**Case Study of Electronic Fuel Injection Competence Acquisition of Students at SMK PGRI 1 Ngawi**

**Muchtar Nasrudin1, Pardjono2, Adhan Efendi3 and Wahyu Noviansyah4**

12Universitas Negeri Yogyakarta,. Colombo No.1, Karang Malang, Caturtunggal, Kec. Depok, Kabupaten Sleman, Daerah Istimewa Yogyakarta 55281

3Politeknik Negeri Subang, Jl. Brigjen Katamso No. 37 (Belakang RSUD, Dangdeur, Kec. Subang, Kabupaten Subang, Jawa Barat 41211

4Universitas Sebelas Maret, Jl. Ir Sutami No.36A, Kentingan, Kec. Jebres, Kota Surakarta, Jawa Tengah 57126

E-mail: adhan@polsub.ac.id

**Abstract.** This study aims to explain the acquisition of electronic fuel injection knowledge at SMK PGRI 1 Ngawi, Namely: (1) achieved the level of knowledge of students, (2) what is the process of understanding electronic fuel injection, (3) how students acquire competence electronic fuel injection, (4) how students try to master electronic fuel injection, (5) What are the attitudes, knowledge and skills of PGRI Vocational students in the EFI field.This research is a type of case study with a descriptive qualitative approach data obtained by using interviews, observation, and documentation. The informants of this study included: automotive skills competency chair of light vehicle engineering, EFI competency teacher, students with less, moderate, high achievement and peer students who participated in the formation of EFI competencies. data is processed using data triangulation techniques. Data analysis using interactive models from Miles & Huberman. The results of the study indicate that: (1) Pencapaian aspek pengetahuan siswa SMK PGRI 1 NGAWI tentang EFI dengan nilai rata-rata kognitif skor 77 (2) the process of understanding student competencies takes place in classrooms and workshops, (3) students gain knowledge about electronic fuel injection independently by reading books, the internet, and the learning process at school, (4) students make efforts by independent learning, group learning, and listening to the teacher's explanation, (5) The competencies obtained by NGAWI SMK PGRI 1 students can be seen from three aspects, namely knowledge, skills and attitudes. In the aspect of knowledge, students get several competencies, namely: (a) basic material regarding electronic fuel injection, (b) electronic fuel injection sensors, (c) electronic fuel injection maintenance, and (d) how to fix it. In the aspect of skills, students get several competencie

**1. Introduction**

*The ASEAN Economic Community* (AEC) or global economic region has been officially opened in Southeast Asian countries on 31 December 2015 . In Indonesia, Senior High School (SMK) is required to produce graduates who are able to compete in the national labor market and ASEAN. Vocational schools are instruments for developing human resources . Quality and standardized Vocational Schools are the key to AEC. The policy of developing vocational education must be based on: (1) facts; (2) goals; (3) values; and (4) future views [1]

In Indonesia formal education institutions that focus on preparing students to have expertise and work in a field at the upper secondary level are Vocational High Schools (SMK) and Vocational Aliyah Madrasas (MAK). Added by [2] SMK / MAK is a form of formal education that organizes vocational education at the secondary education level. Vocational Schools are different from High Schools (SMA), where high school is only oriented to learning that is of general knowledge (cognitive knowledge) only, while SMK is oriented towards cognitive and productive learning. Productive knowledge is expected to be a provision for graduates to be ready to work.

In the framework of developing vocational high schools, efforts to improve teaching and learning processes, curriculum and increase the competence of graduates have an urgent role. According to [8], the development of vocational education now must pay attention to the demands of work in the future and who is in accordance with the demands of the job. Vocational education must be able to be creative and innovative in the learning process [3]. One of the majors in SMK that is the most popular and has a high market share, is Light Vehicle Engineering.

SMK *output* is a learning outcome that reflects how effectively the teaching and learning process is held. This means that learning achievement is determined by the level of effectiveness and efficiency teaching [4] . In the process of teaching and learning, Vocational School is very determined by the ability of the teacher to deliver the material, because in the teaching process knowledge absorbed by students will not be optimal if the method used is also not in accordance with the type of lesson taught . Vocational practices must be balanced to produce graduates who are in accordance with industrial needs [5] .

Competence according to the Big Indonesian Dictionary is the authority (power) to determine (decide something). [6] expresses the definition of competence, *define competence as: 'The capability to perform and use knowledge, skills and use of knowledge, skills and attitudes that are integrated in the professional repertoire of* *the individual.* Competence is the ability to do something using skills and attitudes that are integrated in vocational teaching.

[7] gives an understanding of competence as follows: "Competence is something that students want to have and is a major component that must be formulated in learning that has an important role and determines the direction of learning". [8] teacher competence is a description of what a person can do in work, and what forms of work can be seen . [9] Pedagogic competence is the teacher's ability with regard to theoretical mastery and the application process in learning.

The results of the interview with the supervisory coordinator in the education department , and the Ngawi SMK supervisor , it is known that the government prioritizes skills learning in vocational schools, especially in light vehicle engineering. SMK PGRI 1 Ngawi has equipment that meets the standards and certain fields of study have good qualifications . One of the department of majoring in light vehicle engineering (TKR). This vocational school always represents the district of N gawi in the provincial level competition in the automotive business of light vehicle engineering.

There are many vocational Light Vehicle Engineering department in particular Madiun Ngawi area that does not have a good quality, especially related to technology competence mecatronic or *Electronic fuel injection.* This can be seen from the policies of some Vocational Schools that take conventional technology choices for vocational competency tests conducted at the school. To get learning and knowledge related to good learning, a quality vocational school is needed [10].

The light vehicle engineering department related to *electronic fuel injection* quality is still far from expectations. Therefore, it is necessary to increase the competence of SMK graduates. To get good competencies, the acquisition of superior schools is needed, one of which is SMK PGRI 1 Ngawi. In line with the above opinion, the chairman of the light vehicle automotive expertise package program at SMK PGRI 1 Ngawi revealed that the SMK PGRI in light vehicle engineering department had good quality, as evidenced by the accreditation of A plus as a pilot for other vocational schools. Baromater of automotive education in light vehicles in the Ngawi *leading* district is this school. SMK PGRI 1 is a vocational school representing Ngawi Regency in East Java student competency competition (LKS). So there is no reason not to trust SMK PGRI 1 Ngawi. Learning there needs to be explored and acquisitions need to be sought so it is important to conduct this research to help other Vocational Schools.

SMK PGRI 1 Ngawi is the best vocational school in Madison and is a flagship school. One of the advantages of this Vocational School is on *electronic fuel injection* competency , achievements ever pursued by SMK PGRI 1 Ngawi Champion 1 HSSC 2006 in Ponorogo, Champion III HSSI in Surabaya, Second Place Winner of LKCS East Java Province, First Winner of Ngawi Regency LKS, Third Place Yamaha Motor Champion Show in Madiun and have an industrial class with YAMAHA and DAIHATSU. The choice of *electronic fuel injection* (EFI) competence due to EFI is the main competency in theTKR and will be tested in the final competency test at SMK PGRI 1 Ngawi so that students are expected to master EFI competencies which are the main competencies in light vehicle engineering programs.

**2. Research methods**

This type of research is a type of case study research . This research was conducted at SMK PGRI 1 Ngawi East Java. The selection of this school is based on the fact that the Vocational School is one of the reference Vocational Schools . The techniques and instruments of data collection include data on observation, interviews and documentation. The data obtained was processed in a qualitative descriptive manner.

**3.1 Results and Discussion**

**3.1 Procedures for students in understanding electronic fuel injection systems**

After learning process *electronic fuel injection* that finish right teachers in general quite clearly ha l in accordance with the opinion of students and researchers in the field of observation results.Learning to use it is assisted by an instructional media so'm already understand the material given, student *electronic fuel injection* understand matter from studying the basic material, the types of components EFI, layout and practice of *electronic fuel injection* in the workshop . The process of learning that takes place in the classroom is based on the results of observations of the researcher that the teacher explains the material, students record and understand it . Learning process in the workshop that is stundet work according to SOP, practice and fix it. Opinion on above supported by the results of the following interviews:

the learning process is given material, understanding, knowing the layout and improving "( G.Ba Students , Transcript p. 1 Paragraph 7)

Interviews with two students in understanding *electronic fuel injection* began to understand *electronic fuel injection* material within 2 months, Opinion on above supported by the results of the following interviews:

I can understand EFI in approximately 2 months "(Student GB , Transcript p. 1 Paragraph 4 )

The lessons and explanations of *electronic fuel injection* that are provided by detailed teachers and assisted by using learning media so that students easily understand the material being provided, procedures for students in understanding the competence of *electronic fuel injection* namely students start learn the basic material *electronic fuel injection* , know its function, know the meaning of the sensor and practice *tune up* *.* P roses learning that takes place in the classroom is the teacher explains her material, students record and understand it, while the learning process in which students carry outpractical workshop according to SOP to study media.

**3.2**       **Student activities in gaining knowledge about electronic fuel injection**

The results of interviews with two highly capable students about what activities students are trying to gain knowledge about g *electronic fuel injection* in the learning process in SMK PGRI 1 Ngawi is learning *electronic fuel injection* in the class is done in theory and practice, presentation of the theory 40% and practice 60%, students gain knowledge of *electronic fuel injection* through reading the *manual book,* Youtobe media*,* *browse the* internet and learn in the workshop outside the school . In learning activities in the school environment , students learn material about the use of tools, SOPs, *electronic fuel injection* systems, sensor layout, functions and how to fix them . There are activities outside the school made in improving the students' knowledge in the study of *electronic fuel injection* that workshop practice outside the school, as quoted from the interview:

The division of theoretical learning is around 40% and 60% practices "(Student KG Transcript p.4. Paragraph 7)

I only learned EFI by practicing in a workshop outside the school environment "( KH Students , Transcript p. 6 Paragraph 7)

Next competence *electronic fuel injection* through activities both in school and out of school, at the school through learning classroom theory and practice in the workshop, while outside the school students' self-learning *manual* reading *books,* learning through the internet and practice workshop outside the school. The above description is supported by the results of the interview, as quoted from the results of the following interview:

EFI acquire knowledge through practice, reading *google,* watch *yout* *u* *be* and practice in workshops outside of school. "(Student IR Transcript p. 2 Paragraph 6)

Through book *manuals* and internet *browsing* . "(Student GB , Transcript p. 5 Paragraph 6)

Based on the transcript it is known that students obtain *electronic fuel injection* competence through independent learning activities and gaining *electronic fuel injection* knowledge from teachers in schools.

**3.3** **How do students have electronic fuel injection competence**

The results of interviews with two highly capable students about how students have *electronic fuel i* *njection* competencies in the learning process at SMK PGRI 1 Ngawi, namely the material delivered by the teacher regarding the understanding , functions, and *electronic* parts of *fuel* *injection* , material that has been understood by high-ability students namely censorship, *tune up* and how to care for them, students get *electronic fuel i* *njection* competence by listening to teacher explanations and practice in workshops, outside school students learn the potential of *electronic fuel i* *njection* independently by reading books and the internet, learning processes that accepted in school that is learning theory in class and practice in a workshop. The above description is supported by the results of the interview, as quoted from the results of the following interview:

The material submitted by teachers about the meaning, function, and parts EFI "(Students KG Transcript ha l. 2 Paragraph 2)

The material that I have understood is the sensor, tune up and how to treat it (Student KG Transcript p. 3 Paragraph 6)

Self-study through books and the internet. "( KH Students , Transcript p. 6 Paragraph 6)

Students get *electronic fuel i* *njection* competence by learning to hear material explanations from the teacher in the classroom, learning independently through the internet, then practicing those competencies in practice, so that students are able to obtain these competencies. The above description is supported by the results of the interview, as quoted from the results of the following interview:

I gained EFI competence through teacher explanations, asking friends, and *browsing the* internet. "(Student GB , Transcript p. 3 Paragraph 7)

Learn to *tune up* in the workshop, taught by the teacher. "( Student KH p. 6 Paragraph 7)

Based on the transcript note that students get an *electronic fuel* competency *injection* through the teacher's explanations, practice inlaboratory, and learn independently.

**3.4** **Student competencies include attitudes, knowledge,** **and** **skills in learning electronic fuel injection**

Based on observations of researchers aided by the teacher concluded that the attitudes of students in the process memper by learning from the instructors went very well from the beginning until the class ends d an attitude of students formed according to standart operasional presedure (SOP) industry, namely discipline, passion and hard work.

Students' knowledge is obtained from many factors, students have the basic knowledge of *electronic fuel i* *njection* and regain the same knowledge from instructors in the form of theory and practice. The learning process in the classroom / workshop takes place very well, there are no obstacles in delivering material from the instructor to students and the material is easily understood by students.

Keter Visible regarding *electronic fuel* competence *injection* they can get within two weeks. They acquired these skills during the process of learning theory and practice in the classroom. When the second final competency test of students who are highly skilled students can test the *i* *njection* *electronic fuel* *tune up* practice very well. The above description is supported by the results of the interview, as quoted from the results of the following interview:

Previously I knew nothing but then got used to studying EFI, explained the teacher very well and clearly and workshop facilities that were in accordance with industry standards "( Student of G.Ba , Transcript: 1 paragraph 12)

Hear the teacher's explanation, repeat at home and study with friends who don't understand. ( IR Students , Transcripts: 4 paragraph 12)

The final conclusion from the interview to two highly skilled students is that students' knowledge of theory and practice has been very good. When students have competencies from various sources, it helps students in the learning and practice process so that the results can be predicted very well too. The above description is supported by the results of the interview, as quoted from the results of the following interview:

I studied independently through the internet and practiced in the workshop so that I had understood EFI even though it had not been delivered by the teacher in the class (Student KH , Transcript: 3 paragraph 7)

The observers performed 8 times as many meetings in the classroom learning process, the results of the data used as secondary data to support the results of the data obtained from the results of questionnaires and interviews in answering research questions. On the observation observation sheet which includes three aspects, namely understanding, attitude and practice. Results obtained from the learning conditions in the classroom are all students to listen to all the teacher's explanation, after the teacher explains the material students seemed enthusiastic in the question and answer session, students work with friend in understanding the system of*electronic fuel injection,* some students fluent in making presentations in class, some students understand the explanation explained by the teacher regarding the *electronic fuel* *ijection system* , students who are fluent in presentation get plus points while students who are not fluently sentenced to run around the school field, students are able to deduce the material taught by the teacher. The results can be in terms of understanding that all students understand the material about *electronic fuel* *injection* although there are those who are quick to grasp learning and some are slow in capturing material, the above description is supported by the results of the interview, as quoted from the results of the following interview:

I can understand the material delivered by the teacher ( G.Ba Students , Transcript: 3 paragraph 7)

Material presented by the teacher is clear and easy to understand (Student KH , Transcript: 4 paragraph 7)

The results obtained in terms of attitudes are that all students arrive at 07.00 in the morning, all students pay attention to learning and enthusiasm when learning takes place, all students use practical clothes while in the workshop, all students obey the applicable regulations in the workshop, student presentations run smoothly students' concern for workshop cleanliness is good, all students follow the learning process calmly and seriously.

The results obtained in terms of attitudes, namely the practice process takes place as a standard in the workplace, after being guided by pre- school students independently, *electronic fuel injection*practices carried out by students in accordance with SOP, students carry out regular maintenance of *electronic fuel injection* services, students practice according to the SOP in the industry, students return the tool after the practice is in place, students check the equipment again after they finish the practice.

**4. Conclusion**

Based on the results of the study, it can be concluded that:

1. Achievement of knowledge aspects of NGAWI SMK PGRI 1 students about EFI with a cognitive average score of 77 and an affective average score of 75.
2. The process of the NGAWI SMK PGRI 1 students understands EFI takes place in theory in the classroom, then the material is practiced in the workshop.
3. NGAWI SMK PGRI 1 students obtain EFI knowledge independently through reading books and the internet. Knowledge is also obtained during the learning process at school.
4. The efforts and efforts of NGAWI SMK PGRI 1 students understand EFI by means of independent learning, group learning, and listening to teacher explanations.
5. The competencies obtained by NGAWI SMK PGRI 1 students can be seen from three aspects, namely knowledge, skills and attitudes. In the knowledge aspect, students obtain several competencies: (1) basic material regarding *electronic fuel injection* , (2) *electronic fuel injection* sensors , (3) *electronic fuel injection* maintenance , and (4) how to fix it. In the aspect of skills, students get several competencies, namely: (1) the ability to diagnose *electronic fuel injection* symptoms , (2) how to improve them, (3) cooperate with group partners. In the aspect of attitudes, students become namely: (1) used to check the equipment and materials practice before starting hand on *electronic fuel injection* in the workshop, (2) used to clean the place of practice s fter completing the practice of *electronic fuel injection,* (3) used to follow the rules in accordance with SOP that is taught when in the workshop.

**5. References**

|  |  |
| --- | --- |
| [1] | P. Sudira, TVET XXI CENTURY: Philosophy, Teory, Concepts, Occasional learning Strateg, Yogyakarta: UNY Press, 2016. |
| [2] | A. E. d. J. Iswari, "Madrasaya Aliyah Analysis for the Improvment of Vocational Graduates Competitiveness to Face Global Workforce," in *ICVET*, Yogyakarta, 2016. |
| [3] | A. N. a. R. B. A. Efendi, "Manufacturing of Electrical Dryer Machine for Food and Fruit Products," in *ISME* , IOP Publishing, 2019. |
| [4] | A. B, Technology Education and Vocational:Management and Implementation in the Era of Regional Autonomy, Surakarta: Duta Media, 2015. |
| [5] | H. S. a. A. Efendi, "Implementation of Teacherpreneurship on Teachers at Vocational High School," in *ICTVT*, Yogyakarta, 2017. |
| [6] | M. M, Basic Principles of Membrane Technology., Dordrecht, Netherlands: Kluwer Publisher, 2007. |
| [7] | E. Mulyasa, Improved Curriculum, Bandung: PT Remaja Rosdakarya, 2006. |
| [8] | S. d. a. A. Jihad, Becoming Professional a Teacher, Jakarta: Erlangga Group, 2013. |
| [9] | I. N. a. S. Y, Pedagogic Competence, Cilegon: Genta Production, 2016. |
| [10] | W. N. a. P. Sudira, "The Praxis of Project Based Learning at PIKA Vocational Secondary School Semarang," *Jurnal Pendidikan Vokasi,* vol. 10, no. 1, 2020. |