Journal Homepage: -www.journalijar.com
INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)
Article DOI:10.21474/IJAR01/7191
DOI URL: http://dx.doi.org/10.21474/IJAR01/7191

RESEARCH ARTICLE

THE DEVELOPMENT OF ASSESSMENT INSTRUMENT TOWARDS THE STUDENTS' CRITICAL THINKING ABILITY ON THE HIGH SCHOOL PHYSICS LESSON WITH THE CREATIVE PROBLEM SOLVING MODEL.

EkaYuli Sari Asmawati[1], Undang Rosidin[2] and Abdurrahman[2].

1. SMAN 1 Metro Lampung, Indonesia.
2. Lampung University, Indonesia.

Manuscript Info

Manuscript History

Received: 03 April 2018
Final Accepted: 05 May 2018
Published: June 2018

Keywords:-
assessment instrument, critical thinking, high school physics lessons, creative problem solving.

Abstract

This research aims to describe the characteristics and implementation as well asto describe the response of the teachers and the students towards the implementation of the assessment instrument on the students' critical thinking ability with the learning model of Creative Problem Solving. This research is a developmental research. The results of this research are the characteristics of the assessment instrument which consist of two parts, namely an instrument to measure the psychomotor and cognitive domain, specially designed to measure thestudents' critical thinking ability using the learning model of Creative Problem Solving(CPS). The use of assessment instrumentsin learning is effective to improve the students' critical thinking ability. The response of the teachers and the students about the assessment instrument that has been developed is good and worthy to be used in the learning.

Introduction:-

The twentyfirst century is the centenary in which science and technology havedeveloped veryfast. The rapid development of science and technology has the effects on the challenges and the global competition faced by each country, especially Indonesia. To be able to play a role in global world, every country should absolutely prepare the generation that have twenty first century skills. The best way that can be done to make it happen is through education. Rotherham & Willingham (2009) noted that the success of a learner depends on the twenty first century skills.Thus,a learnermust learn to possess them. According to the National Education Association (2002), it stated that there are 18 kinds of twenty first century skills that need to be supplied on each individual, where one of the twenty first century skills is the Learning and Innovation Skill that consists of 4 aspects, namely critical thinking, communication, collaboration, and creativity.

Critical thinking skills need to be developed in the students because through the critical thinking skills the students can more easily understand the concept, able to apply the concepts in a different situation and more sensitive to the problems they face. According to Tinio (2003), he states that one of the skills needed to face the future challenges that will come is critical thinking skills. Based on this, critical thinking thus enables students to overcome the problems of life encountered in an organized way, formulate innovative questions, and design solutions.

Corresponding Author:-EkaYuli Sari Asmawati.
Address:-SMAN 1 Metro Lampung, Indonesia.

In the process of learning the students are trained to develop their critical thinking skills so that they are able to solve the problem both individually or in groups, while the function of the teacher in developing critical thinking skills only as a facilitator and motivator. According to Kartimi & Liliasari (2012), the roles of educators to develop critical thinking skills to the students are such as the pusher, the facilitator, and the motivator.

In physics learning, critical thinking can be implemented by adjusting the indicators of critical thinking skills with the characters in the subjects of physics, basically critical thinking skills, according to Ennis (in Costa, 1985: 54), are developed into some indicators of critical thinking skills, whichconsist of five large groups namely: (1) elementary clarification; (2) Basicsupport; (3) interference; (4) advanced clarification; (5) strategy and tactics.

The students'ability to think critically is still low because the teachers still tend to use the conventional learning model, that is a learning that does not stimulate the students to think critically. To support students' thinking skills, there should necessarilybe the existence of physics lessons conducted based on the problem. According to Friedel et al.(2008), he claimed that in order to teach using the problemsolving approach, the problemsolving process must serve as the foundation of the lesson.

The learning model that can be used to overcome the students' critical thinking ability who are still low, is the learning model of Creative Problem Solving (CPS) which is a variation of the problem learning models.Because with the mentioned learning model,the students are be able to solve the problem they encounter, according to the Susilo (2012). Through the problem based learning model, the students can solve the problems in such structured and gradual ways so that the results are quickly and accurately obtained. Based on this matter, with the problem-based learning modelthe students will thus be trained to identify, analyze and evaluate the problem carefully so that they can develop their critical reasoning power to solve the problems they face.

In addition to the reasons above there are some researches that have proved that the problem solving based learning modelcan improve thestudentssthinking skills as Friedel et al.,(2008) stated that the literature provided evidence that problem-solving style, problem-solving level, and critical-thinking disposition each contributed to the employment of critical-thinking skill level during the problem-solving process.This research used the learning model of Creative Problem Solving (CPS) by 5 phasesas stated by Vidal (2010), namely: the five steps of the CPS approach are: (1) fact finding; (2) problem finding; (3) idea finding; (4)solution finding; (5) acceptance finding.

In addition to the appropriate learning model, there is also necessarily the right assessment because it is an important component in the implementation of education, as accordance with Mardapi's statement (2008) that efforts to improve the quality of education can be taken through the improvement of the learningquality and the quality of the assessmentsystem. Evaluation (assessment) towards the process and learning outcomes is a part that is not an inseparable part of the planning and implementation of the learning process done by the teacher. According to Susetyo (2015), an assessment is the last part in the learning process, aimed at knowing its achievements of determined purposes in the curriculum and takingthe decisions for all the students for the next learning stages.

Methods:-

This is a developmental research or Research and Development (R&D) with Borg and Gall development model (1989), from the ten steps developed by Borg and Gall, this research implementation only reached until the steps to seven, namely: (1) research analysis, needs assessment, and proof of concept; (2) product planning and design; (3) preliminary product development; (4) preliminary field testing; (5) product revision; (6) main field testing; and (7) operational product revision. This research used the trial design products with One-Group Pretest-Posttest method design (Sugiyono; 2009). The effectiveness level of the products was seen from the results of the pretest and posttest.

The samples of the research comprise of 32 students of science program in SMAN 1 Metro Lampung Indonesia. There were 2 teachers from different schools providing the responses towards the instrument used and the responses of the 32 students of assessment instrument representing a group of students from low, medium and high.

The questionnaires instrument was used for the data in this developmentalresearch to collectthe data about the feasibility of the product, based on the suitability of the design and the contents of the product that has been developed. The user response questionnaire instrument is used for the product legibility.

To determine the dicrimination power, then the value used is r_{count} which can be seen from the value of the pearson correlation on the validity test. The dicrimination power classification was used based on the rules of Supardi (2015), (1) dicrimination power between the lowest infection rate was from 0.00 - 0.30 interpretedas bad; (2) dicrimination power between 0.31 - 0.40 as sufficient; (3) dicrimination power between 0.41 - 0.70 as good; (4) dicrimination power between 0.71 –1.00 as very good interpretation; and (5) negative dicrimination powerinterpretednot good are discarded. The data usedwas taken from the questions items with the interpretation of good and very good.

A special test method was done to know the effectivenesslevel of the developed product. The research design used was One-Group Pretest-Posttest Design. The data collected are the data about the results of the tests written by the form of the question of explanation obtained on the implementation phase, which is in the form of the results of the students' score. The test data was used to know the influence of assessment instrument with the learning model of Creative Problem Solving which was used to improve the students' critical thinking ability.

The data collection of questionnaires was carried out when the external test on the stage of the tryout usage, done to know the response of the teachers and students to the assessment instrument towards the students' critical thinking ability with the learning model of Creative Problem Solving. The responses weretaken from 2 teachers and 32 students representing the students of low ability, medium and high to get information directly from the teachers and students who were involved as the subjects of research.

The results analysis of the percentage of the students'ability to think critically was conducted to measure the students' critical thinking ability after learning with the learning model of Creative Problem Solving.

Table 1:-The Table of the Criteria for the Students'Critical Thinking

Your Score	**Criteria**
89% < X ≤ 100%	Very High
78% < X ≤ 89%	High
64% < X ≤ 78%	Moderate
55% < X ≤ 64%	Low
0 percent < X ≤ 55%	Very Low

Source: Pritasari (2012)

Indicators of success in this research is the students' critical thinking ability in the science class SMA Negeri 1 Metro who were classified into the category of moderate, high or very high as 75% ≤ X ≤ 100%.

Results:-

Based on the result of the observation and needs analysis, it was obtained the information that the use of the learning model and the assessment instrument to measure the students' critical thinking abilitywas still rarely used. There have been no visible physics teachers who never make the appropriateassessment to assess the students' critical thinking ability. The observation result on the document owned by the teachers of physics shows the following matters: (1) very little critical thinking skills indicator that appears in the learning results indicator (2) most of the testsonly measure the skills of low level. From the questionnaire,it was obtained the information that students and teachers want a learning and assessment model which is appropriate to measure the students' critical thinking skills.

Based on the results of the research, this study compiled an assessment model to grow the students' critical thinking ability in understanding the physics lessons on the material of elasticity and Hooke law as presented in Figure 1. There are five stages of Creative Problem Solving(CPS), namely fact finding, problem finding, idea finding, solution finding, and acceptance finding, which were used to foster the ability to think critically. At the every stage of learning, there are some indicators of critical thinking skills.

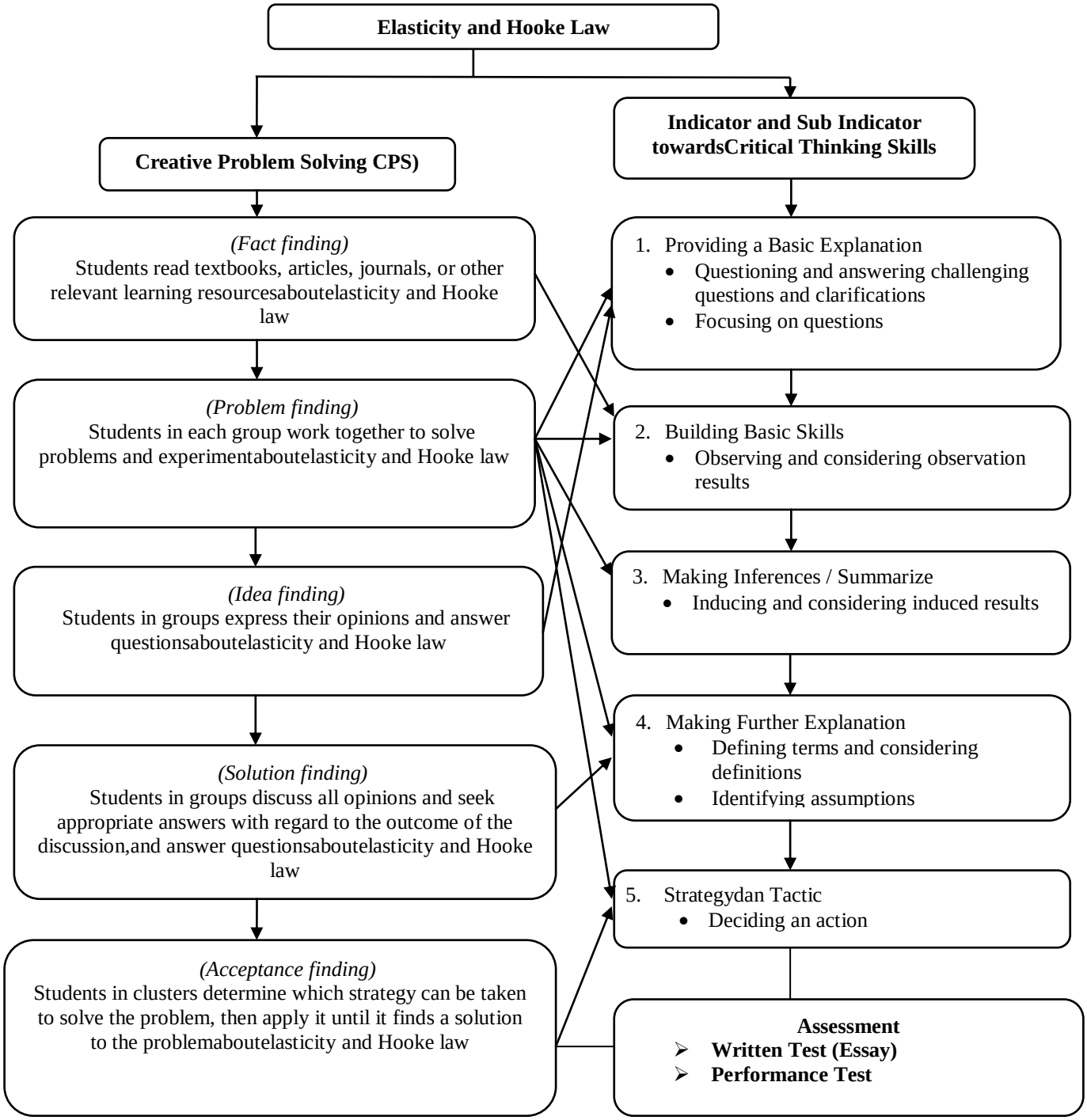

Figure 1:-The Assessment Model to Cultivate Critical Thinking Skills in Understandingthe Material of Elasticity and Hooke Law

At the every stage of learning, the assessment was done according to the indicators of the critical thinking skills by using the technique and the test form adjusted with the indicators. The indicators of critical thinking about the elasticity and the Hookelaw, namely discussing voltage, high yield-strain, modulus elastic material, analyzes the nature of the elasticity of the ingredients, analyzing the implementation of elastic nature in daily life, determiningthe spring constant through experiments Hookelaw, concluding the experiment Hooke law, analyzing the Hooke law on the material elasticity, formulating the spring constants of the series arrangement and the parallel arrangement

according to Hooke law, concluding the order trial of the series and the parallel structure of the spring, and analyzing the implementation of Hooke Law in everyday life.

The characteristics of the assessment instrument with the model of Creative Problem Solving on the developed material of elasticity and Hooke law, arewhich the assessment instrument consists of two parts, namely the instrument for measuring the psychomotor domain in the form of performance assessment and measuring the cognitive domain of written test consists of 7 description questions, the assessment instrument is designed specifically to measure students' critical thinking skills which include building basic skills, making basic explanation, making inference / concluding, making further explanation, as well as strategy and tactics.There are 5 stages on the assessment instrument of Creative Problem Solving (CPS),namelyfact finding, problem finding, idea finding, solution finding, and acceptance finding. This assessment instrument is equipped with pictures/images and tables that are colored so that they arouse students' interest for working on the question of who created.The language used in the assessment instrument is easily understood and does not cause a dual interpretation (ambiguous).The formulation of the assessment instrument is equipped with grid or latticework and in accordance with the core competence and basic competence that exist in the curriculum, the rules of writing assessment instruments have been adapted to applicable rules, and the questions developed can measure the indicators of students' critical thinking ability so that they can be used as a measuring tool for the achievement of learning objectives.

The test results compatibility, the ease of use and the benefit of products are presented in Table 2.

Table 2:-The Test Table Compatibility, the Ease of Use, and the Benefit of the Products

Test Type	Psychomotor Assessment		Cognitive Assessment	
	Percentage	Criteria	Percentage	Criteria
Compatibility	83.75%	Compatible	88.75%	Compatible
Ease of Use	90.63%	Very easy	84.38%	Easy
Benefit	82.82%	Useful	85.94%	Useful

The data of the test result from the experts judgement on examining the assessment instrument with the model of Creative Problem Solving in detail can be seen in table 3 below.

Table 3:-The Test Results on Experts Judgement towards the Assessment Instrument with the Model of Creative Problem Solving

Test Type	**Psychomotor Assessment**	**Cognitive Assessment**
Material Test	71.43%	100%
Construction Test	72.73%	90.91%
Language Test	66.67%	100%

Based on the table 3, it is seen that assessment instrument that has been developed is worthy to be used; as accordance with the interpretation of Mardapi (2012) namely 90%-100% criteria for very good, 80%-89% as good, 70%-79% as sufficient, and score < 70% as low.

From the test stages,the data readability was obtained from the questionnaire of students; responses to the assessment instrument with the Creative Problem Solving model of elasticity and Hooke law which include 10 aspects,namely the language used is easy to understand, the images used are clear and interesting, the structure of the sentence is clear, there are clear filling instructions, the steps of work in the assessment are easy to understand, the terms contained in the assessment are easy to understand, learning is formulated clearly in the assessment, the content of the assessment in accordance with the material being taught, the assessment can encourage students' curiosity, and the assessment provides an opportunity for the students to write and communicate.From the existing data obtained, the average percentage of students' answers was obtained 86% which categorized in good criterion.

The result of validity test of sig <0.05 indicates that the item is valid. Calculation of reliability test based on the value of Cronbach's Alpha on Reliability Statistics table obtained value of 0.865 is a high reliability value exceeds than 0.7. This is in accordance with the Supardi statement (2015) that the level of reliability Cronbach Alpha index used 0.7 and above indicates that the reliability of tests made reliable or steady.

Whether the test items have good quality or not, they can be determined from the degree of difficulty or difficulty level possessed by each item.The recapitulation on the analysis result of the tryout questions towards the critical thinking descriptioncan be seen in table 4.

Table 4:-The Recapitulation on the Analysis Result of the Tryout Questions towards the Critical Thinking Description

No	Validity		DiscriminationPower		Level of Difficulty	
	Score	Criteria	Score	Criteria	Score	Criteria
1	0.000	Valid	0.662	Good	0.24	Difficult
2	0.000	Valid	0.742	Very good	0.28	Difficult
3a	0.002	Valid	0.529	Good	0.24	Difficult
3b	0.034	Valid	0.377	Sufficient	0.19	Difficult
3c	0.006	Valid	0.474	Good	0.28	Difficult
4a	0.016	Valid	0.421	Good	0.48	Moderate
4b	0.000	Valid	0.596	Good	0.23	Difficult
5a	0.001	Valid	0.579	Good	0.41	Moderate
5b	0.001	Valid	0.574	Good	0.45	Moderate
5c	0.000	Valid	0.742	Very good	0.30	Difficult
6a	0.000	Valid	0.797	Very good	0.34 hkd	Moderate
6b	0.014	Valid	0.431	Good	0.38	Moderate
7a	0.000	Valid	0.662	Good	0.30	Difficult
7b	0.000	Valid	0.673	Good	0.23	Difficult
7c	0.003	Valid	0.514	Good	0.40	Moderate

The percentage of the critical thinking ability, in each indicator of critical thinking ability based on pretest and posttest result, can be seen in table 5.

Table 5:-The Comparison of the Percentage on the Value of Pretest and Posttest towards Each Indicator of the Students' Critical Thinking Skills

Indicator	**Pretest**		**Posttest**	
	Percentage	**Category**	**Percentage**	**Category**
Providing Basic Explanation	32,81%	Very Low	74,06%	Moderate
Building Basic Skills	35,38%	Very Low	76,25%	Moderate
Creating an Explanation with More Information	38,54%	Very Low	79,58%	High
The Strategy and the Tactics	35,00%	Very Low	76,00%	Moderate

Based on the result of data processing on questionnaire about the teachers' response about the clarity of guidance on the use of assessment procedure, students' response, objective, language, construction, systematics and practicality of the assessment instrument towardsthe students critical thinking ability, with the average of Creative Problem Solving model is 86,61% with good criterion, which can be seen in Figure2.

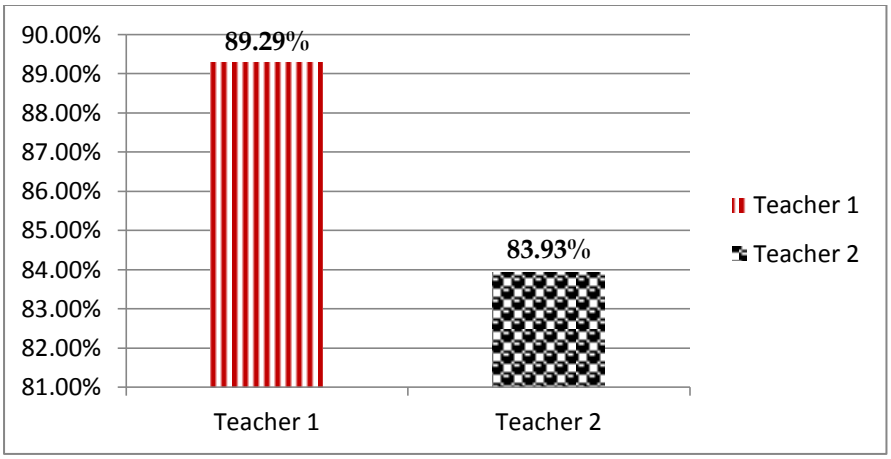

Figure 2:-The teachers' Response towards the Assessment Instrument with the model of Creative Problem Solving

For the student questionnaire responses, all statements are in good criteria, the first statement is onthe students' interest and enthusiasm; the second statement is that the assessment instruments are very important and useful for training the students critical thinking; the third statement is that the assessment instruments make the students more enthusiastic to follow the learning process; the fourth statement is that the assessment rubrics can help students in carrying out the learning process correctly, the fifth statement is that the students' learning motivation has increased, the sixth statement is that the students' knowledge and skills have also increased. To more clearly see the results of the student responses to the existence of assessment instruments with Creative Problem Solving model which can be seen in Figure 3.

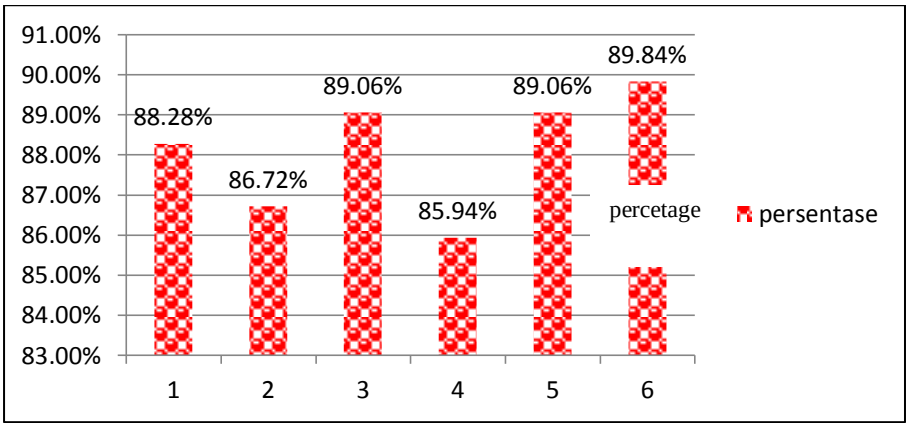

Figure 3:-Thestudents' response to the existence of theassessment instrument with the model of Creative Problem Solving

Discussion:-

The results of this study show that the assessments that have been developed can be used to assess students' ability in learning, the assumption in accordance with the opinion of Suyatna & Rosidin (2016) assessment should be able to measure all aspects that students know and students do. Based on this it shows that the assessment used in the learning process succeeded in accordance with the statement (Mueller, 2005; Shwartz, 2006; Lombardi, 2008) that evaluation is an assessment of student learning process that can show the success of learning.

Assessment instruments with Creative Problem Solving model of the development results are easy to use, in accordance with Uliana's opinion (2009: 2) that evaluation instruments are said to be easy to use if they have features: easy administration, easy to apply in judgment, complete rubric (scoring guide) equipped with clear instructions, and does not demand a lot of equipment when using it.Assessment benefit test does not provide suggestions for improvement, nor criticism of the one-on-one test questionnaires that have been given by the researcher at the time of tryout test, meaning that the assessment instrument is useful, and it is in line with the

opinion of Sudjana (2011), the nature of the assessment is that the assessment should be able to assess the students'learning process and outcomes. The use of the assessment instruments with the Creative Problem Solving model of development outcomes in Physics learning for psychomotor assessment (performance assessment) is useful, in accordance with the opinion of Hutabarat (2004: 16) that performance appraisal is more useful if it can be used to assess students' ability to present oral, problem solving in a group, the participation of students in a learning activity, and the ability of students in using laboratory equipment and the students' ability to operate a tool or an appliance.

Each of the learning activities in the assessment instrument with the model of creative problem solving, consists of five main activities done by the students, namely fact discovery, clarification issues, expressing opinion, evaluation and the selection as well as implementation of the lessons like this, will encourage and train the students (learning outcome) in improving the students'critical thinking skills. This is as revealed by Linn, et al (2006) when the students get involved in the investigation and learn to integrate their ideas; they are ready to apply what they learn in class in order to be applied outside of the classroom.

Based on the response of the teachers(seen infigure 2), researchers get the information that the assessment on cognitive assessment, i.e.essay, can be used because it had to meet the criteria of a good question in terms of the substance of the construction and appropriate language, as in line with Rosidin's statement (2016: 51) that the development of the questions need to pay attention on the rules of the writing of the items about which covers the substance/materials, construction, and languages. The teachers agree with the use of the assessment instrument with the model of creative problem solving by the lessons of elasticity and Hooke law. This is because the assessment instrument developed can be used for assessment in learning, and it is in line with the statement of Suyatna & Rosidin (2016) that evaluationhas various purposes, such as assessment for learning, assessment of learning and assessment to learning.

The assessment instrument developed also meets the criteria of good assessment, according to the statement of thunder (2013:99) that the main condition assessment is acquired by the data on the measurement result with a high accuracy rate in accordance with the competence, sub competencies and performance criteria that have been assigned. Based on the teachers' opinion, the assessment instrument developed can be used to identify the students, according to the opinion of Wulan (2007:381) that a standard assessment is required to identify clearly what should students know and that should be the students can do in the use of performance assessment. The teachers also feel really helped with the existence of this instrument because it is accompanied with the rubric, in accordance with the opinion of Sudria & Siregar (2009:224) who state that the assessment of performance in practice should be carried out by using the task and the rubric.

The response of the students to the assessment instrument with the model of Creative Problem Solving as the development results (seen infigure 3) , the students are more interested and enthusiastic in the use of assessment instruments with the model of Creative Problem Solving for assessment of knowledge and skills.It is in line with the opinion of Totiana & Redjeki (2013) thatusing the model of Creative Problem Solving hashigher learning activities than the students who are taught using the conventional method. The evaluation on the assessment instrument with the model of Creative Problem Solving is very important and useful to train the students'critical thinking. It is congruent with Hariawan, et al (2014) that the learning model of Creative Problem Solving may increase the activity and creative thinking students and critical thinking in the process of learning. The evaluation on the assessment instrument with the model of Creative Problem Solving makes the students more passioned to follow the learning process. The rubric assessment can help the students in implementing the learning process correctly, and it is in line with the statement of Rosidin (2016: 20) that by using the rubric a teacher can assess whether the studenthas done his/her work with the remark "not good", "good", or "very good" on an organization (or work settings) and distinguish how good or how carefully learners do analysis.

Based on the student responses, it indicates that the students agree with the use of assessment instruments towardsthe model of Creative Problem Solving by the lessons of elasticity and Hooke law. This is because before the implementation of learning, they know about what to do, the aspects to be assessed as well as the scores that students will get in accordance with what the students actually do on learning activities, so that they get a fair assessment.This assumption is supported by the Slater's statement (1993) that one of the stages in the performance appraisal is to inform students about what to expect and what performance should be shown by the students during the learning. In addition, students are more motivated to learn when assessing teacher's judgment in accordance with

existing assessment instruments. It motivates the students to develop better and the students become more enthusiastic, as congruence to the research revelation of Zainul (2001) that by knowing the criteria that will be used to measure and assess the success of the learning process, the students will openly and actively seek to achieve the success.

Conclusion:-

Based on the results of the research, it can be concluded that the characteristics of the assessment instrument consist of two parts, namely an instrument to measure the psychomotor and cognitive domain,especially designed to measure the students' critical thinking ability by using the model of teaching Creative Problem Solving (CPS). The use of assessment instruments with the model of teaching Creative Problem Solving in learning is effective to improve the students' ability to think critically. The teachers' and the students' response about the assessment instrument that has been developed is good and worthy to be used in the learning to improve the students' critical thinking ability.

Reference:-

1. Borg, W. R. & Gall, M. D. (1989).*Educational Research: an Introduction.* New York: Longman.
2. Costa, A. L. (1985).Goal for Critical Thingking Curriculum. In Costa A.L. (ed). *Developing Minds: A Resource Book for Teaching Thinking*. Alexandria: ASCD. 54-57.
3. Friedel, C. R., Irani, T. A., Rhoades, E. B., Fuhrman, N. E., & Gallo, M. (2008). It's in the Genes: Exploring Relationships between Critical Thinking and Problem Solving in Undergraduate Agriscience Students' Solutions to Problems in Mendelian Genetics. *Journal of Agricultural Education*, *49*(4), 25-37.
4. Guntur. (2013). Pengembangan Asesmen Hasil Belajar Siswa Penjasorkes pada Permainan Bola Voli di SMA. *Dissertation UNY*.
5. Hariawan, H., Kamaluddin, K., & Wahyono, U. (2014). Pengaruh model pembelajaran creative problem solving terhadap kemampuan memecahkan masalah fisika pada siswa kelas XI SMA Negeri 4 Palu.E-Journal of Physics Education Tadulako, 1(2), 48-54
6. Hutabarat, O. R. (2004). *Model-model PenilaianBerbasisKompetensi PAK*. Bandung: Bina Media Informasi.
7. Kartimi & Liliasari. (2012). Pengembangan Alat Ukur Berpikir Kritis Pada Konsep Termokimia Untuk Siswa SMA Peringkat Atas dan Menengah.*Journal of Science Education, Indonesia*.1 (1), 21-26
8. Linn, M. C., Lee, H. S., Tinker, R., Husic, F., & Chiu, J. L.(2006). Teaching and assessing knowledge integration in science. *Science*, 313(5790), 1049-1050.
9. Lombardi, M.(2008). *Making the Grade: The Role of Assessment in Authentic Learning.*New York: Educausa.
10. Mardapi. (2008). *Teknik Penyusunan Instrumen Tes dan Nontes*. Yogyakarta: Mitra Cendikia.
11. Mueller.J. (2005). The Authentic Assessment Toolbox: Enhancing Student Learning through Online Faculty Development. *North Central College,* 1(1), 1-7.
12. National Education Association. (2002). Preparing 21st Century Students for a Global Society : An Educator's Guide to the "Four Cs". From https://www.nea.org/assets/docs/AGuide-to-Four-Cs.pdf.Diaksestanggal 20 Oktober 2015
13. Pritasari, A. D. C. (2012). Upaya Meningkatkan Kemampuan Berpikir Kritis Siswa Kelas XI IPA 2 Sekolah Menengah Atas Negeri 8 Yogyakarta pada Pembelajaran Matematika Melalui Pembelajaran Kooperatif Tipe Group Investigation (GI).*Doctoral dissertation UNY.*
14. Rosidin, Undang.(2016). *PenilaianOtentik (Authentic Assesment)*. Yogyakarta: Media Akademi.
15. Rotherham, A. J., & Willingham, D.(2009). 21st Century Skills: the challenges ahead. *Educational Leadership*, 67 (1) , 16 - 21.
16. Shwartz.(2006). The Use of Scientific Literacy Taxonomy for Assessing the Development of Chemical Literacy among High-School Students. *Chemistry Education Research and Practice*, 7(4), 203-225.
17. Slater, T.F.(1993). *Performance Assessment The Physics Teacher* [Online]. 31(5), 306-309. Tersedia: Solar. Physics. Montana.edu/Slater.Accessed on 2nd September 2015
18. Sudjana, N.(2011). *PenilaianHasil Proses BelajarMengajar*. Bandung: Rosdakarya.
19. Sugiyono.(2009). *MetodePenelitianPendidikanPendekatanKuantitatif, Kualitatif, dan R&D*.Bandung :Alfabeta.
20. Sudria, Ida Bagus Nyoman & ManimpanSiregar.(2009). Pengembangan Rubrik Penilaian Keterampilan Dasar Praktikum dan Mengajar Kimia pada Jurusan Pendidikan Kimia.Journal of Education and Teaching, 42(3), 222-233.
21. Supardi.(2015). *Penilaian Autentik Pembelajaran Afektif, Kognitif, dan Psikomotor.* Jakarta: PT. Raja Grafindo Persada.

22. Susetyo, Budi.(2015). *Prosedur Penyusunan dan Analisis Tes untuk Penilaian Hasil Belajar Bidang Kognitif*. Bandung: PT. Refika Aditama.
23. Susilo, A. B.(2012). Model Pembelajaran IPA Berbasis Masalah Untuk Meningkatkan Motivasi Belajar dan Berpikir Kritis Siswa SMP. *Unnes Science Education Journal*, *1*(1), 12-20.
24. Suyatna, A &Rosidin, U .(2016). Assessment model for Critical Thinking in Learning Global Warming Scientific Approach.*Proceedings of Internationale Conference on Educational Research and Evaluation*.1-7.
25. Tinio, V., L.(2003). *ICT in Education*.http://www.apdip.net/publications/iespprimers/ICTinEducation.pdf. Accessed on 16thOctober 2015.
26. Totiana, F., VH, E. S., & Redjeki, T. (2013). Efektivitas Model Pembelajaran Creative Problem Solving (CPS) Yang Dilengkapi Media Pembelajaran Laboratorium Virtual Terhadap Prestasi Belajar Siswa Pada Materi Pokok Koloid Kelas XI IPA Semester Genap SMA Negeri 1 Karanganyar Tahun Pelajaran 2011/2012. Journal of Chemistry Education/*Jurnal Pendidikan Kimia (JPK)*, *1*(1), 74-79.
27. Uliana.(2009). *KriteriaInstrumenEvaluasi*. (Online), (http://stahdnj.ac.id, accessed on 20 Februari 2017).
28. Vidal, R. V. V.(2010). Creative problem solving: An applied university course. *Pesquisa Operacional*, *30*(2), 405-426.
29. Wulan, Ana Ratna.(2007). *Penggunaan Asesmen alternative pada Pembelajaran Biologi.* Seminar Nasional Biologi. Bandung: Universitas Pendidikan Indonesia.
30. Zainul, A. (2001). *Alternatif Assesment*. Jakarta: PAU-PPAI Universitas Terbuka.