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PORTFOLIO-BASED PHYSICS LEARNING MODEL TO IMPROVE CRITICAL THINKING SKILLS Mohammad Tawiland Bunga Dara Amin Lecturersat Faculty of Mathematics and Science (FMIPA) Makassar State University (UNM), Indonesia Mobile Phone: +6281341885984 and +62081342435174 Email: tawil_mohammad@yahoo.co.id and bungadaraamin@yahoo.com ABSTRACT The purpose of this study is to find out whether the implementation of Portfolios–based physics learning model can enhance students' thinking skills and to study the nature of critical teacher and student responses to the implementation of Portfolios–based physics learning model.

The method used is mixed with the method of experimental research design embedded. The results showed that all the syntaxes of physics-based learning model portfolio were performing well. Implementation of the model was found that N-gain gain critical thinking skills higher than conventional learning.

There are significant differences in critical thinking skills of students who follow physics-based learning model portfolio with students taking conventional learning.Responses of teachers and students towards the learning and implementation of physics-based learning model portfoliowere very positive. Keywords: Portfolios–based physics learning, critical thinking skills 1.

INTRODUCTION During the last decadethere aredemandson schools and teachers to be more accountable and responsible andtohigheracademic standards. There isacommonbeliefthat the practiceof assessmentrefers to theminimum competencytestsand measuredwitha standard, objectivetypes,have failed todevelopand measurehigher-order thinkingskillsrequiredin the presentworld.

Manyeducators, citizens, andmeasurementexpertsbelievethatthis situation canbe overcomeby introducing alearning modelcalled the Portfolios–based physics learning model. The problem arises ishowthe effect ofthe implementation ofportfolio-based learning model, along with an assessmentsystemthat candrive tohigher level thinkingskills?, this study is aimedto implement aportfolios–based physics learning model anddevice-oriented learning critical thinking skills.

Syntaxesof portfolios–based physics learning comprises eight phases: Phase-I. Teachersconveythe purposeandmotivatingstudents; Phase-II. Teachersidentify problems; Phase-III. Teachersposeing problemsfor thestudy ofclassand return portfolio directed students tochooseproblems; Phase-IV. Teachersguide thegroupsand practicecritical thinking skills; Phase-V. Teacherdirectstheportfoliodeliveryanddocumentationto document theportfolio ; Phase-VI.

Teacherdirectsstudents tothe discussion; Phase-VII. Teachersevaluatestudent portfolios, and Phase- VIII. Teacherappreciate andeffortsbothindividuals and groups. 2. UNDERSTANDINGASSESSMENTANDPORTFOLIO Understandingassessmentintheportfolios–based physics learning modelSMA/MAstatedthat theassessmentnotonly includesthejudge, butalsosignificant:(1)to helpstudents learn, (2) individual andgroup, (3) multi-context, (4) anti-bias, and (5)emphasis onstudentexcellence.

Webb(1993:68)definesassessmentas atoolthatcanbeusedbyteachertohelpstudents attainthegoals ofacurriculum. According toBlaustein(1999), assessmentis the process ofgathering informationand makingdecisionsbased on that information(inIbrahim, 2005:3). Thusit can be saidthat theassessmentis a system ofassessment byteachersthroughoutthe learning processundertakenby thestudents andfor helpingstudents to achievethe learning objectives.

According to JohnsonandJohnson(2003:103), aportfoliois anorganizedcollectionofevidenceaccumulatedovertime onastudent's orgroup's academicprogress, achievement, skills, andattitudes. Lim(1977) stated that, aportfolioisa collectionof workovertimethatreflectsprocessed, products,achievement, andprogress. It isvaluabletothe teacher, and to thestudent, and to thestudent's family .

Ibrahim(2005), definesa portfolioas a collectionof representativestudent workshowing the development ofstudents' skillsfrom timeto time. Paulson(1991:21) pointed out that , aportfolio ofstudent work samples thatdemonstrateeffort,progressandproficiencyin oneormoreareas. Gronlund(1998), definesa portfolioas a collectionof student work samplesdependson thebreadth ofobjectives .

Examples ofstudent workprovides abasis forconsideration ofthe progress oflearningandcan be communicatedto students, parents and other interested parties. Based on these definitions, it can be concludedthatportfoliois a collection ofstudent working which has the objectiveto collecta series ofbasicperformance information(performance) orstudent work, evidence ofaccomplishments, skills, and attitudes.Collection of informationrepresentsachievementorimprovementexper ienced bythe studentsfrom timeto time toachievecertainobjectives of the curriculum.

Focusof the portfolioisproblem solving, thinking, andcomprehension, written communication, science relationship, and students reflection on learning science. 3. IMPLEMENTATION OF THE LEARNING PORTFOLIO Nur (2002) pointed out that according to O'Malley and Pierce, portfolio is very student- centered, which means that students have input not only on what is included in the portfolio but also on how the content is evaluated.

Teachers are encouraged to incorporate new roles for teachers and students into the classroom so that the portfolio can be more student-centered than teacher-centered. Based on this description, it can be said that the student-centered features the portfolio as a "spirit" portfolio where the position of teacher is as a facilitator. Studies of portfolio strategy showed that the implemention of portfolio in science learning, is highly effective in improving conceptual understanding, students' attitudes, and cognitive processes in science lessons (Leonard,1996). Regarding the effect of the application of portfolio learning on learning outcomes.

Budimansyah (2002) explains that students will be able to assess themselves against the results of the performance, so as to identify the weaknesses and advantages in completing a task performance. Furthermore, students will have the nature of honesty, and high interpersonal. Such capability is needed in the era of globalization. Correspondingly, Nur (2002) also suggests that the portfolio-based learning can lead to improve learning outcomes are real.The above descriptions indicate that the application of portfolios may have implications for the improvement of learning outcomes. 4.

CRITICAL THINKING SKILLS Critical thinking is an important thing whichmake a person tobe creative. Torrance (Carin & Sund, 1995), and Lawson (1979)., & Taeffinger., at al (1982), pointed out that critical thinking is. the process of 1) difficulties sensing problems, missing elements, 2) making guesses and formulating ideas or hypotheses about these deficiencies; 3) Evaluating and testing these guesses and hypotheses; 4) Revising possibity retesting them, and finally , 5) communicating the results.

The definition suggests that critical thinking is as a critical process, which sensing difficulties, the problem of information gap, the missing element and disharmony, clearly defining the problem, make a hypothesis, testing the hypothesis back or even redefine the problem and finally communicating the results. Critical thinking will be easily realized in a learning environment that directly provide opportunities for students to think open and flexible without fear or shy.

For example, set up learning situations should be facilitating the discussion, encourage someone to express ideas. According to Carin and Sund (1995) to induce creativity in learning aspects needs (1) to develop a high confidence and minimize fear, (2) to encourage free communication, (3) conduct limited objective and individual assessment by the students; and (4) control is not too tight.

Critical thinking can be developed rapidly using a portfolio-based learning because learning model is able to facilitate almost all students' skills, ie skills to develop knowledge already possessed by students, skills predict from limited information, skills find the problem, formulate hypotheses skills, skills testing hypotheses, and skill saw information from a different perspective. 5. RESEARCH METHODS The research methodused ismixedmethodsresearchdesignEmbedded ExperimentalModel(Creswell.,

&Clark, 2007)as shownin Figure1. Figure 1. Embedded ExperimentalModel Embedded ExperimentalModelDesignboxstatingthisdata set andthe results, whilequantitative dataQUANstatedthatthe datain the formof numbers.In this research, quantitative dataisdatavalidationof the analytical resultsbased onfield trialson alimited classesandqualitativedata related to thecategory.

In this research, qualitative dataare:analysis of thesyllabus, teacher needs analysis, environmental analysis, analysis of questionnaires. The subjects of this studyis allSMAstudent of academic year2010/2011.The research instrumentconsisted of: (1)a testof critical thinking skills, (2) questionnaires, and (3)the observation sheetactivities of teachersand students.

Datacritical thinking skillswas collected usingcriticalskills tests. Dataresponsesof teachersand studentswas measured by usingquestionnaires and theactivities ofteachers andstudents by usingthe observation sheet. Data processing techniquesaredescriptive andinferentialanalysis.

Thegain occurredbefore and afterthe learningcalculated bythe normalized formula(N-gain) (Meltzer, 2002). pre pre post S S S S g ? ? ? max Spost is the finaltestscores; Spreearliertest scores, andSmaxis the maximum score. Ngain level criteriais showingin Table1 (Meltzer, 2002).

qualbeforein tervence QUAN trial QUAN post-test qualof intervence intervence QUANanalysi s(qual) afterintervenc e Interpretation dataresultsQUAN (qual) Table 1. TheN-Gain Category Limitation Category g > 0,7 High 0,3 = = 7 Medium g< 0,3 Low 6. RESULTSANDDISCUSSION The averageN-gain critical thinking skillsof studentson the subjectof temperatureand heatforexperimentalclassis 0.9inhigh categoryand control classis 0.3in low category.The averageN- gain critical thinking skillsof studentson anytopicandheattemperaturesasshown in Table2. Table 2.

The averageN-gain Critical ThinkingSkillsEveryTopictemperatureandHeat No Topic The averageN-gain Critical ThinkingSkillsInTopic Experimental class Control Class T S R T S R 1. Liquidexpansion 0,9 - - - - 0,3 2. Specific heatof substances 0,9 - - - - 0,3 3. Heatmeltingice 0,9 - - - - 0,3 DescriptionT= high, C = medium,R= low Table 2showsthat thecritical thinking skillsof studentson the topic oftemperature andheathave increasedandare in high categoryinvolving the topicsof it was consecutivemeltingheat, specific heatsubstancesandliquidexpansion.

In thecontrol classfound thatstudents' criticalthinking skillsfor all subjects are in low category. These resultsshow thatstudents who takeportfolios–based physics learningincreasedin criticalthinking skillsforall thetopicsof temperature andheatcompared tostudents who attendconventional learning.However,students in control classhavecritical thinking skillsateachtemperatureand theheatthoughtopicskillsarestill low.The averageN-gain on everyindicatorof students' critical thinking skills is shownbyTable 3. Table 3. The averageN-gain InEveryindicatorCritical ThinkingSkills No.

Skillsindicatorcriticalthinking The averageN-gain indicatorCritical ThinkingSkills Experimental class Control Class T S R T S R 1. Providesimple explanation 0,9 - - - - 0,3 2. Buildbasic skills - 0,9 - - - 0,3 3. Makinginductionand considerinductionwith an explanation: making inferencesandhypotheses 0,9 - - - - 0,3 4.

Creating andconsider thedecisionwith the explanation: the application ofthe principle 0,9 - - - - 0,3 DescriptionT= high, C = medium,R= low Based on Table 3 all the indicators of critical thinking skills have increased. The most improved indicators included in the category increased height is to develop a simple explanation followed, Buildbasic skills, making induction and consider induction with an explanation: making inferences and hypotheses, make decisions and consider the explanation: the application of the principle.

In the control classes it was found that all the indicators of critical thinking skills are included in the low category. These results show that students who take physics based learning portfolio increased in critical thinking skills for all indicators of effective critical thinking skills than students who take conventional learning, however, students in the control classes have critical thinking skills on each indicator though lower.

Thus it can be said that each student who attend both portfolio based physics learning and following the conventional learning basically have critical thinking skills, which distinguishes them to that students who take portfolio based physics learning had the opportunity to practice a gradual and sustained so that the thinking skills their critical to experience is growing compared to students who did not get a chance to practice intensively thinking skills.

Students' response to the learning component and implementation of physics-based learning portfolio showed very positive (80%) in the aspect of interest, positive (93%) in the aspect of renewal, positive (70%) in the aspects of ease of understanding, positive (85%) in the aspects of the application and very positive (80%) in the delivery aspects of teacher clarity.

The results of the response of teachers of physics to physics-based learning model portfolio of highly positive (100%) in both the role and quality aspects and teachers do not experience hurdle in implementing physics-based learning portfolio in both the regulating the implementation of physics- based learning portfolio, preparing time to implement portfolio based physics learning and deliver the tasks to be done by students.

According to teacher, the benefits that can be obtained through thin model is portfolios students quickly grasp the concepts that have been taught and quickly develops critical thinking skills. Comments from teachers showed that the temperature and heat of physics-based learning portfolio is a form of learning that is loaded with innovations is something new.This indicates that all the syntacof physics-based learning model portfolio working well.

This will increase the activity of students in discovering the concepts, principles and theories of physics. Similarly, the teacher will present the course material critical guidance in learning and doing. This is because the portfolio based physics learning of students trained to think critically, especially in terms of posing problems, and investigate the matter through trial.

Students can determine the level of critical thinking skills through portfolio assessment, this information will better motivate students to learn physics and ultimately will improve their critical thinking skills. This is consistent with the theory that active learning on students construct their own skills and knowledge. Conventional learning students do not get the opportunity to develop critical skills so that when working on problems they could not resolve correctly.

Responses of teachers and students towards the learning and implementation of physics- based learning portfolio is very positive. This suggests that the portfolio based physics learning, along with his supporters to generate interest and motivation in learning a physics student, and ultimately improving student learning outcomes.

Teachers have high motivation in implementing the learning, because teachers in this very important role as a facilitator in the learning and teaching tools are very helpful in implementing the learning process in the classroom. Learning device applied in this study allows students and teachers implement all phases of learning. This is consistent with theoretical models of learning (Joyce, Weil, & Showers (1992:14) that emphasizes supporting aspects implementationto portfolio based physics learning model. 7.

CONCLUSION Portfolio based physics learning model portfolio consists of: a) learning syntax (preliminary: core learning: making the exercise trial, stabilization concepts related to experiments and cover: t he provision and evaluation tasks), b) the social system (the collaboration between students and students and teachers c) principles: (teacher acts as a facilitator), d) support systems (learning devices, lab equipment), e) the impact of instructional (critical thinking skills) and the impact of accompaniment (the ability to make the experiment).

Application of portfolio based physics learning can further enhance students' critical thinking skills compared with conventional learning application.Teachers and students are responding very positively to the physics-based learning portfolio and its implementation in peembelajaran temperature and heat. 8. ACKNOWLEDGEMENTS The researches convey many thanks to the Directorate of Research and Community Service funding this research over three years.

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