



## THE DEVELOPMENT OF SOFT SKILLS-BASED STUDY MATERIAL OF CHEMISTRY IN THE TOPIC OF THERMOCHEMISTRY FOR VOCATIONAL HIGH SCHOOL STUDENT

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### ABSTRACT

Business and industrial field need workers who have not only good academic achievement but also the ability of hard skills and soft skills. In order to prepare students who have a good academic skills, hard skills, and soft skills, it has to be done in all subjects including chemistry integrated to the expertise competencies of Motorcycle Engineering. The research design used One Group Pretest Posttest Design imposed on students in class TSM XI SMK 1 Kedung. Validator assessment results indicated that teaching materials developed very feasible to be applied in chemistry learning. The result show that the learning device by using the integrated chemistry materials can increase students understanding of the thermo chemistry material with the acquisition of N-gain was at 0.63 or in the modest category. Group of high-achieving students had the score of N-gain 0.65, while the medium-achieving students obtained 0.63 and low-achieving students obtained 0.61, all had medium category. Percentage of students who passes the mastery learning reached 87 % (if mastery learning (KKM > 75). The percentage of students' soft skills in at least good criteria was at 87.10 %. 90.71 % students gave positive responses towards the learning material.

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**Keywords:** Integrated, Thermo Chemistry, Soft Skills

### INTRODUCTION

Vocational high school is the priority objectives of preparing students to enter the workforce and develop a professional attitude. In Indonesia, vocational high school is often called as sekolah menengah kejuruan (SMK). The existence of SMK is expected to overcome the unemployment rate. However, in fact, the unemployment rate is still high. Based on the results of preliminary studies, the low absorption in the industrial or company is due to the lack of soft skills in vocational high school graduates. Results of a preliminary study in SMK Negeri 1 Kedung which used as the subject of study showed that 77.93% of students chose to work in the company after graduating from school, 11.71% chose entrepreneurship and only 10.36% who wanted to go to higher education level. Moreover, in an interview with the

Coordinator of Special Employment Exchanges, it can be concluded that there are small numbers of graduates of SMK 1 Kedung who employed in the company. One of the causes of failure in the admission tests of vocational graduates is the ability their soft skills.

Job seekers problem is mainly caused by the lack of soft skills mastery. Mariah & Sugandi (2010) stated that during the study in SMK, the students are primarily focus on hard skills. Soft skills are oblivious to it, therefore, the weakness of vocational graduates in hiring the job opportunities in general is a matter of personal skills. The efforts to overcome these problems include the long process of education before entering the job world. The students need to acquire soft skills training. Johnstons and Gregory (2005) stated that education needs to manipulate the curriculum taking into account the development of soft skills must be included in the curriculum. Divitniet al. (2012) defined that soft skills as part of ge-

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neric science skills include leadership, teamwork, communication and work throughout life. Types of soft skills that will be developed are the cooperation, responsibility, ability to solve problems, communicate, and empathy. Empathy is involved into types of soft skills according to the opinion of Hojat et al. (2002). Empathy involves the cognitive domain, as well as affective or emotional. The ability to empathize is needed in the company world in accordance with the needs of vocational students. Gentry et al (2007) stated that empathy is positively related to job performance. Selection of the type of soft skills is developed based on a summary of the survey results on the business partner with the school.

Other preliminary study results showed that the vocational school teachers in the district of Jepara rarely insert aspects of cooperation, responsibility empathy, problem-solving skills, and co-operation as part of soft skills in their learning activities. Results of preliminary studies showed 79% teachers said that soft skills in teaching are never taught with reason that there were no chemistry books that support soft skills integration. Moreover, 36% teachers relied on chemistry teaching materials for high school and 64% were already used teaching materials for SMK. Based on the results of preliminary studies most of chemistry teacher in the district of Jepara had never developed a self-made teaching materials. Teaching materials not only contained the knowledge and values but also the skills to meet the learning objectives. In this study, teaching materials developed was teaching materials integrated with soft skills-based competency. Integration between chemistry study material with competency skills and soft skills were packed in the form of teaching materials that support learning model of integration. Fogarty (1991) put forward 10 integrated learning models; one that was associated with this study was the networked models.

The formulations of the problem in this study were: (1) how is the feasibility of developing an integrated chemistry teaching materials especially the thermo chemistry topic based on soft skills in learning activities? (2) How is the effectiveness of the integrated chemistry teaching materials based on soft skills in learning activities? (3) How is a student's response to the teaching materials developed? The purpose of this research was to produce an integrated study material in chemistry based on soft skills in the topic of thermo chemistry. The study materials were used for vocational high school students, determined the effectiveness and students' response to teaching materials.

## METHODS

This study was included in the category of research and development model. According Sugiyono (2010), method of research and development is a research method used to produce a product and also test the effectiveness of the product. Development undertaken is the development of integrated chemical teaching materials on thermo chemistry material with material soft skills competency-based skills. Research and development of teaching materials using models Thiagarajan et al. (1974), known as 4-D models. This model consists of Define (definition), Design (design), Development (development) and Disseminate (deployment). In this study, a modified 4-D model or simplification of the four phases into three phases, i.e Define (definition), Design (design), Development (development), while Disseminate (deployment) was not done because of time considerations and implementation. Also, as the consideration that the stage (development) has produced a good device (decent). The study design used is "One group pre-test-posttest design" (Sugiyono, 2010). The study begins with the provision of initial tests to determine the initial position of the student. Furthermore, the students treated learning by using teaching materials developed which consist of soft skills-based thermochemistry material. The next step was to conduct a final test to determine the results of treatment, the use of teaching materials that have been developed in learning. Teaching materials developed said to be effective if there is a significant difference between the results of the final test at the beginning of the test, with the provisions of the final test result is better than the initial test.

This study was conducted in SMK N 1 Kedung Jepara. The research was scheduled for the second semester of academic year 2012/2013, precisely in January to July 2013. The population in this study were students of class XI TSM second semester of academic year 2012/2013. In the limited testing that the subject of the trial was 12 students of class XI TSM-2. In the wide-scale trials were the subject of a trial was a class XI TSM-1 student. Sampling technique was simple random sampling with sampling of the population at random groups of students in the classroom, regardless of the strata in the population.

Teaching material development stage consisted of four stages of development that define, design, development and disseminate, however, disseminate stage was not performed in this study. Define phase covered curriculum analysis,

analysis of student characteristics, analysis the thermochemical materials on subject content standards of chemistry for eleventh grade, material analysis corresponding to the lessons in the competence of expertise, synchronization with the material productive thermo chemistry materials, and formulating the learning objectives. Design phase included preparing teaching materials chemistry expertise was integrated with the soft skills-competency oriented and preparing research instruments. Development phase included validation expert, limited scale trials, and large-scale trials.

Methods of data collection was done through the interview method to obtain preliminary information on the activities, constraints and problems in chemistry learning in SMK N 1 Kedung Jepara. Documentation methods used to obtain information from the object observed during the study in the form of photos of activities and tasks of the students in the form of presentation material, report the student group work. Observation method was performed to observe aspects of soft skills of students during the learning process in trials using developed teaching materials. To measure the level of understanding of students on the concept of thermochemical material, the student was treated in the form of an evaluation test. Questionnaires used in this research was a check list. Check list sheet was to assess the students' response to the chemical teaching materials integrated with soft skills-based thermo chemistry material. The instrument used in this study were the validation sheets, observation sheets of soft skills of students, student questionnaire responses and student evaluation form test questions.

Before the test instrument was given to students, it first conducted the trials to analyze the concept mastery test validity, reliability, level of difficulty of questions and different power of instruments. Analysis of observation sheet used to answer the problem of teaching materials developed form. Research and development of teaching materials is said to be successful if the average scores of the validator including decent category. Observation sheets included were observation of teaching materials, teaching tools, and observation of activities based on students' soft skills. Testing the validity of the observation sheets used the validity of construction with expert opinion. The reliability of the observation sheet used an observer agreement.

Analysis of learning outcomes was used to address both issues in this study, i.e. the effectiveness of the developed teaching materials. Based

on the research design that used "One group pretest-posttest Design", the developed teaching materials is effective when student learning outcomes after treatment is better than before treatment (Sugiyono 2010). Test analysis of study results was performed using normalized (N-gain). Level of significance difference before treatment and after treatment was measured using the t test.

Soft skills analysis of observational data was used to answer the problem of the effectiveness of teaching materials through the observation of the presence of soft skills for learning activities. Analysis of student responses was performed by descriptive analysis that aimed to determine the response of students. It expressed by using questionnaire. The assay of questionnaire reliability was performed using Cronbach  $\alpha$  coefficient. Student response data obtained through the questionnaire were analyzed descriptively using percentages. On assessing student responses, it was in the form of multiple choice questions; (a) strongly agree, (b) agree, (c) less agrees, (d) does not agree. Student response is said to be positive if the average percentage of answers or responses to category (a), (b) at least 70%. Analysis of mastery learning using a formula which compares with teaching completeness criteria (KKM) is 75.

This study was successful if the teaching materials have been developed obtained an average score of validators in the category of reasonable or valid, completed in learning classical with a limit of completeness (KKM) of 75, the percentage of soft skills of students either  $\geq 70\%$  of the total number of students responded positively to the learning undertaken.

## RESULTS AND DISCUSSION

A limited scale trial was conducted in order to obtain better teaching materials before they implemented in the wider class. Students provided the feedback through questionnaires given after the performance of a limited scale trial. Based on the results of limited testing, it was indicated that the developed teaching materials and supporting instruments gave agreed criteria was 58.67% and strongly agree 31.33%. These percentages achieved showed that the developed teaching materials was approved suitable to be applied in a broader research.

The amount of increased understanding of thermo chemistry material known by calculating the N-gain of pretest to posttest. Pretest average value was 47.63, while the value of posttest was 80.11. The magnitude of the increase in pretest

and posttest values was 0.63 of N-gain or fall into the category of being. N-gain calculation results were then tested for its significance using t-test.

Based on t test results, it showed that there were significant differences in the average score of pretest and posttest. Further analysis of the pretest, posttest, and N-gain scores data, each group of student achievement could be useful to know the improvement and effectiveness after studying the integrated soft skills-based thermochemistry material. The results of the analysis of the average score of pretest, posttest, N-gain are shown in Table 1.

Students who obtained high achievement turned out to have a better score of N-gain than a group of modest and low student achievement. The findings of this study had the same pattern with research conducted by Sudarmin (2012).

Sudarmin found that high-achieving students were students who had greater N-gain in terms of increasing its scientific generic skills. Results of other studies that support this idea was the finding of Gerace and Beaty (2005) which showed the regular pattern on physics learning using science-oriented problem-solving thinking skills. Students who had high achievement showed better analytical skills of thinking and long-term memory retention than the low achievers. Thermochemistry study material contained on three basic competencies that are needed by vocational school students. Overall analysis of student data for each material group are presented in Table 2.

Based on Table 2, it is shown that the group of third material of study on the determination of combustion heat in a variety of fuel has increased better than other materials. Study material about

**Table 1.** Pretest and Post-test Scores on Student Achievement Group

Achievement Group	Number of Student	Average of Pretest Score	Average of Post-test Score	N-gain	Criteria
High	8	51,67	82,92	0,65	Modest
Modest	12	50,28	81,11	0,63	Modest
Low	11	41,82	76,97	0,61	Modest

**Table 2.** Material of study description, pretest, post-test, N-gain, t-test

No	Description	Pretest Score	Post-test Score	N-gain Score	t-value	Criteria	
						N-gain	Decision
1	Energy	50.18	81.00	0.63	14.63	Modest	Significant
2	Determination of $\Delta H$ value	44.91	79.92	0.59	18.28	Modest	Significant
3	Determination of fuel combustion	48.79	84.27	0.69	13.65	Modest	Significant

**Table 3.** N-gain Analysis of Student Achievement Group in Each Study Material

Study Material	Achievement Group	Pretest Score	Post-test Score	N-gain	Criteria
Energy	High	56.94	81.94	0.58	Modest
	Modest	51.85	83.33	0.69	Modest
	Low	43.43	77.78	0.61	Modest
Determination of $\Delta H$ value	High	47.12	81.73	0.67	Modest
	Modest	47.44	77.56	0.57	Modest
	Low	40.56	72.73	0.54	Modest
Determination of fuel combustion	High	53.13	85.94	0.68	Modest
	Modest	51.92	84.62	0.67	Modest
	Low	40.91	82.95	0.73	High

the energy-endothermic and exothermic reactions have a better improvement than the material of study in determination of enthalpy changes. Analysis of mastery level of each student basic competency achievement are presented in Table 3.

Table 3 shows that the topic in energy (endothermic and exothermic reactions), students who excel in this topic were increased on their mastery level. They obtained greater score than the high and low achievers. In the matter of determination of  $\Delta H$ , it indicated that high-achieving students increased their mastery of the material; greater than moderate and low achievers. In the topic of determining the heat of combustion of various fuels, it showed that students who achieved low level of mastery were greater than the high achievers.

At the end of the learning activities, a post-test was carried out and the results showed that 87% students had completed the minimum standard of achievement, and the remaining 13% percent were not. Students who did not scored as many as four students were coded E-2, E-7, E-9 and E-21. Students with code E-2, E-7 and E-21 were the group of underachieving students, while the E-9 was a student in the group of achievers being. The third lower-achieving students had cognitive abilities below other students. E-9 group had a weakness in numerical problems, the students had achieved a low value with N-gain of 0.38 in the third topic. The average value of

post-test was 80.11. The t-value was outside the number line of t-table (between -1.798 to 1.798); therefore the statistical test showed that the average scores was higher than the minimum standard.

The development of soft skills can be observed through the observation on students during the learning process. The percentage of the students who achieve a minimum category on these skills are shown in Figure 1.

Figure 1 shows the percentage of students' soft skills who achieved well minimum score were more than three quarter; therefore, the results showed that the indicator of success has been achieved. The analysis of student' soft skills were conducted by peer teachers, i.e. two teachers observed each 10 students and one teacher observed 11 students. Observations were made during six meetings. The detail of the softskill analysis is shown in Figure 2. Analysis of observations of soft skills in detail of every aspect showed minimal differences in the percentage of both categories.

Figure 2 reveals that not all aspects of soft skills have successfully demonstrated. Empathy was below the indicator of success, which was only reached 67.74%, while the other aspects showed values above indicators of success. The percentage of students who had a minimum of either category was 87.10%. It can be concluded that the research had reached the minimum threshold of success of 70%. Further analysis established that each aspect of soft skills showed the percentage

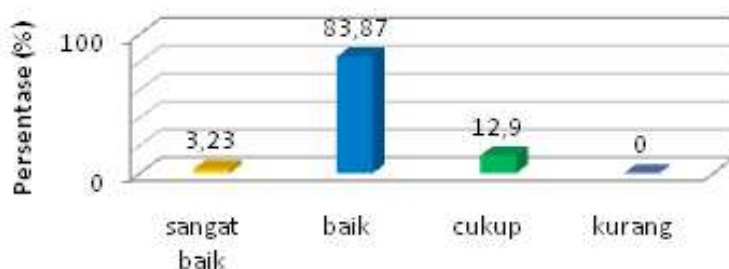


Figure1. Student' soft skills percentage

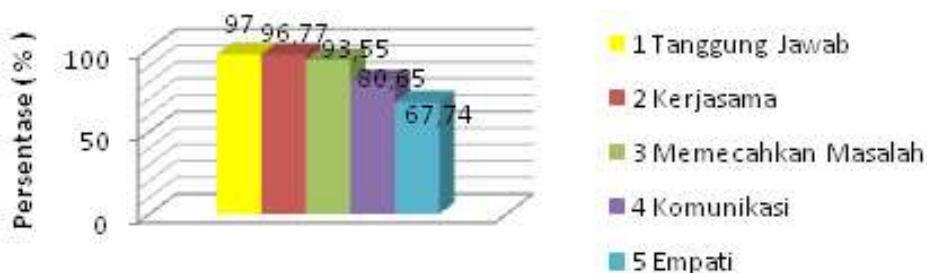


Figure 2. Percentage of student' soft skills in detail which categorized as well minimum score

of them from highest to lowest were responsibility, teamwork, problem-solving skills, communication, and empathy, respectively.

The results of this study did not differ much with the results of Faizah (2012) which concluded that soft skill aspects sequence from the highest to the lowest was cooperation, responsibility, problem solving, communication, self-confidence, and leadership, respectively. Cale (2008) put the aspect of cooperation at the second position after the critical thinking in terms of soft skills aspects that influence the career enhancement and business. Results of this research with the research that has been conducted by previous researchers showed a pattern that did not much different. Empathy does not meet the criteria for success indicators of this study because its percentage was below three quarter. This percentage is lower than the limit of 70% criteria. Sara Konrath (Bryner S 2010) in his research concluded that empathy of students was significantly declined; means that the current generation is more selfish or individualistic. Ed O'Brien et al (2012) in his research concluded that age has an effect on empathy; young people have less empathy than older. The results from O'Ed O'Brien et al (2012) aligned with the results of this study. Effort to increase the empathy was done through

the use of soft skills-based integrated teaching materials.

Improvement of soft skills ability on each meeting was measured from the first meeting until the sixth meeting known through the number of scores obtained by students for each meeting. Figure 3 shows the increase in scores for each student soft skills of each meeting.

Figure 3 shows the pattern of increase in soft skills learning. It was increased from the first to the second meeting. However, there were two students obtained slightly different scores. Students with code U-21 scored for soft skills ability that remained on the fourth and fifth meetings. This was because of the student U-21 had a weakness in the ability to solve problems and responsibilities, while the fourth and fifth meetings required the ability aspects of soft skills of problem solving and responsibility in the learning process. Student with code U-28 scored on soft skills that remained on the fifth and sixth meetings. Student U-28 code had a weaknesses in aspects of communication, while the fifth and sixth meetings required communication skills in the learning process. Results of comparative analysis of N-gain with the student learning outcomes are shown in Table 4.

Table 4 shows that the overall results es-

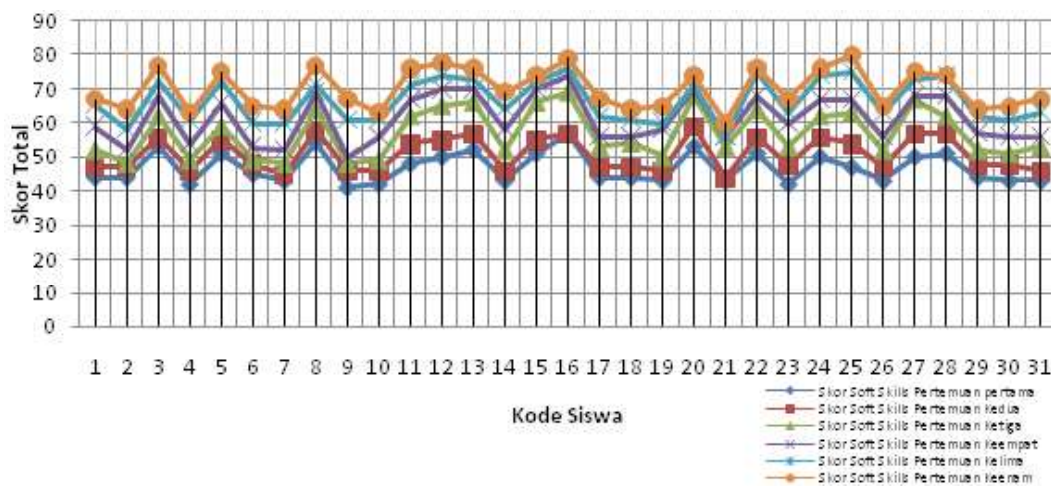


Figure 3. Soft skills scores obtained by each student in every meeting

Tabel 4. Comparison between N-Gain Value of Soft Skills with The Study Results

No	Ability Improvement	N-gain			
		Overall	High	Modest	Low
1	Study results	0.63 (Modest)	0.65 (Modest)	0.63 (Modest)	0.61 (Modest)
2	Soft Skills	0.64 (Modest)	0.68 (Modest)	0.71 (High)	0.53 (Modest)

established the medium N-gain scores in learning and soft skills. High-achieving students who had increased in N-gain learning outcomes, they had moderate soft skills category. Low-achieving students had a learning outcome and their soft skills were moderate. High-achieving students did not always have good soft skills as well, and vice versa. These findings were consistent with studies of Chamorro-Premuzic (2010) which stated that there was a negative relationship between academic intelligence with soft skills. Research that has the same pattern were the findings of Farh & Tesluk (2012). They produced findings that a worker who had the emotional intelligence in the form of soft skills did not always resulted in good performance. Also in the absence of the atmosphere and managerial support, the implementation of the development of soft skills, to obtain a good results was impossible. Mariah and Sugandi (2010) stated that the involvement of teachers was still needed in the effective implementation of the development of soft skills. In this study, the involvement of teachers was on the development of teaching materials which guide the students in learning activities that can improve their soft skills. Analysis of student responses in the research was carried out using a questionnaire to determine the response of students to teaching materials used during the learning process. The percentage of student responses is shown in Figure 4.



**Figure 4.** Percentage of student response criteria

The percentage of student responses related to chemistry teaching materials which integrated with soft skills-based competency, showed that the majority of students agreed or responded positively to the use of teaching materials that have been developed. The minimum percentage of students agreed was 90.71%, whereas students who chose to disagree was 35.10%. Majority of students responded positively to the teaching materials used in learning process. It can be concluded that the results achieved the criteria of minimum standard as much as 70% of the students gave positive responses.

## CONCLUSION

Based on these results it can be concluded that the soft skills-based integrated teaching materials in the topic of thermo chemistry had a very decent criteria based validation of three experts or validators. Other instruments that support the research and development of teaching materials also had a decent according to the assessment criteria from the validators. The implementation of developed teaching materials in learning could effectively improve the understanding of the concept of integrated thermo chemistry with the acquisition of N-gain of 0.63 (moderate). Improved understanding of these concepts could apply to all groups of student achievement. A group of high achieving students had a score of N-gain of 0.65, and the achievement was 0.63, whereas the underachievers was 0.61, all moderate category. Other effectiveness were demonstrated by the percentage of students who passed the study at 87%.

Implementation of the developed soft skills-based teaching materials on thermo chemistry topic can effectively improve students' soft skills with the acquisition of N-gain of 0.64 (moderate). Improved soft skills to a group of high achieving students obtained a score of N-gain 0.68 (medium), whose achievement was 0.71 (high), and low achievers was 0.53 (moderate). The percentage of students whose soft skills had minimum categorized either by 87.10%. Students responded positively to the implementation of the integrated chemical teaching materials with a percentage of 90.71%.

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