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Physics Practicum Matter Suitability to Skills Competency Vocational Investigation In Central Java Province Indonesia

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Abstract: ***The investigationaims in this study were to reveal the implementation of physics practical work by the teachers and the conformity of thepractical work material with the existing expertise competence in a vocational high school (SMK). This study focused on the vocational high schools in an Expertise Concrete and Stone Construction Engineering. The research method used a literature review, analysis of curriculum and research result, as well as semi-open-interview that involvedabout 13 SMK from 7 districts in Central Java Province, Indonesia. The Vocational High School are involved, consisted by 6 Private SMK and 7 Public SMK, with26 physics' teachers (N = 26). Based on the analysis result of existing curriculum in SMK Tujuh Lima 1 Purwokerto and SMK Negeri 2 Purwokerto, as well as the research results, showed that the physics practicum based expertise competence canbe developed, by connected the basic competence of physics and theexpertise field or productive group. The research results and semi-open interviewere obtained that 22 teachers or 84.46% agreed, if the physics learning in SMKis supported by the physics practical work activities- expertise competencybased, using the natural sand material of Logawa River, to develop no-fines concrete technology. The description percentage of teachers'opinion is as followed: make easy of concept understanding (19.23%), more attractive to students (3.84%), increase the creativity of students (3.84%), associate the physics material with a competence or expertise (38, 46%), students can be apply the theory and the practical work (3.84%). The description percentage of teachers who do not agree were : too difficult for students (7.69%), lack of the teachers' ability and make difficult for teachers (7.69%). The development tested of physics practical work-expertise competence requirement based in SKMSeven Five 1 Purwokerto, equiped the students with the science process skills such as: the observe ability, the ability to interpret the results of observation, communication skill, ability to classify, predict ability, the ability to plan the study, the hypothesis explainingskill, the ability to use the tools and materials, as well as the ability to carry out the experiment.***

Keywords: no-fines concrete, aggregate Logawa River, science process skill, physics practical work-skills competency requirement based

1. Introduction

Based on the mindset formulation improvement of curriculum 2013 in Indonesia, it is obtained that the Standard Competency derived from requirement, Content Standard derived fromthe graduate Competency Standards, through the core competenciesthat free subjects, and all subjects should contributed to the formation of attitude, skill, and knowledge, as well as the subject derived from thecompetency that want to achieve. In addition, based on the learning in curriculum 2013 emphasized on: student-centered, interactive, active-probe, real-world context, team-based learning, stimulation in all directions (all senses), multimedia tools (various educational technology equipment), multi-disciplinary knowledge (multidisciplinary approach), and Critical (required a creative thinking)

The educational expertise spectrum of vocational high school in Indonesian, consistedby six subject fields of expertise, such as: Technology and Engineering, Information Technology, and Health Communication, Arts-Crafts-Tourism, Agribusiness and Agro Technology (Agriculture), as well as Business and Management. These six studies are divided into 121 competency skills. Three fromthese six subject fields of expertise, supported by adaptive subjects (physics) ie Study Field of Technology and Engineering Skills, Health and Agriculture., Respectively the total hours of physics was 276 hours, 192 hours and 192 hours.

Three from the physics basic competences that printed in a curriculum of SMK, the expertisefield of concrete and stone construction engineeringwere as following : (1) Mastering the basic concepts of physics that directly supported the competencyimplementation of its expertise program, (2) Applying the basic concepts of physics to support the competency implementation of its expertise program in a daily life, (3) Applying the basic concepts of physics to develop the abilityof its expertise programon the higher level. Based on these conditions, the physics learning had a role in achieving the skills program, and this matter should be an important concern for a physics teacher at SMK. But the field reality showed that the physics teacher of SMK does not correspond to the expected competencies.

According to Tan & Temiz, (2003), the fundamental purpose from the teaching science currentlywas to educate the students in order theycan conducted the research, explore, investigate, make a connections between dialy life with a topics of science, using the scientific methods in solvingthe problems and see the world through thescientist view. The physics learning as a part of science was essentially aimed to develop the intellectual of students' competence, such as independent learning, problem solving, decision making and critical thinking (*American Association for the Advancement of Science* (AAAS), 1993; *National Research Council* (NRC), 1996.

The process of physics learning that held by the teachers largely, have the quality of academic theoreticalyet and less

supported by the practical work activities in the laboratory that can equiped students in understanding the concept. In addition, based on the research results of Memon, 2007 (in Faize, 2011), a science teacher was only equipedby the pedagogy theoretical aspects, but it was less of emphasizing the practical work teaching methods. The equping of teachers in conducted the practical work was very less, this impacted to the lack of teaching skillin using of practical work method. According to Utari 2010, its needed to think about how the learning process is delivered to the students, in orderthe science learning was able to give the effect to the expected capabilities.

On the other hand, the teachers in their profession shall to fulfill the Academic Qualifications Standards and Teachers' Competencies as printed in the Regulation of the NationalEducation Minister No. 16 of 2007 in Indonesia. The teacher competency standards developed completelyfrom four main competencies; pedagogical, personality, social and professional. These fourth competencies integrated in the teachers' performance, some professional competencies of physics teachers, including: understanding the concepts, laws, and physics theories, as well as its implementation flexibly, explaining the application of the physic laws in a technology related to the physic, especially that found in a daily life, creative and innovative in the application and development of the physics field and its related sciences, using the measure tool, prop, calculator, and computer software to enhance the physicslearning in the classroom, laboratory and field, designing the physics experiment for the study or research purposes.

Science learning that supported by the practical workwas very effective in understanding of students' concept. The students should tried to acquire and achieve the knowledge, as well as have the science process skills (Taşdere & Ercan, 2009). Science process skills emphasised on the skill formation in acquiring the knowledge, and communicate its result. The ability to use the reason mind, and act efficiently and effectively to achieve a specific outcome, including to the creativity that defined as a skill. The equiping of science process skills can be donethrough the learning activities in the laboratory.

The research result of Purwandari, et al. (2012), the ability of students science process skills on the expertise competence of Concrete and Stone Construction Engineering SMK "X1" in Purwokerto was still low. The research activity that carried out by using the physics practical work- competency skillrequirement based, involved the students of class X, on the subject of quantity and unit. The implementation of physics practical workusedthe material of natural sand aggregate of Logawa River and the test specimen of no-fines concrete. The physics practical work, by using the sand material and the test specimenof no-fines concrete have the purposes, to understand the physics concepts, but its adapted to what is being learned in the subject of inspection techniques and the implementation of concrete construction. On that stud, the science process skills that are analyzed including: the ability to observing, planning theresearch, explaining the hypothesis, using the tool and material, conducting the experiment. The result obtained such as, the ability to observing (38.24%), planningthe research (16.56%), explaining the hypothesis (19.4%), using tool and material (12%) conducting the experiment (14.5%). meanwhile the science process skill that included the abilites, interpretingthe observe result skill, communicating skill, classifying skill and predicting skill showed the results of the average value respectively about 21.6%, 7.37%, 8.14% and 8.6%.

Physics learning should accommodated and became the baseof a productive learning or expertise competence in SMK. The physics learning needed to support with the physic practical work matterial- expertise competency requirement based, that can be doneby analysing of the existing curriculum, by linking the physics and expertisecompetence and the research result. The purpose of investigation in this study was to reveal the material suitability of physics practical work toward the vocational high school'sexpertise competency in the provinasof Central Java, Indonesia.

2. Method

This study was an analysis of the requirement about the implementation of physics practical work, that can be developed based on the requirementof the expertise competency. The investigation conducted by identification the existing curriculum in the expertise fieldof Concrete and Stone Constructionof SMK Tujuh Lima 1 Purwokerto and SMK Negeri 2 Purwokerto, in a adaptive group and productive group. The adaptive group was aphysic competence, while the productive group was a expertise competency that outlined in the standard and basic competencies. The identification resultis used as the basisof obtaining the relevance between physics basic competencies and the expertise competency or productive. The identification result and the relevancy between the competence that made by table and linked to the results of research that produced the physicspractical work material, that support the competence of Construction Techniquesof Stone and Concrete. The research activity is also supported by the field observationthat regarding to the existing infrastructure in SMK Seven Five 1 and SMK N 2 Purwokerto. The next stage was the semi-open'swritten interview about the teacher's response againsted the development of physics practical work competency-expertise competence requirement based , by using the natural sand material of Logawa River and technology development of No-fines Concrete. The study involved about 13 SMK from 7 districts in Central Java Province, Indonesia. The Vocational High School are involved, consisted from 6 PrivatesSMK and 7 PublicsSMK, with 26 physics teachers (N = 26). This study is also explored the science process skill (KPS) of vocational high school's students of class X in SMK Tujuh Lima 1 Purwokerto, on the practical work material of volume measuring of concrete cavity, by grain size variation of natural sand aggregate, diameteredof 9 mm, 5 mm, 4 mm and 2 mm. The instruments used in the study are as followed: 1. The semi-open questionabout the SMK's physics teacher responses, 2. The practical work moduleof measuring and calculating the cavity volumeof no-fines concrete.

3. Result and Discussion

Based on the analysis of existing curriculum in SMK 2 and SMK Seven Five 1 Purwokerto, stated that the physics competence in SMK, especially in expertise field of Concrete and Stone Construction Engineering, consistedby several Competency Standards, that are then presented in the Basic Competence. The identification of physics competency standard that can be attributed to the expertise competence are included : 1. Measuring the amount and applying the unit, 2. Interpreting the mechanical property of the materials, 3. Applying the concept of temperature and kalor, 4. Applying the concept of temperature and kalor, 5. Applying the concept of fluid, 6 . Applying the vibration, wave, and sound. The explanation of competency standard, to the physics basic competence, included; 1 .mastering the concept of scale and unit, 2. Using the appropriate measuring instrument to measuring a physical quantity, 3. Mastering the concept of temperature and kalor, 4. Mastering the influence of kalor to a substance, 5. Measuring the temperature and kalor, 6. Calculating the kalor, 7 . Calculating the vibration, wave, and sound.

Identification of skill competency (productive group) that identified, can be linked to the physics competence, consistedby three competency standards, that set out by the six core competencies. The competency standards that shall, included: 1. Examination Technique and Implementation of Concretes Construction, 2. Building Material Science, 3. Implemented the concrete casting, which is described in the core competencies, as followed: 1. Checking the building materials, 2. Describing the building materials of stone and concrete, 3. Making a light concrete mix.From the curriculum analysis of SMK, the ExpertiseConcrete and Stone Construction Engineering (between the physics competence and productive competence group) and a literature review of research results that related to technology of no-fines concrete, so it was developing a physics practical work material- expertise competency requirements based, as followed: 1. The attenuation of sound waves, 2. The density and specific gravity of the aggregate, 3. The density and specific gravity ofno-fines concrete bricks wall material, 4. The thermal conductivity ofno-fines concrete brick wall material, 5. The rate of kalor flow of no-fines concrete bricks wall material, 6. The power temperature insulation of no-fines concrete brick wall material.its completely set out in Table 1.

Table 1: The Physics Practical Work Material-Expertise Competence Requirement Based

No.	Phsyics Competency		Expertise Competency		Physics practical work-TKBB requirement based	Research Title
	Competency Standard	Basic Competency	Competency Standard	Basic Competency		
1.	Measuring the amount and applying the unit	mastering the concept of scale and unit Using the appropriate measuring instrument to measuring a physical quantity	Examination Technique and Implementation of Concrete Construction	Checking the building materials	Measuring the specific mass and aggregate spesific quantity	The Development of manufacturing technology of No-fines'light concrete by using the dust waste of rice husks and krisik gravels used as spouses of noise reduction wall and temperature isolation. (Purwandari, R.D., compete grant of, DIKTI, Fisrt Years 2009)
					Measuring the specific mass and spesific quantity of test specimen of no-fines'light concrete	
			Building Material Science	Describing the building materials of stone and concrete	Measuringthe cavity volume of test specimen of no-fines'light concrete.	
2.	Interpreting the mechanical property of the materials	Deciding the material Strength	Building Material Science	Describing the building materials of stone and concrete	Calculating the pressure mass energy of no-fines'light concrete	
					Calculating the pull-crack mass energy of no-fines'light concrete	
					Calculating the curved-mass energy of no-fines'light concrete	
3.	Applying the concept of temperature and kalor	Recognizing the way of kalor movement	Building Material Science	Describing the building materials of stone and concrete	Measuring the thermal conductivity of no-fines'light concrete	The Development of manufacturing technology of No-fines' light concrete by using the dust waste of rice husks and krisik gravels used as spouses of noise reduction wall and temperature isolation. (Purwandari, R.D., compete grant of, DIKTI, Fisrt Years 2009)
					Measuring the kalor flow on the no-fines'light concrete	
					Measuring the nature of temperature insulation of no-fines'light concrete	
4.	Applying the concept of temperature and kalor	Recognizing the way of kalor movement	Implemented the concrete casting	Making a light concrete mix	Measuring the hydration temperature of no-fines'light concrete	The nature study of rice husk dusts as the application of chloride acid as the Pozzola materials to improving the cocrete's

						quality, Purwandari, R.D., 2006, Thesis UGM, Yogyakarta
5.	Applying the concept of fluid	Applying the laws of static fluid and the dynamic in the daily life	Building Material Science	Describing the building materials of stone and concrete	Capillarity mass of no-fines'light concrete	The Ratio Influence of Loga River Aggregates-rice husks-dusts of rice husks toward the capillarity energy, used as the hydroponics plants on the verticullar technology, compete grand, UMP, Purwokerto
6.	Applying the vibration, wave, and sound	Calculating the vibration, wave, and sound	Building Material Science	Describing the building materials of stone and concrete	Measuring the attenuation of sound waves of no-fines'light concrete	The Development of manufacturing technology of no-fines'light concreteby using the dust waste of rice husks and krisik gravels used as spouses of noise reduction wall and temperature isolation. (Purwandari, R.D., compete grant of, DIKTI, Fisrt Years 2009)

SMK that involved in this study, amount 13 schools that selected randomly and scattered in the southern part of Central Java province. The most western Locationin Cilacap district, bordered with West Java province,meanwhile the most easternwas in Sragen bordered with East Java Province. The totally of SMK are consisted byseven publicsSMK and six privatesSMK. The purpose of choosing SMK randomly in seven districts was in order the data obtained, representing the whole teachers' opinion. SMK that involved to be focussed on the Expertise concrete and Stone Construction Engineering. from the seven districts, there was only Klaten district that has four SMK and have an expertise fieldof Concrete and Stone Construction Engineering. For the Detailed description of SMK's names and the districts' names, explained in the Table 2.

Table 2: Vocational High School, expeprtise field of Stone and Concrete construction technique in Central Java, Indonesia

No.	*Name of School*	*Type of School*	*Regency Area and Postal Code*	*Number of Teachers*
1.	SMK Negeri 2 Purwokerto	Public	Banyumas, 53116	2
2.	SMK Negeri 1 Klego	Public	Boyolali, 57385	2
3.	SMK Negeri 1 Wanareja	Public	Cilacap, 53265	2
4.	SMK Negeri 2 Cilacap	Public	Cilacap, 53212	3
5.	SMK Negeri 2 Kebumen	Public	Kebumen, 54315	3
6.	SMK Negeri 1 Purworejo	Public	Purworejo, 54101	2
7.	SMK Negeri 2 Sragen	Public	Sragen, 57212	1
8.	SMK Tunggal Cipta Manisrenngo	Privat	Klaten, 57485	1
9.	SMK Kristen 1 Klaten	Privat	Klaten, 57417	2
10.	SMK YPP Purworejo	Privat	Purworejo, 54171	2
11.	SMK Muhammadiyah 4 Klaten Tengah	Privat	Klaten, 57419	2
12.	SMK Tujuh Lima 1 Purwokerto	Privat	Banyumas, 53143	2
13.	SMK Muhammadiyah 1 Klaten Utara	Privat	Klaten, 57434	2
Amount of Teachers				26

The teachers whoinvolved in the semi-open- written interview activity, consisted by12 male teachers and 14 female teachers, with the teachers's working masses, between 3 years-34 years.the academic qualification was 88.46% of undergraduate and 11.53% was the graduates of S2. From the whole teachers who involved, about 84.61% were the teachers with the academic graduates formundergraduate of education, meanwhile, about 15.38% were non-educational graduate. The results of written interview about the teacher's response towards the development of the physics practical work, used the natural sand materials and technology of no-fines concrete, it is obtained the results as describing in Table 3.

Table 3: The Teachers' Response Towardsthe Development of Physics Practical Work, Used the Natural Sands Material and Technology of No-Fines Concrete

Description		*Number of teachers*	*Percentage*
The physics learning in SMK must be supported by physical practical work activity-expertise competency based, the physics practical work in SMK, especially in Expertise Field ofConcrete and Stone, can be done by activity of physics practical work, by used the materials of natural sands of Logawa River and the technology development of *No-fines Concrete*	Agree Reason's: - Makingeasier the comprehensionof the concept -more attractive for students - Enhancing the students' creacitivity - Relating the physics material with the competency or expertise field - Students can implementing the theory and practice Not reason's	22 5 1 1 10 1 4	84,46% 19,23% 3,84% 3,84% 38,46% 3,84% 15,38%
	Not agree Reason's: 1. Too difficult for students 2. It was not appropriate with the teacher's skill (Human Resourcing) in the expertise program, the SDM TKBB's skill was low, the physics teacher of SMK was also taught the another expertise fields such as mechanical and electrical techniques, so if it was appropriating to the each expertise fields, there was an difficulty for the teacher.	4 2 2	15,38% 7,69% 7,69%

Thedevelopmenttrial of physics practical work, appropriated with the expertise field or in this study is called as the expertise competency requirement based in SMK Seven Five 1 Purwokerto, had been done. The one of practical work material that carried out, was measuring and calculating the volume of no-fines concrete cavity, by using the density of water. In this activity, besidethe physics application against the expertise field, was also make easier the comprehension of concepts and equiped the studentswith the science process skill. The practical work by using the concrete specimen ofcylinder-shape's no-fines, by height size about 16 cm and diameter cylinder about 10 cm. The trial specimen material of no-fines concrete by using aggregate of Logawa River with the grain size variation of natural sand's aggregate, diametered about 9 mm, 5 mm, 4 mm and 2 mm. The science process skill that be procured, are included: the ability of observing, the ability of interpreting the observation result, communicating skill, ability to classifying, the ability of predicting, the ability of planning the study, the capability of hypothesis explaining , the ability to usingthe tools and materials, as well as the ability to conducting the experiment.

4. Conclusion

The conclusions that can be explained from this requirement analysis phase were:

1. The physics learning at Vocational High School, should not only in a academic theoretical, but it should be supportedby thepractical work, that can facilitated the students in understanding the concept, providing the hands-on practice's experience to the students, equiping with the science process skill and can developping a scientific attitude.
2. In order the physics practical work can supporteditsfunction as the supporting the achievementof expertise competency, it was necessary thematerial that can be developed based on the analysis of the curriculum, that is connected the physics basic competency and basic competence of another expertise field or productive group, the literature review of research results, the technology that is being developed and local potencythat can be utilized.
3. The physics practical work–expertise competency requirement based, was consistent with the basic learning of curriculum 2013 in Indonesia, that emphasized on: student-centered, interactive, active-probed, real-world context, team-based learning, stimulation in all directions (all senses), knowledge plural disciplines (multidisciplinary approach), and critical (requiring by creative thinking).

5. Suggestion

The physics' teacher of Vocational High School must be really understood that students be more easily to understandthe physics concepts, through the practical work activity, in addition the physics competence has a function to support the expertise competency. Another thing that is needed to be noted that the physics practical work in SMK, needed to be held the mapping of the materials, in order its to be appropriatedwith the requirement ofthe expertise competency. This matter thatwas underlying the needs of SMK's physics teachers, to receive the training about the implementation of the physics practical work that was appropriated with the competence field in a Vocational High School, in order to improve the teacher's competence and understanding of the teachers in implementing the physics learning.

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Anna Permanasari, Professor on analytical chemistry, a lecturer in chemistry education Department of Science and Mathematics Faculty –Indonesia University of Education since 1983. Since she do her research in adsorbent for organic and inorganic residues, she also involve in science educational research. Some doctorate students of science education program of graduate school were under her supervision.The field of research in education is on science literacy.

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