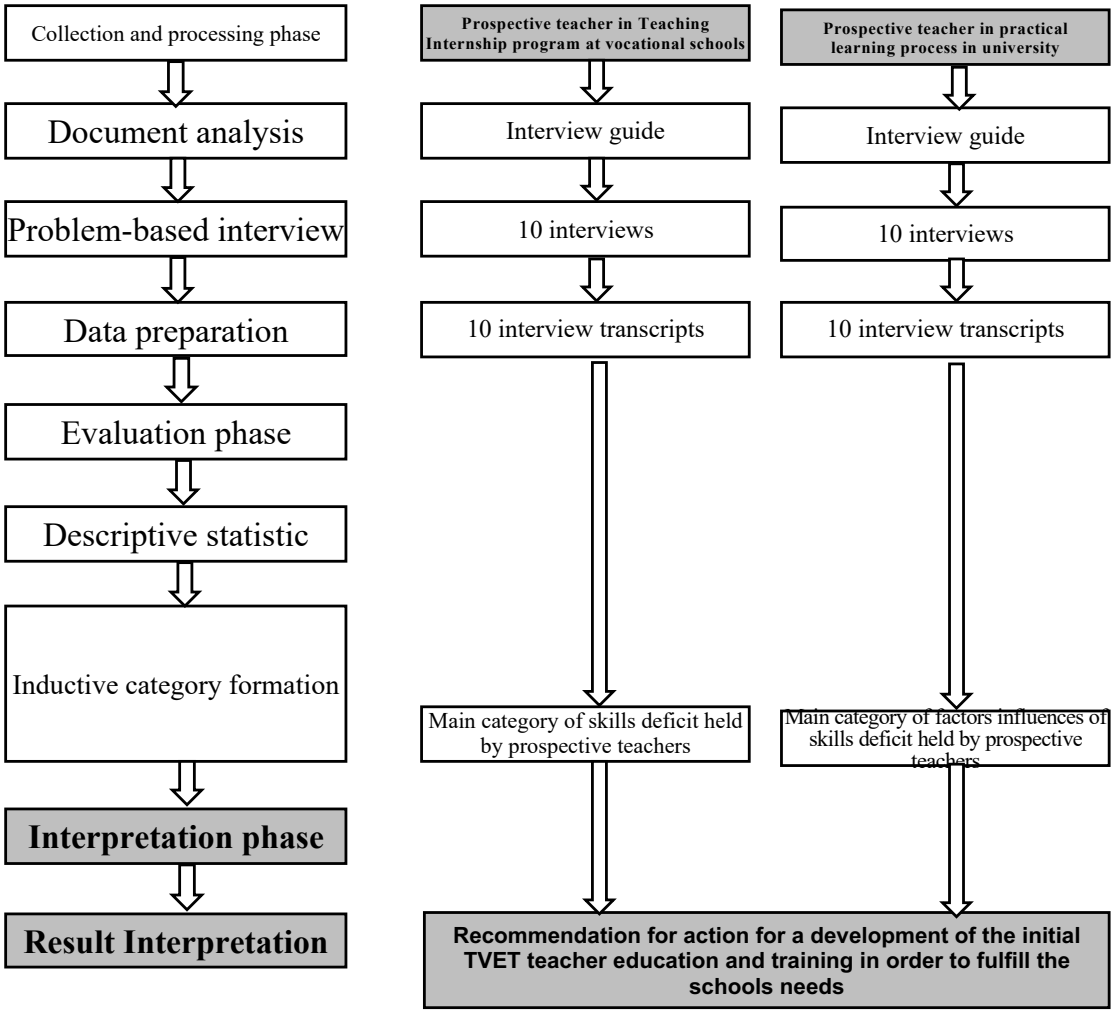

Figure 1. Methodological approaches and results

2.3 Data collection

Instruments are tools that are required to get information. Airasian and Gay (2000) stated that instrument is a tool that is used for collecting data. While Arikunto (2000) revealed that instrument in collecting data is a tool that is used by researchers to help them in collecting data to make it more systematic and easier. Here, the instrument is the researcher herself. Sugiyono (2008 stated that in qualitative research, the instrument are the researchers themselves. Hence, the researchers should be validated by themselves about their ability in conducting research. In qualitative research, collecting the data mostly is done in participant observation, depth interview and documentation. Sugiyono (ibid. In this research, the researcher uses interview supported by document review. In this study, primary data sources in the form of words were obtained from interviews with predetermined informants involved in the implementation of practical learning carried out at the UPI Vocational Education Technology Faculty in the Mechanical Engineering Department as well as interviews with Teachers in Vocational High Schools that were the places for The Students from the UPI FPTK conducts an internship as a prospective teacher. While the secondary data sources in this study is curriculum data at the UPI Vocational Education Technology Faculty in the Department of Mechanical Engineering and the Vocational Middle School curriculum in the related study program.

2.4 Data verification technique

In qualitative research, data can be categorized good data if the data are valid. In this research, the researcher uses triangulation technique. Cohen et al. (2000) stated "Triangulation may be defined as the use of two or more methods of data collection in the study of some aspect of human behaviour".

Thus, triangulation technique means the researcher uses two or more techniques in collecting the data to get validity. The purpose of triangulation is to increase the credibility and validity of the findings. Methodological triangulation refers to researchers using more than one method in the research. Cohen et al (2000) explained "Methodological triangulation is using the same method on different occasions or different methods on the same object of study". Thus, methodological triangulation is using different methods to get validity of data. The researcher uses methodological triangulation to get validity of data. Besides, the researcher collects the data by using interview guides which is supported documentation review which can give evidence if the participants are people that is proper to be used as subject of research.

2.5 Data analysis

The data analysis technique used in this study is qualitative analysis by following the theoretical concept of "content analysis of Philip Mayring's model." The definition of content analysis is "an in-depth analysis that can use quantitative and qualitative techniques on messages using scientific methods and is not limited on the types of variables that can be measured. The aim of this analysis method is to compress the complexity and abundance of the empirical data material into essential elements and still maintain a high level of quality of the informative value of the basic data (Lange 2020). Therefore, the qualitative content analysis (summary, structuring) is ideally suited for evaluating the interview material collected about kind of skills deficit in the activity of teaching internship at secondary vocational schools and for deriving possible influencing factors on the skills deficit owned by prospective teachers. The procedure and methodology of qualitative content analysis is based on the classic features of general content analysis (Kuckartz 2009, Mayring 2010). From the data that has been formulated, it will be analysed properly to produce the right research as well, below is the content analysis framework (Figure 2):

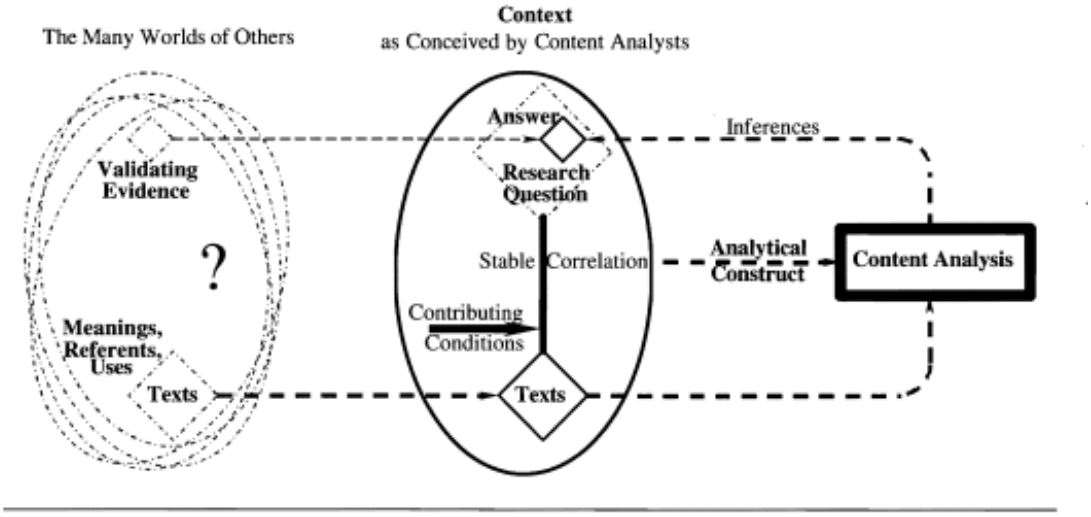

Figure 2. Content analysis framework (ibid.)

The two biggest parts of the picture above are the real data context, the real symptoms and the conditions that surround them (Figure 2). While the context created by the researcher is a part that is built by the researcher based on the target analysis, various factors influence it. Both contexts will influence content analysis which will later be described in the analysis that will be made. In the qualitative content analysis procedure, there are two central approaches to development: (1) inductive category development and (2) deductive category application. In this study the approach used was inductive category development. Inductive category development within the framework of a qualitative approach, questions about how the categories are defined, how the categories are developed. This will be a concern, to develop aspects of interpretation, categories, as close as possible to the material, to form them in terms of the material. The main idea in the content analysis procedure for the inductive category development is to formulate a criterion and definition, starting from the theoretical background and research questions, determining the calculated textual material. Material is done through categories that are temporary and step by step material.

3. Empirical findings

The sample included a total of twenty peoples (n=20) aged 40 up to 56 years. ten peoples are supervisor teacher at secondary vocational schools for sub-research question one, and ten peoples are lecturer at TVET Faculty of UPI Bandung for sub-research question two. To increase the interviewer's competence and to evaluate the guidelines, the interview situations were simulated in advance and then analysed, with two interviews being carried out as trial interviews that were not included in the evaluation. Within the entire sample for sub-research question two (n=10), most of the interviewee questioned were between 40-45 years old (four interviewee), three interviewees between 45-50 years old, two interviewees between 50-55 years old, and one interviewee was more than 55 years old. While the condition of sample for sub-research question one (n=10), most of the interviewee questioned were between 40-45 years old (five interviewee), four interviewee were over 55 years old, and one interviewee between 50-55 years old (Figure 3).

NO	CODE	POSITION	ROLE IN INTERNSHIP PROGRAM	AGE	SPECIALIZATION	INSTTUTION
1	UL 1	Lecturer	Internship supervisor	40-45	AUTOMOTIVE	UPI
2	UL 2	Lecturer	Internship supervisor	>55	CNC	UPI
3	UL 3	Lecturer	Internship supervisor	40-45	REFRIGERATION	UPI
4	UL 4	Lecturer	Internship supervisor	40-45	WELDING	UPI
5	UL 5	Lecturer	Internship supervisor	50-55	AUTOMOTIVE	UPI
6	UL 6	Lecturer	Internship supervisor	50-55	MACHINING	UPI
7	UL 7	Lecturer	Internship supervisor	45-50	WELDING	UPI
8	UL 8	Lecturer	Internship supervisor	45-50	HYDROLIC AND PNEUMATIC	UPI
9	UL 9	Lecturer	Internship supervisor	45-50	REFRIGERATION	UPI
10	UL 10	Lecturer	Internship supervisor	40-45	MACHINING	UPI
11	TVS 1	Teacher	Supervisor teacher	40-45	REFRIGERATION	SMK 1 CIMAHI
12	TVS 1	Teacher	Supervisor teacher	40-45	REFRIGERATION	SMK 1 CIMAHI
13	TVS 1	Teacher	Supervisor teacher	40-45	REFRIGERATION	SMK 1 CIMAHI
14	TVS 1	Teacher	Supervisor teacher	40-45	AUTOMOTIVE	SMK 6 BANDUNG
15	TVS 1	Teacher	Supervisor teacher	50-55	AUTOMOTIVE	SMK 6 BANDUNG
16	TVS 1	Teacher	Supervisor teacher	>55	AUTOMOTIVE	SMK 6 BANDUNG
17	TVS 1	Teacher	Supervisor teacher	40-45	WELDING	SMK 2 BANDUNG
18	TVS 1	Teacher	Supervisor teacher	>55	WELDING	SMK 2 BANDUNG
19	TVS 1	Teacher	Supervisor teacher	>55	MACHINING	SMK 12 BANDUNG
20	TVS 1	Teacher	Supervisor teacher	>55	MACHINING	SMK 12 BANDUNG

Figure 3. Interviewee list

3.1 Results of inductive category formation

In this study, inductive category development was carried out on two sub-research questions, below will explain the implementation steps of data analysis through inductive category development.

3.1.1 Activity of teaching internship of prospective teachers at secondary vocational schools (SMKs)

The first sub-research question seeks to find out, how the activity of teaching internship at secondary vocational schools is conducted to investigate what kind of skills deficit held by prospective teachers.

From the data analysed, the main category of 'teaching ability' is a topic that has received a lot of responses, namely 95 interview materials discussing this matter, besides that the main category 'lesson plan development' is also one of the topics of discussion about activities carried out at schools. From the ten interviews conducted, 160 materials were obtained at this analysis stage, of which there were fifteen sub-categories and seven main-categories, (Figure 4). Main categories of teaching ability are obtained from 95 materials, divided into nine materials for the sub-category theory teaching ability, 28 for the sub-category practical ability, thirteen for the sub-category practical ability limitations, 21 for the sub-category expected competency form intern students, eleven for the sub-category problem solving ability, eight the sub-category intern students advantage skills, and five for the sub-category intern student's deficiency. The main lesson plan development consists of seventeen interview materials with details of four for the sub-category preparation of lesson plan development by intern students before teaching, thirteen for lesson

plan development process. The main category of teaching assignment consists of thirteen materials with two sub-categories, namely: ten teaching plans for intern students in school's sub-category, three teaching preparation for intern students in the beginning of the program. The main category teaching role consists of one subcategory, namely: the sub-category intern student's role in practical teaching.

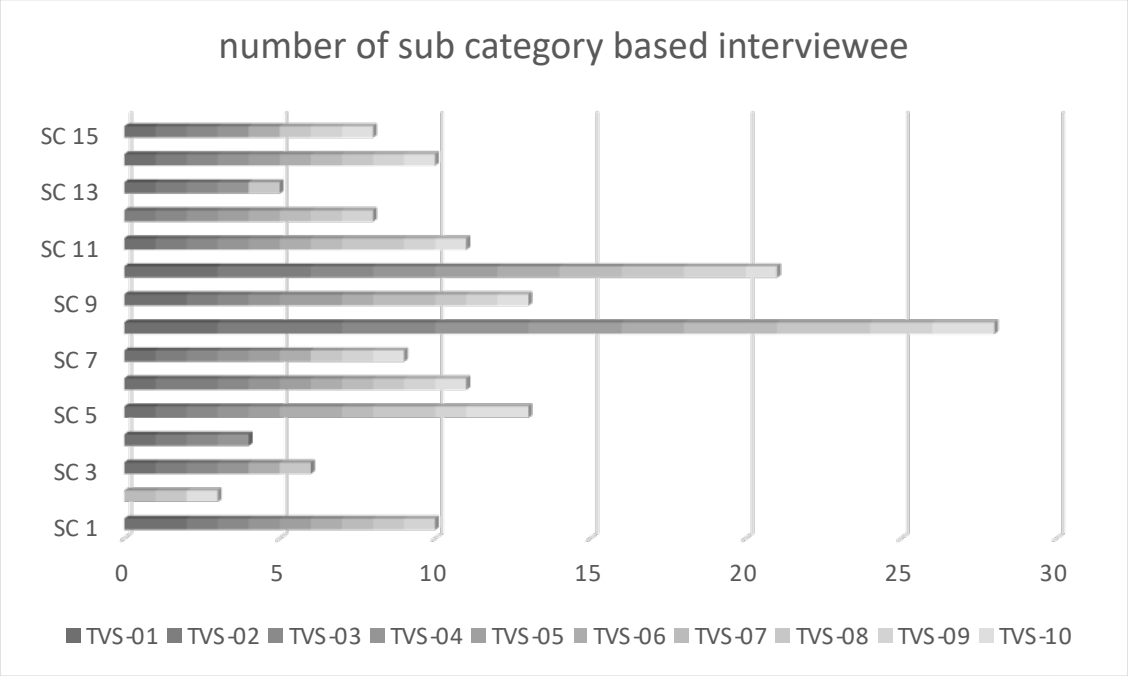

Figure 4. Nominal distribution within the inductive category development (Teaching internship program at SMK)

3.1.2 Activity of Practical Learning Process at TVET Faculty

The second sub-research question seeks to find out, how the learning process is conducted at TVET faculty at Universitas Pendidikan Indonesia (UPI), especially in practical learning process part. From the data analysed, the main category of 'practical learning process' is a topic that has received a lot of responses, namely 74 interview materials discussing this matter, besides that the main category 'curriculum development' is also one of the topics of discussion about activities carried out at TVET faculty. From the ten interviews conducted, 166 materials were obtained at this analysis stage, of which there were fifteen sub-categories and five main-categories, (Figure 5). Main categories of curriculum development are obtained from twenty materials, divided into nine materials for the sub-category curriculum development schedule and eleven for the sub-category curriculum development strategy. The main category learning strategy consists of nineteen interview materials with details of six for the sub-category learning situation, six for learning concepts and seven for learning targets. The main category of learning preparation consists of 26 materials with three sub-categories, namely: eight practical learning preparation sub-category, six practical learning preparation sub-category and twelve learning plan sub-category. and for the main category teaching internship consists of two subcategories, namely: the sub-category teaching internship requirements of seventeen interviews, and the sub-category of teaching internship purposes as many as ten interviews.

3.2 Evaluation of interview results

3.2.1 Activity of teaching internship of prospective teachers at secondary vocational schools (SMKs)

- The implementation of the teaching internship program at SMK for prospective teachers is useful for providing field experience in the learning process.
- The intern teachers have sufficient knowledge in the field of pedagogy as a provision for teaching at SMK.
- Intern teachers have good social attitudes in adapting and communicating in the school environment.

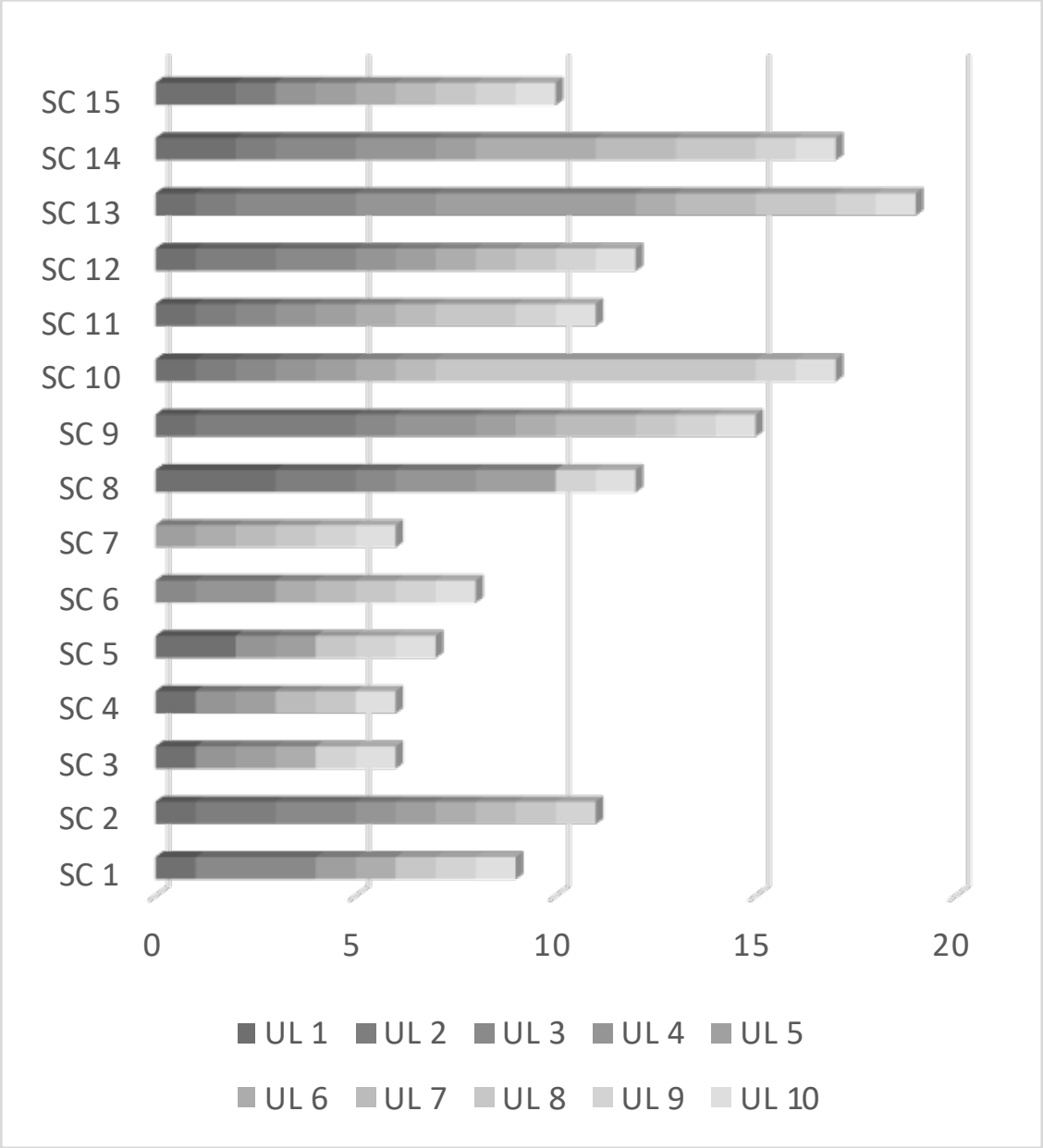

Figure 5. Nominal distribution within the inductive category development

- In its implementation, the apprentice teachers already have good methods and media in teaching in the classroom.
- Intern teachers have good confidence when teaching the theory class in grade 11.
- Intern teachers can demonstrate practical skills in grade 11.
- Intern teachers have shortcomings when teaching advanced theory in grade 12.
- The practical skills of the intern teachers still do not meet the requirements for practical teaching in grade 12.
- Intern teachers are involved in the evaluation of vocational school students at the end of each semester.

3.2.2 Activity of practical learning process at TVET faculty

The second sub research question seeks to find out, how the activity of learning process at TVET faculty is conducted. To do so, the following interview data have been analysed. To get better understanding of the problem at hand, the following main categories with respective codes have been set out and carefully

investigated. From the data obtained at the time of the interview, there are the following facts:

- Curriculum development is compiled periodically and incidentally as needed, and involves lecturers, industry, and schools as input providers.
- In fact, the compiled curriculum does not fully refer to the SMK curriculum, as evidenced by the types of courses that are still too broad and general and do not specifically refer to technical competencies.
- The comparison between theoretical and practical learning is still greater in theory, namely between 60–70 %.
- The need for practical tools and materials is not fully provided by the faculty management due to the lack of available funds for practical learning process.
- Comparison of the amount of equipment with students is still not ideal for production and construction engineering and automotive majors.
- The existing practice schedule does not match the number of job sheets that must be completed.
- Due to the lack of practical materials, the lecturer does not assign students to complete all the job sheets that have been compiled.
- Practical assignments are mostly carried out in group mode due to the lack of tools in certain courses.
- There has been no implementation of competency certification from third parties that can measure students' technical abilities.
- There are several collaborations with industry that were initiated by lecturers without any support or regulations from the university.

4. Discussion of the research result

4.1 Skills deficit of prospective mechanical engineering teachers

Becoming a vocational teacher in Indonesia, especially in vocational high schools, is required to have practical skills in accordance with school needs because the education system implemented at SMK is school based, therefore the implementation of the learning process both theory and practice is carried out in SMK as a whole, and the teacher in charge is required to have practical skills to guide vocational students in achieving the competency targets that have been set in accordance with the applicable graduate standards nationally. Productive teachers are tasked to train students to have working competencies according to the Indonesian National Working Competency Standards (SKKNI) and make students become qualified skilled workers in specific jobs that are suitable for industrial needs. They are taught subjects that are following the competencies that are the main elements of Vocational Secondary Schools graduates. Responding to the demands, productive teachers in Indonesia must have theoretical and practical abilities (Surono and Wagiran, 2016).

4.1.1 Main category Teaching Ability

TVET Teachers must be enabled to link closely with the world of work and local/regional communities/society to identify the real training needs and to develop appropriate training programs as well as for youth, adolescents and adults" (Stolte 2009). In current situation, Spöttll (2009), described that as a TVET teacher he or she must fancy his or her students, he or she must identify himself or herself with the school, he or she must be able to work under psychological pressure and should be curious! Apart from this – and this is more or less self-explanatory – a teacher must be:

- a social worker,
- a psychologist,
- a mediator,
- a communicator,
- a team worker,
- an expert,
- a "knowledge networker".

Teachers who are good at communication, classroom management and appropriate subject technology will create a positive learning environment. Although it is important to be proficient in your subject area, it is important to communicate the necessary skills and concepts in a way that students can understand. The ability to teach effectively is certainly a requirement for a prospective vocational teacher in carrying out daily duties as a vocational teacher at SMK. In this case the teaching internship program for prospective

vocational teachers is very important to be able to evaluate the abilities that are already owned and the abilities that are still not suitable or are not mastered by the prospective vocational teachers.

As vocational teachers, apart from being required to demonstrate technical skills to students in the classroom, they are also required to be able to carry out the theoretical learning process as a basis of knowledge in practical activities in the workshop. The ability to teach theory is as important as practical teaching because an understanding of the basic theories of a skill is fundamental to students before they carry out practical learning activities. Sink (2014), reminds us that cognitive theory will assist the learner to obtain the thinking techniques to improve performance in the job. Harasim (2017), pointed out that theory is an explanation of why things happen or how things happen. She defines learning theory as a theory designed to help us understand how knowledge is created and how people learn. Lefrançois (2019, writes that learning theory aims to systematize and organize knowledge about human learning. He believes that powerful learning theories are designed to explain behaviour, predict behaviour, and even shape or change learner behaviour. Some of the respondents described that the intern has a good skill for teaching theory to SMK students.

In a sense, a theory also called knowledge is something you must read or understand before you must act in a certain way. The level of theoretical knowledge you have learned will also affect your learning style. In vocational education, a "deeper" theory is needed as the basis of knowledge and to ensure that someone can understand the actual process to be carried out. For students in vocational schools, this depends on how much theory the students have learned before practice. Of course, they learn different. Another definition of theory is about preparing for work or practical tasks at schools. With the importance of theoretical mastery at this stage, it is expected that future professional teachers will have sufficient abilities to meet these requirements, but this is also affected by the knowledge they acquire during university lectures. Kyarizi, (2016) reminds us that, in Vocational education, however, knowledge cannot be viewed in the same way as verbalizing explanations of what a vocation consists instead it should be viewed as being an integration of contextual, theoretical (conceptual, procedural, and propositional), practical, and indigenous everyday knowledge. This is because to be a competent craftsman, a person needs to use all forms of knowledge that relate to his or her vocation in the context in which it is applied. In today's modern world, vocational education has embraced the concept of learner-centred education. This is expected to direct the learning process into an activity that can further explore the abilities of learners in school. In its implementation, the vocational teacher plays a more important role as a facilitator in the learning process. For many teachers, moving towards learner centred approaches means they must leave the centre stage to become the creator of a learning environment that gives multiple opportunities for learners to learn. Most of the work is done before facilitating the session, to set the stage for the learning and assessment tasks teachers have developed for the session. Therefore, the purpose of a session plan is to align all learning and assessment activities to the learning outcomes for each lesson, and to ensure that learners achieve said learning outcomes.

A session plan is like a road map that helps facilitators to stay on the track. It is a pathway that leads to the set destination (learning outcomes). A session plan is a planning document that gives a facilitator room to deviate, as unplanned events during the session might necessitate this. A facilitator should remain flexible and bear in mind that educating learners is the most important thing, not the plan. Facilitators must avoid situations that will prompt a rush to complete the planned session, as this is counterproductive. With clearly defined learning outcomes, the facilitators can describe what should be achieved in the learning process, and state what the learners can do at the end of the session. Learning outcomes give learners an idea of what the purpose of that session is. It also gives the facilitator practical direction, as it determines the structure of the session, facilitation method, and the mode of assessment to use (Doherty/Olelewe 2019). Thus, it can be ascertained that a vocational teacher has a very crucial role in preparing human resources to face the challenges of the 21st century which we know are very diverse and global in nature. The aim of the 21st century facilitation of learning is to support learners in establishing lifelong learning habits, an ability to learn with technology, the development of knowledge, character, and higher-order skills (such as creativity, critical thinking, communication, collaboration). Implementation of an innovative pedagogical approach will have an impact on teachers/facilitators, learners, and the learning environment. It is important that the teachers have a clear mental picture of their responsibilities as facilitators. After all, the quality of the TVET education system cannot exceed the quality of its facilitators/teachers (ibid.).

Considering that the purpose of vocational education is to prepare someone to master a skill according to the demands of a standard or occupation, the practical learning process is a major factor in the TVET process. The overarching goal of vocational education is, we believe, the development of working competence in a chosen vocational area. In other words, vocational education is about enabling people to learn how to

do things at a standard set by experts from the occupation into which they are progressing. The primary outcome of vocational education is expertise – being able to do skilful things of a kind and in an area of work that is quite clearly specified and understood. This distinguishes vocational education from more academic forms of education where the valued goal (as defined de facto by most forms of assessment) is to be able to write and talk about something; to be able to explain, critique, theorise and justify (Lucas/Spencer/Claxton 2012). Wrenn/Wrenn (2009 described that educators in professional or service-related fields desire their students not only to learn theory and understand why theories are important but also to learn how to apply the theoretical frameworks in practice. Too often we hear anecdotal accounts of students in internships who are unable to make this transition from theory to practice with confidence and effectiveness. Perhaps the difficulty in making the transition from theory to practice arises, at least in part, from a failure of the teacher to integrate both theory and practice into the same course in the curriculum in ways that are relevant and meaningful to the student. Such integration helps students to more closely associate the practical value of learning theoretical concepts.

4.2 Factors influence of practical skills deficit of prospective mechanical engineering teachers

4.2.1 Main category learning strategy

For achieving the target set to prepare students for become a TVET Teacher, lecturers at university need proper lesson plans to conduct an effective classroom whether in theory or practical learning process. In this context, Doherty et al. (2019, who described the lesson plan for innovative pedagogy approach in a 21st century and in an outcome-based education will focus on two main aspects:

- The session plan must be learner centred, inclusive and learner friendly.
- The session plan must embed whenever possible, 21st century skills.

For many teachers, moving towards learner centred approaches means they must leave the centre stage to become the creator of a learning environment that gives multiple opportunities for learners to learn. Most of the work is done before facilitating the session, to set the stage for the learning and assessment tasks teachers have developed for the session. Therefore, the purpose of a session plan is to align all learning and assessment activities to the learning outcomes for each lesson, and to ensure that learners achieve said learning outcomes (Figure 6).

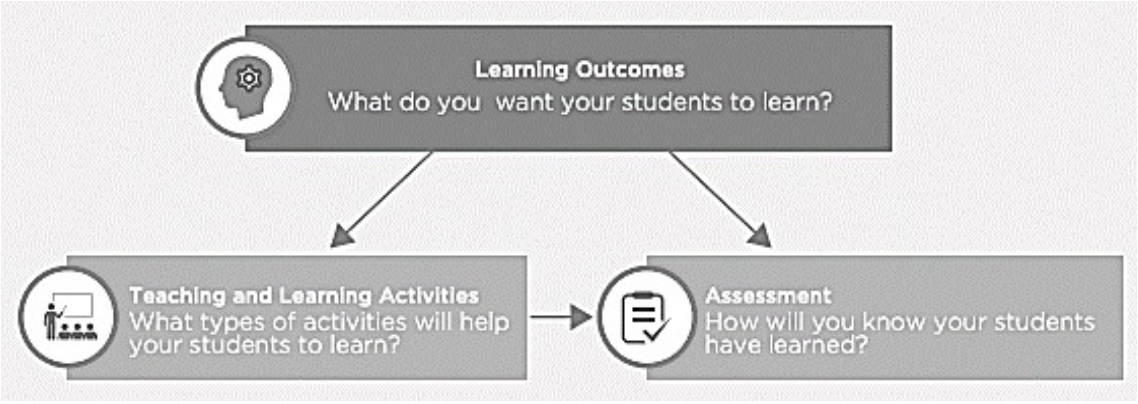

Figure 6. Learning outcome (ibid.)

From the explanation above, it can be said that the condition of the learning process must be student-centred with practical activities that provide flexibility to carry out creativity, innovation and strong thinking analysis supported by lecturers who become facilitators in the process. CBT is a structured training and assessment approach that allows individuals to acquire the skills and knowledge to perform simple or complex tasks to a specified standard. CBT is focused on:

- The performance of tasks and duties by an individual.
- The conditions in which they are to perform these tasks and duties.
- The standard to which they are to perform.

CBT is an outcome-based learning system for developing curricula. Training and assessment are centred around learners achieving certain competencies according to clearly defined criteria and undertaken within workplace-like conditions. CBT is, therefore, a form of training that is specifically focused on achieving competence. Training is typically divided into small units that are dedicated to the mastery of a specific competency and articulated together into more complex structures. Once students can demonstrate the mastery of a given competency, they then proceed to the next unit. Instead, CBT attempts to be market-relevant, since it is based on information about the needs of the labour market and, in return, signals to employers the available skills and employability of jobseekers (ILO 2020).

From the results of the interviews obtained and analyse the theoretical approach of CBT, the application of the CBT concept in practical activities in workshops has not fulfilled the basic principles of the CBT concept which must refer to competencies that must be achieved gradually. In fact, what TVET Faculty UPI did in general was still referring to courses. this is not in line with the ILO (ibid.), statement that CBT is replacing traditional training and learning methods, which are often undertaken within a course or subject. These have tended to mostly focus on knowledge without the mastery of real-life industry skills or any consideration for labour market performance (ibid.). The quality of teacher training exerts has a major influence on the quality of the young persons to be trained and on the sound development of democratic societies. It is therefore recommended to implement the teacher training at universities by all means. The teacher profiles must not be determined too narrowly. They must not only concentrate on instruction but must focus on the development of schools as a whole and must concentrate on the industrial challenges as contents of training (Spöttll 2009). From interview respondent described that the implementation of teaching and learning activity at TVET Faculty of Universitas Pendidikan Indonesia (UPI) so far strived to always connect learning with industry characteristics. In practical learning activities, the learning target was based on occupation in industry related.

4.2.2 Main category practical learning process

There is a growing interest in practice-based learning in countries with both advanced and developing economies. Much of this interest is directed towards augmenting students' learning within vocational or higher education programmes of initial occupational preparation or those for professional development (i.e., further development of occupational knowledge across working life). Increasingly, educational programmes organised by universities, technical colleges, and professional bodies, are often either premised upon or partially based within the learner's occupational practice. Hence, at this time, there is a wide and growing acceptance that the experiences provided in practice settings, usually workplaces or work settings, are essential for developing the knowledge required to effectively practice occupations (Billett 2010). In this context, practical learning process conducted at TVET Faculty of UPI was implemented with some cooperation with industry to ensure the outcome was in line with industry development and meets the demands regarding the occupation in industry, but this activity was done personally by lecturers not as a system from university.

In practical learning processes vocational trainers should carry out a demonstration to transfer skills to students, in this context, Doherty et al. (2019), described that a teaching method used to communicate a skill with the aid of audio, visuals, or audio-visuals such as flip charts, posters, power point slides, real objects [e.g. making a dovetail joint, folding a napkin in bishop mitre shape], video clips, or through role/life display [e.g. demonstrating how to greet a person at a front desk, how to stand / speak when giving a presentation], etc. A demonstration session is the process of facilitating the learning of skills in a step-by-step process. This may involve showing by reason or proof, explaining, or making clear examples or experiments. Demonstration method improves the understanding of complex skills and principles because the learners can pay attention to and follow along with the learning process. This method does not need to be facilitator demonstration, it can be to invite experts, can be learners in experiential learning cycles; 'demonstration' can also – and often better – be 'video demonstration' following the demonstration on a video clip, visible to all learners. It can be stopped, replayed, allows close ups etc.

To measure the success of the practical learning process that has been carried out in the form of practical assignments to students according to the targets that have been prepared, the lecturer needs to carry out a measurement or assessment of the competencies that students have obtained as a whole and in a comprehensive way. Assessment of learning characterises how we may traditionally view assessment. It involves making judgements about students' summative achievement for purposes of selection and certification, and it also acts as a focus for institutional accountability and quality assurance – for example, the number of 'good' degrees awarded is used as a key variable in university league tables. On the other hand,

assessment for learning is formative and diagnostic. It provides information about students‘ achievement which allows teaching and learning activities to be changed in response to the needs of the learner and recognises the huge benefit that feedback can have on learning (Black/Wiliam 1998). In this context, Abrahams/Reiss (2015), describe about summative and formative assessment:

- Summative assessment: Assessment of the learning, where the marks are for a terminal test or examination.
- Formative assessment: Assessment for learning, where students are given feedback from the teacher during the teaching, they receive to progress as opposed to being given a final assessment of their learning.

Regarding evaluation and assessment activities, respondents explained what they did to assess the achievement of student practical competencies in the form of comprehensive assessments starting from daily assignments, attitudes in the learning process, midterm exams and final semester exams. The evaluation carried out so far is still in the form of fulfilment to give students a grade to pass a course. Until now, the evaluation has not led to an objective measurement of the quality of learning outcomes. Learning outcomes are used as one way of driving efficiencies and permitting a move away from time-based programmes and education systems. Efficiencies could include exemptions from instruction in parts of programmes, and increased institutional accountability based on outputs (defined as learning outcomes) of educational processes (EU/Directorate-General for Education/Culture 2012). Competence-based qualifications consider the influence of the learning (or working) context when learning outcomes are defined and assessed. This context has a strong influence on the range of learning outcomes that are considered important, the interaction between them, the way the learner learns, how the outcomes are assessed and most importantly, the value attached to qualifications in the field (ibid.).

From data obtained, only in automotive major conducted the third-party certification because the lecturer has willing to do so, whether the other major not to do so due to lack of funding. We can see that currently there are no rules or policy from university to conduct the thirds party certification. This situation causes learning outcomes not to be accurately described and the quality of graduates is not measured objectively.

4.2.3 Main Category Curriculum Development

To qualify graduates who become vocational teachers with capability and competence according to the needs of the school, an appropriate curriculum is needed in its implementation. Curriculum development in TVET Teacher education and training should be conduct in sustainability manner, in this context, Yunos et al. (2019), state that the purpose of a Teacher Education programme is to produce quality teachers, especially teachers that can perform the task of teaching effectively and deliver the purpose of the National Education Philosophy, consequently leading to a sustainable TVET Teacher Education programme. The curriculum must be able to react with the changes took place in the workplace. TVET Teacher Education programmes require different criteria than general Teacher Education programme. More particularly, they highlighted these specific criteria for TVET Teacher Education Programme as follows (ibid.):

- specialization
- work-based design
- dynamic
- interactive teaching and learning
- international syllabus

Respondent stated that, curriculum development is carried out regularly, either as a fixed schedule from the university every 5 years or an evaluation every year to make the necessary adjustments related to changes or developments in the industrial world. In terms of curriculum development, Spöttl et al. (2012) in their working paper ‘Standards for TVET Teacher Training’ and the TT-TVET Consortium (2005) present general standards for TVET teacher education covering six areas of development:

- Standards for lecturers’/teacher trainers’ activities (in TVET teacher education) as support for teachers’ practice in TVET,
- Standards for supporting students (trainee teachers) and their learning processes within TVET teacher education,

- Standards for evaluation (of curricula) and assessment (of students' achievements),
- Standards for developing curricula and learning contents,
- Standards for developing methods for instruction and training and
- Standards for developing the organizational frameworks for learning environments.

The standards mentioned above must be a reference in the implementation of curriculum development carried out at TVET Faculty so that the learning process can be measured both in terms of process and learning outcomes. In the context of Indonesia TVET Teacher training, Indonesia has developed National Competency Standards for teachers and lecturer through act number 14 of 2005, this act has become the basis for the development of Initial TVET teacher curricula in university. The act states that a teacheris an educator in a school – both public and private who can educate based on the formal education background that has been taken. The teacher is in charge of educating, teaching, guiding, directing, training, evaluating, and evaluating students' education in early childhood education, through formal education, basic education and secondary education.

Especially for vocational teachers, the emphasis on professional competence is the main issue discussed and becomes the object of development to ensure the quality of learning at SMK. As described in act number 14 of 20015: Professional competence is the ability possessed by the teacher about mastering learning material widely and deeply, it is one of the things that allows teachers to be able to guide students to meet the standards of competence and national standards of education. The following components are a part of professional competence.

- Mastering material, structure, concepts, and scholarly mindsets that support the lessons learned.
- Mastering the competency standards and basic competencies of subjects or fields of development that are capable of.
- Develop learning materials on an ongoing basis by carrying out reflective actions.
- Using Information Technology Communication to communicate and develop themselves.

The curriculum developed at TVET faculty of UPI were different with study programme at secondary vocational school (SMK), which is make the contain of the subjects at TVET faculty would be not covered all the competency unit which is contained in subjects at SMK. Only refrigeration and air conditioning study programs have the same study program with SMK, meanwhile, production and design study program at UPI must cover 6 study programs at SMK, and automotive study programs must cover 3 study programs at SMK. To develop a curriculum that suits school needs, in its implementation, curriculum development is compiled by lecturers by involving the SMK as an input provider for curriculum content. In principle, the curriculum prepares vocational teachers who have pedagogical competences and technical competences that are in accordance with the needs of the school, therefore curriculum development is carried out, its content also refers to the same standards referred to by SMK. From the explanation above we can see that in its implementation, referring to the differences regarding the characteristics of the study program and the existing curriculum structure, it can be ascertained that the practical skills of graduates produced by UPI cannot directly meet the needs of schools because the curriculum structure does not provide much practical experience according to the needs of the SMK. In this context, Axmann et al. (2015 explain in "Four pillars and twelve key elements of teacher training system", in Pillar one that, effective teacher training systems are those that have a meaningful structure which includes different distinct stages of teacher preparation, those that train recruits according to good practice and in ways coherent with local contexts.

5. Conclusion

The conclusions in this study are compiled based on the research objectives, data analysis, description, and discussion of research results. Some of the conclusions that can be conveyed are as follows:

- The curriculum applicable in the vocational technology education faculty still has a gap regarding the needs in the SMK curriculum (miss match).
- There are different views in determining study programs between tertiary institutions and secondary vocational schools, resulting in prospective teachers not being able to directly choose the areas of expertise they will pursue when they become teachers because the knowledge gained in tertiary institutions is not specific to the existing study programs at SMK. This is especially the case in production and engineering design study programs.

- The education of prospective vocational teachers in tertiary institutions is still not able to answer the demands of vocational schools for prospective teachers who have professional competence in accordance with the demands of the curriculum in SMK.
- The developed curriculum in TVET faculty, even though it has involved industry and schools, has not answered the needs because the comparison of academic subjects is still more than that of expertise courses.
- The learning process carried out at TVET faculty is still less than ideal if it is seen from the comparison between the number of theoretical hours and practical hours. In interviews, it was found out that the number of theoretical hours ranged from 60-70% compared to 30-40% for practice.
- The practical learning process carried out in the TVET faculty is the most important thing in preparing the professional competence of vocational teachers according to predetermined standards. In its implementation, it has been carried out as much as possible with several limitations, such as hours of practice that are not in accordance with the demands of the worksheet, the amount of equipment and materials is not balanced, and funding is not in accordance with the needs.
- The practical learning process that is carried out refers to the concepts that are in accordance with the characteristics of vocational education, which is oriented towards mastering competencies even though it has not been able to reach the advanced level as expected.
- Assignments given to students are based on funding conditions, equipment, and available practical materials. This is not ideal because assignments must be based on worksheets that have been prepared based on learning objectives according to the demands of the curriculum.
- In overcoming limitations in the learning process, the lecturers have made every effort to carry out practical learning to the fullest, such as: collaborating with industry for practicum activities, involving alumni to help fulfil practicum tools and materials, providing additional time outside of regular time so that students have sufficient time to complete all given practical assignments.
- The management of the faculty does not objectively evaluate the success of the practical learning process carried out by the lecturers to measure the extent to which the effectiveness and efficiency of practicum activities have been carried out.
- Evaluation of competency attainment during practical learning is only done to provide final grades to students. There is no objective measurement of competency mastery that has been carried out systematically by the University.
- Several lecturers conducted third-party assessment and certification through their respective personal policies to ensure the quality of the related students.
- The implementation of the teaching apprenticeship shows that prospective teachers can teach only up to grade 11 at SMK. They do not yet have the confidence to teach in grade 12 because the skills required have not been fully mastered by them.
- Prospective teachers have good pedagogical skills in the learning process. They also have excellent communication skills with vocational students, colleagues, and school management.

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