Increasing vocational school students' competency

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Increasing vocational school students' competency of automotive brake system by implementing diagnostic problem-based e-jobsheet

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Abstract. This study aims to determine product feasibility, effectiveness, and student responses to e-job sheet based the diagnostic problem on brake system checking competence. The research method used is Research and Development (R & D). The results of the product feasibility test by the media expert were 90.6% and by the material experts 84%, both stated very feasible. The product effectiveness test used a one-group pretest-posttest design test, the result of the students' competence increased from 42% to 84%. This shows that there was a significant difference in the average competence of students between before and after using the e-job sheet based diagnostic problem with a tcount of 14.77>ttable of 2.10. The result of the n-gain test obtained medium improvement criterion with average 0.33. Analysis of students' responses obtained 89.08% which is categorized very good.

1. Introduction

Implementation of learning in vocational high schools is not far from the support of learning media, especially the practice supporting media to improve the skills of students and assist students in learning certain skills because basically the characteristics of vocational education [1] that the vocational education preparing students for work; vocational education emphasizes the mastery of knowledge, skills, attitudes and values in working; the relationship of vocational education with the world of work is very close; vocational education requires up-to-date facilities for practicum.

Observation during the practicum in the workshop at SMK Harapan Mulya Brangsong Kendal, it was found that the students were less directed to perform every practice activity. It is unclear and unstructured starting from the preparation to the evaluation. Students were still a lot less clear and confused in doing the practice. Students prefer to practice without reading and understanding the procedures in the worksheet. Students were only trained to disassemble and reassemble workpieces to complete the brake without being able to explain the frequent damage symptoms in the field. The brake system job sheet was also not maintained and controlled by teachers or students.

Learning activity is to develop students' potential in theirselves. Learning can be obtained from various sources especially when it comes to diagnose problems in vehicles. Learning uses educational media such as worksheets are purposed to make more effective communication and interaction between teachers and students. It develops e-job sheets based on diagnostic issues be one of actions to be more effective, efficient and interesting in learning [2, 3]. The job sheet is a guidebook held by students with purpose to maximize the understanding in effort of building ability that suitable with learning outcome indicators. The job sheet is a way to keep students focus as it is very impossible to learn without it. [4, 5, 6, 7; 8].

The steps taken to prepare the job sheet were (1) curriculum analysis; (2) arranging maps that job sheets need; (3) determine the titles of the job sheets. These preparations were then arranged by what was in the job sheet. At least the job sheet contained the title, the basic competencies to be achieved, the completion of time, the tools/materials needed to complete the tasks, the brief information, the work steps, the tasks to be done, and the reports to be done. Basic assessments of the job sheets are: (1) the clarity of learning objectives, including the ease of understanding the materials; (2) the clarity of content or material; (3) the clarity of general instructions; (4) the conformity of equipments and materials; (5) the suitability of precautions or k3; (6) the accuracy of work steps; (7) the clarity of working drawings, including the level of attractiveness of the drawings or text illustrations; (8) the suitability of the beginning questions and the final questions; (9) the accuracy of the documents guidance; (10) the suitability and accuracy of the evaluation format; (11) the clarity or accuracy of language use [9, 10, 4].

The development of information and technology provides many new things and new approaches that can be developed to support the infrastructure of the learning process [11]. Diagnostic problems E-Job sheet-based become one of the corrective actions for practicum learning. The e-job sheet (Electronic Job sheet) is based on Information and Communication Technology (ICT). It has enormous potential as media or tools for developing such skills in the learning process [12]. It refers to e-books, e-modules or m-learning that have developed at this time. Electronic Job Sheet or E-Job sheet is a combination of teaching materials in the form of worksheets which is packaged into electronic as well as other electronic materials that have been developed [13, 14]

Job sheets which were developed into electronic were also added to diagnostic problems. This diagnostic problem was based on diagnosing a problem in a vehicle. A diagnostic problem commonly performed by a repairman will now be displayed in a worksheet form to increase the competence of the practicum competence and demonstrate it according to the specified criteria. Students will be better able to know the disturbances that exist in a vehicle and able to apply it properly through appropriate work steps [15].

Thus, the diagnostic-based e-job sheet emphasizes the effectiveness and efficiency of learning for an analysis that provides a better framework as it relates to theory and job performance during the practicum, so a job sheet is made in electronic form to make it not boring. This e-job sheet used Kvisoft FlipBook Maker pro 4.3.40, a software commonly used to create e-module and so on. This software can read pictures, SWFs, videos and documents like PDF, Word, Excel, PowerPoint and convert them into dynamic 3D magazines and effectively sharing online and offline with the format .html, .exe, .zip , .swf, screen saver and .app [16]. The contents of this job sheet are characterized by work steps based on problem diagnosis and its completion so as to improve competence in practicum and hypothetical thinking skills. This e-job sheet introduces students to the actual state of the field and can be an efficient and interesting hand to learn [17, 18].

Brake system inspection can be grouped as follows: (1) high inspection of brake pedal; (2) free brake pedal inspection; (3) spacing of brake pedal spacing; (4) inspection of the work of brake buster; (5)

parking brake inspection; (6) inspection of master cylinder condition; (7) inspection of brake shoes; (8) brake canister inspection; (9) inspection of brake shoe gap and brake canister; (10) wheels' cylinder inspection; (11) inspection of brake pad thickness; (12) inspection of the thickness of the rotor disk; (13) inspection of the rotor disk; (14) examination of caliper conditions (calipers sliding); (15) brake leak inspection (brake hoses) [19].

The purposes of this research were to: 1) test the feasibility of the e-job sheet based on diagnostic problem; 2) test the effectiveness of the e-job sheet based on diagnostic problem for improvement of brake system inspection competence on students' practicum competence progress; 3) know the students' responses to the e-job sheet based the diagnostic problem.

2. Method

The method used in this research was Research and Development (R & D) [20]. The research and development steps taken in this study include: 1) potentials and problems; 2) data collection; 3) product design; 4) design validation; 5) design revisions; 6) product trial; 7) product revision.

Design validation is done by media experts and material experts. The product was declared feasible, then tested. The product trial used a product trial design using Pre-Experimental Designs (nondesign) type One-Group Pretest-Posttest Design [20]. Treats were given to 19 students at SMK Harapan Mulya Brangsong Kendal. The students were given two treatments, before and after using the e-job sheet the based diagnostic problem on brake system inspection.

Collected data on the development of the e-job sheet based diagnostic problems was in the form of quantitative data generated from the validity of the diagnostic problem-based e-job sheet and the improvement of practicum competence from pretest and posttest data. Meanwhile, the qualitative data were in the form of responses from students about product development after the trial of the product.The instruments of data collection were: 1) the feasibility test sheet or expert validation consisting of media experts who assessed several modified aspects [10], including ease of use, software, consistency, chart, language and benefits;modified material experts were from Trianto[4] who assessed several aspects of the job sheet of learning design, presentation, job sheet content; 2) test methods used to measure basic capabilities and achievements [21]; materials taken on chassis maintenance and light vehicle power transfer in Basic Competencies number 3.7 and 4.7; before using this practicum test instrument to asses, it should be assessed/validated on the instrument so that it can be used to become a practicum instrument or sheet; the validation of practicum tests assessed in this research were terms of material, structure and language; 3) questionnaire method to show responses to the feasibility of tested products [20].The validities of practicum test which are assesed include aspects of material, structure, and language; 3) questionnaire is to show responses to the feasibility of tested products.

Data analysis techniques are:Feasibility test of experts is to calculate the feasibility of products from media experts and material experts [22].the formula is $P = \frac{\sum n}{\sum N}$ X 100% and the result of the formula will be confirmed by the following table.

Table 1. The percentage of product feasibility

Persentage	Criteria
76-100%	Very Eligible
51-75%	Eligible
26-50%	Less eligible
0-25%	Not eligible

Test of practicum test product by using paired t-test to find the effectiveness of the e-jobsheetwith its prerequisite analysis tests are normality test and homogeneity test. Analysis of students' responses is by using questionnaires and analyzed by using scale of rating percentage [22].Table of rating percentage scale of students' responses is as bellow:

Table 2. The rating percentage scale of students' responses

Rating percentage	Criteria
76-100%	Excellent
51-75%	Good
26-50%	Less good
0-25%	Not good

3. Findings and Discussion

The results of this research are: 1) The feasibility of product; 2) The effectiveness of product; 3) students' responses. The test results of product feasibility which done by media experts and material experts are shown in table 3.

Table 3. Assessment results of media experts

Aspects	Score from Validator			Total
	1	2	3	
Ease of use	13	14	14	41
Software	8	8	8	24
Consistency	15	14	16	45
Graphics	19	18	23	60
Languages	17	20	20	57
Advantages	7	8	8	23
Total Score				250
Maximum Score				276
Percentage of feasibility				90,6%
Criteria of feasibility				Very eligible

Table 3 shows that analysis of assessment results of media experts in testing the feasibility of diagnostic problem based e-job sheet on braking systems is obtained by calculation based on the formula which is according [22] is 90.6% and claimed "Very Eligible".

Table 4. Assessment results of material expert

Aspects	Validator			Total
	1	2	3	
Learning design	24	25	23	72
Presentation	14	12	12	38
Content of job sheet	69	67	66	202
Total score				312
Maximum score				372
Precentage of feasibility				84%
Criteria of feasibility				Very eligible

Table 4 shows that the analysis of assessment results of material expert in testing the feasibility of diagnostic problem based e-job sheet on brake system is obtained by calculation based on the formula which is according to [22] is 84% and stated "Very Eligible".The results of product effectiveness test include prerequisite test of normality and homogeneity analysis, paired t test, and n-gain test.

Table 5. Analysis result of pretest and posttest normality test

Tests	$X2_{value}$	$X2_{tabel}$	Conclusion
Pretest	5,66	9,49	Normally distributed
Posttest	4,02	9,49	Normally distributed

Table 5 shows the result $X2_{value} < X2_{table}$ so it is concluded that the results of pretest and posttest are normally distributed.

Table 6. Result of pretest and posttest homogeneity test analysis.

Sample	F_{value}	F_{tabel}	Conclusion
Pretest and posttest	1,69	2,19	Homogeneous

Table 6 shows the results of $F_{value} < F_{table}$ so it can be concluded that the results of the homogeneity test data analysis of pretest and posttest samples are homogeneous.

Table 7. The results of paired t-test analysis of pretest and posttest values

t_{value}	t_{table}	Conclusion
14,77	2,10	There is a significant difference between pretest and postest.

Table 7 shows the result of $t_{value} > t_{table}$ so it is concluded that the result of paired t-test analysis shows e-job sheet based on significant diagnostic problem so that it can give influence to improve the students' competence.The result of the n-gain test analysis is 0.33 which showed that the improvement of students' skill is categorized into medium which is according to Hake [23]. Results of students' responses showed 89.08% so it was claimed "Excellent".The result of students' responses analysis showed the results of responses to products that have been tested to students. This result will be a reference for product revision. The result of students' response analysis is shown in table 6 with description of result of score 4 (strongly agree), 3 (agree), 2 (disagree), and 1 (strongly disagree).

Table 8. Results of students' response analysis

Statement	Scores				Total
	4	3	2	1	
1	36	21	6	0	63
2	40	21	4	0	65
3	68	6	0	0	74
4	44	12	6	1	63
5	52	15	2	0	69
6	52	12	2	1	67

7	52	15	2	0	69
8	56	15	0	0	71
9	52	9	6	0	67
10	48	21	0	0	69
Total Score					677
Maximum score					760
Percentage of responses					89,08%
Criteria					Excellent

Statement:
1 =   Interesting cover of diagnostic problem based e-job sheet
2 =   Diagnostic problem based e-job sheet operation is easy
3 =   The displayed picture is good
4 =   The writing is easy to read
5 =   The language is clear
6 =   Language is simple
7 =   The work steps are easy to understand
8 =   Diagnostic problem based E-job Sheet is interesting to learn
9 =   Diagnostic problem based E-job sheet is used to practicum learning
10 =   Diagnostic problem based E-job sheet makes me learn faster

The final product of e-job sheet based on diagnostic problem on the inspection of brake systems is electronic and it has the characteristic of diagnosis of problem at work steps. Being Packaged in electronic form that can be operated on laptop / computer (.exe) and on android phone (.apk) becomes more effective and efficient in practicum learning in the workshop. Diagnosis of the problem is presented in several steps so that when the students get up to an inspection, they also recognize the problems that exist in the brake systems.

Diagnostic problem based E-job sheet that has been developed consists of 2 important parts namely cover and content. The contents of the job sheet are introduction, steps, and closing. Introduction contains preface, table of contents, list of navigation symbols and their meanings, basic competencies, objectives, occupational health and safety, tools and materials, work instructions and supporting information in the form of conventional brake system materials. The work step on the diagnostic problem-based on e-job sheet is a major part of the development because in the work step contains diagnosis of the problem. This closing contains bibliography, report sheet attachments, and author profiles.

Product feasibility test is used to determine the feasibility of a product before it is tested so that when conducting test, the product can be used optimally. This is in line with research conducted by Devi, et al [24] who developed a performance assessment based e-job sheet that got 95.51% which is in a very feasible category of validators before conducting test. The feasibility of e-job sheet product based on diagnostic problems for media expert is 90.6% with the category is very eligible to be used, while for material experts is 84% which is also very feasible category for testing.

The practicum produced the normal and homogeneous distributed data, then paired t-tests showed different posttest result is better than pretest. This is in line with previous study conducted by Setyawan and Suprianto[9] with the development of job sheet that has been made to improve learning outcomes, it is obtained 38.08% of pretest and 61.76% of post test. The study was also conducted by Devi, et al [24] that the development of job sheet based performance assessment increased in 33.33% (pretest) to 80.56% (posttest). Then research which conducted by Rohmawati, et al [25], It was improved in learning outcomes for research which was using worksheet (the worksheet) passing grade

of the control class is 72.5% and the experimental class got a passing grade of 95%. The study which conducted by Ulas, et al [26] showed a score change in the adjective knowledge achievement test for control and experiment class, from 31.90 to 76.66 that indicated that there was the increase in students' learning outcomes. Study which conducted by Badawi and Wahyudi[27] showed that there is a significant difference in learning outcomes in using Work Preparation Job Sheet (WPJS) from tvalue of 4.938> t table of 1.67 which means the mean of practicum learning result that using WPJS is better.

The increase of percentage of mean between pretest and posttest for research and product development of e-job sheet based diagnostic problem was from 42% to 84%. The improvement of students' practicum skill was increased into the "medium" category of 0.33 because for the medium category gets the results between 0.3 to 0.7. That result can make the product e-job sheet based diagnostic problem feasible to use and improve students' competence.

Student feedback was taken after conducting test to the students. In line with previous research conducted by Asri, et al [28] who developed "worksheet with contextual teaching and learning oriented" which resulted in responses 85% - 89% (very feasible) by students, then a study conducted by Restiyowati[25] who developed interactive e-book that got students' response equal to 88,91%. Research on the development of e-job sheet based on diagnostic problem also got very good responses from the students because it got value equal to 89,08%.

4. Conclusion

Based on the research and development that has been done, it can be concluded that diagnostic problem based e-job sheet on braking systems inspection competence is very feasible to use according to the assessment of media expert who assesses aspects of ease of use, software, consistency, graphics, languages, and benefits and material expert that assesses several aspects in the job sheet that are learning design, presentation, and the contents of the job sheet. Diagnostic problem based E-job sheet is also very effective for students which can be seen from the improvement of students' skills when the products are given to the students. It gets the excellent responses from the students so that diagnostic problem based e-job sheet could be accepted by the students and the societies later on. Therefore, this diagnostic problem-based e-job sheet can be used further for practicum in the workshop.

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FINAL GRADE

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GENERAL COMMENTS

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