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Developing Problem-based Learning Model of Integrated Science Subject in Madrasah Tsanawiyah

Furtasih[1], Siti Masitoh[2], Andi Mariono[3]
[1, 2, 3] Educational Technology, Pascasarjana, UniversitasNegeri Surabaya Indonesia
Coresponding email : furtasihmpd69@gmail.com

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Abstract:

This study aimstodevelop a problem-based learning model in natural sciences of MTs NW 1 and 2 LenekEast Lombok equipped with teaching materials, students' worksheets and problem-based learning process guides and teacher guides. This research used Research and Development approachby Borg's and Gall. The respondents of this researchwere students of class VIII MTs NW 1 and 2 Lenek East Lombok. Theinstruments were consisted of questionnaires, tests and interview guidelines. This research was conducted with assessment of the students of class VIII and three stages of tests; one-to-one, small group, and large class trials test. The category of instruments assessments and trial was "Very Good". The data analysis technique used was independent t-testhypothesis sampling with SPSS 1II.0. The result of this research showed thatthe developed learning model becomes feasible to be applied in teaching and learning activities with completeness score above II5 reaching 91.4%.

***Keywords:** Development, Instructional Model, Problem-Based Learning, Integrated Natural Sciences.*

INTRODUCTION

Every teacher expects that learning activities they do can be effective, efficient, interesting and enjoyable so that the active learning process occurs amongthe students. To realize this expectation, the teacher develops a learning design in accordance with experience, knowledge, skills and all available resources, supporting the optimal achievement of each learning activity. The application of the principles, theories, methods and learning strategies that are considered best and suitable for teachers becomes the capital for teachers in designing, developing learning. This is also the job of the teacher's profession in achieving learning expectations. One of the principles to guarantee the occurrence of learning events, according to Merill, M.D., in Reiser and Demsey, is "when learners are engaged in solving real-world problems" when students are involved in solving real-world problems. (Reiser & Dempsey, 2007: 63).

The findings at the Madrasah Tsanawiyah / MTs level Integrated Science lessons held in Madrasas are almost all still passive (passive learning) and boring. This is caused by only teachers who actively provide / teach learning material and practicums while students / learners have a tendency to passively accept subject matter (theoretical), so that the provision of minimal analytical skills, individual learning is not optimal and lacking in activities that lead to problem solving. Thus, many students have difficultiesin learning and are boring especially in Integrated Science learning materials using a lot of Latin language. These are the results of a survey / observation in one of the MTs in East Lombok and it is clear that only the teacher is very well versed in the material (interview results, observations on 9-13 February 2018). This, if left unchecked will result in learning objectives or competency standards, basic competencies will not be achieved. Therefore, to

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run the learning process in the field of Integrated Science it is necessary to have innovation.

To carry out innovation in educational institutions, educators must also be innovative, including learning models. According to Miarso, to improve the quality of learning including Integrated Science learning to suit the demands of educational requirements and development needs can be done by utilizing educational technology, one of which is to develop innovative learning systems (Suwandi, 2015: 94). Innovation in the learning process in question is the provision of Integrated Science material through a problem-based learning model in accordance with the statement made by Amir, in the Problem Based learning process, before learning begins, learners are given problems. The problems given / presented are problems that have a context with the real world. The closer to the real world, the better the effect will be on increasing learner skills (Akcay, 2009: 28). Problem Based Learning (PBM) is a learning strategy, which is a learning solution designed to improve learning by bringing, delivering, requiring students to learn the content of teaching material when solving problems (Jonassen, 2011: 154). To optimize Integrated Sc learning, the involvement of the learners needs emphasized in order to construct knowledge and improve the learner's ability so that they can solve problems so that the learning paradigm will shift and be student-centered (Safrina and Saminan, 2015: 311). For this reason, this research was conducted so that it can develop, apply problem-based learning models in Tsanawiyah Madrasah in the field of Integrated Science.

Problem Formulation: (1). Is the development of learning models needed? (2). How to design a problem-based learning model in order to improve and empower student competencies in Integrated Science subjects in Tsanawiyah Madrasah?

Research objectives: (1). Obtain a learning model that can be used as an example to improve the ability of learners who are equipped with teacher guides, teaching materials and LKS-PBM, (2). Involve the teacher as a collaborator in this study who is able to develop problem-based learning models in Integrated Science subjects. (3). Provide input to institutional leaders or curriculum policy holders to further develop the learning model resulting from this research.

METHOD

The study was conducted on students of class VIII MTs NW 1 and 2 Lenek East Lombok NTB on Integrated Science subjects. The implementation time starts from January 2018-August 2019. Using a research approach through research and development procedures Borg and Gall is a cycle consisting of 10 steps that can be summarized into four stages as shown in Figure 1 (Borg and Gall 2007: 625).

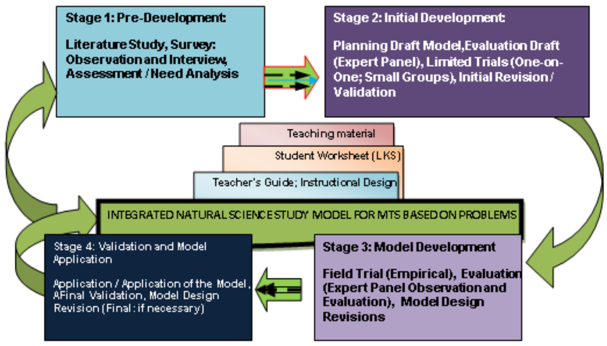

Figure 1. Stages of development and testing of integrated science-based learning model products

Research & Development is a process used to develop and validate educational products, in the form of a cycle of steps consisting of: (1) studying findings relating to the type of product to be developed, (2) developing products based on results the findings, (3) conducting a field test of the product in the setting where the product will be used, (4) revising the weaknesses found in the field test (Hindle, 2004: 576). The sampling technique is purposive sampling. Data collection instruments

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are: researchers, teacher guides (implementation of PBM models, learning designs), teaching materials, LKS-PBM, interview guidelines, questionnaires / questionnaires, observations, cognitive level measurement tests, results / products.

ValidationModel, Evaluation, and Revision

The steps in the evaluation stage refer to the Suparman formative evaluation model, namely: review by subject matter experts, instructional design experts, media experts outside the instructional development team, one-to-one evaluation, small group evaluation and field trials (Suparman, 2004: 276). The validation sheet / questionnaire given to the material expert, instructional design expert (construct) and media expert (lay-out) in the form of the Guttman Scale namely: "yes-no"; "True False"; "never-never"; "positive-negative" (Richey and Klein, 2014: 139). One-on-one evaluations, small group evaluations, and field trials; Validation sheets given to students in the form of a Likert Scale to measure attitudes, opinions, and perceptions of a person / group of people about an educational phenomenon or phenomenon (Djaali & Pudji Muliono, 2008: 28). Likert scale is used as a checklist with five categories of answers (Sugiyono, 2012: 135).

RESEARCH FINDING AND DISCUSSION

Model Development.

Competency Analysis Required. Integrated science as a subject whose role is to prepare learners on issues, real problems and assignments related to the competence of Natural Sciences that need to be prepared and implemented optimally so as to be able to guarantee the creation, experience, real knowledge needed by students as prospective scientists who are professionals in the science field. The ability needed by students to be able to solve these problems that are directly related to their daily life / real world can be explained in table 1.

Table 1. Competency Standards

No.	Materials		Competency Standard	Basic Competency
1.	Fungi and their role		Apply science concepts in life	Identify the various fungi according to their benefits correctly.
2.	Chemicals in life			Looking for information about the uses and side effects of chemicals in everyday life Describe natural chemicals and artificial chemicals in packaging contained in food ingredients
3.	Understand the nature of substances and their changes			Classifying substances in objects / forms in daily activities Explain changes in substances
4.	Diversity of living things			Identify the characteristics of living things Classifying living things based on the characteristics they have Describe diversity in the organization system of life from the cellular level to the organism
5.	The ecosystem			Explain the ecosystem Identifying the components that make up the ecosystem and maintaining a balance for survival.

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Analysis of Learning Model Needs.

Based on observations in the field and interview shows that the Integrated Science learning process still uses conventional models so that teachers are active while students are passive and often feel bored, so it requires the design of learning models that are centered on students, namely Problem Based Learning (PBM) models. The initial information collection is intended as a basis for developing models that will be developed, in various ways: observation, interviews and questionnaire distribution to students and teachers involved in learning integrated science subjects.

Draft Model 1. Initial Model Development.

The initial development of the model is done with a system approach so that the learning model developed is assumed to be a system that processes inputs in the form of learners who do not yet have the competence to be outputs in the form of learners having the desired competencies. The Instructional Development Model / MPI needs to take steps: determine instructional needs and formulate general instructional goals, conduct instructional analysis, identify learners' behaviors and initial characteristics, formulate specific instructional objectives, write benchmark reference tests, develop instructional strategies, develop instructional materials, design instructional materials and carry out formative evaluations, get instructional systems.

Draft Model 2. Description of the Learning Model developed.

In summary, in the design of learning for the PBM model of Integrated Science subjects developed contains the main thoughts about: (a) Teacher's guide book PBM Integrated Science model consisting of; Elements of the PBM model / Teacher's guide in implementing the PBM model, PBM learning design (needs analysis, formulating objectives, instructional analysis, sequence of special competencies, competencies that must be achieved by Integrated Science PBM participants, Problem Based Learning Strategies / Integrated Science PBM). (b) Teaching materials. (c). PBM student worksheet

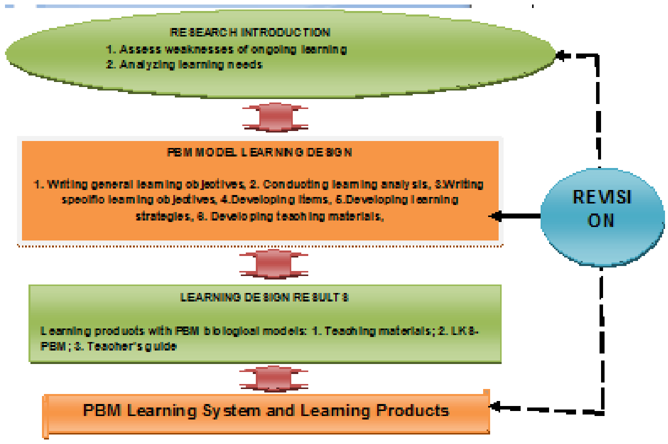

Figure 2. Development of the Integrated Science PBM Model

Final Model.The development is based on the process and product of the PBL model of Integrated Science subjects in MTs. The learning model developed is a linear procedural model as shown in Figure 2

Feasibility Model Early Field Test Development

The results of expert content evaluations (material) Prof. Dr. Hj. RusdianaAgustini, M.Pd, Head of Program Study, lecturer and researcher from the Surabaya State University Postgraduate Science Education Study Program. Dr. Erman, M.Pd, lecturer and researcher in the department of science education at the Postgraduate University of Surabaya. Drs. Mukrim Ismail Integrated Science teaching teacher class VIII MTs Lenek 1 and as the Head of the curriculum; on the data aspects of the substance of the Integrated Science material states that the material in the development of the PBM model is feasible for field trials. Learning design expert Prof. Dr. Mustaji, M.Pd, a lecturer in Education Technology at Surabaya State University in Surabaya, stated that the development of the PBM model with three products, namely the learning design contained in the teacher's guide, teaching materials, the PBM Worksheet is worthy of field trials. Similarly, the results of the evaluation of media experts Dr. HadiGunawanSakti, M.Pd Lecturer at Mandalika University of Education Mataram; stated that the development of the PBM model was worthy of field trials after going through revisions.

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Model Effectiveness

One-on-one Trials. The one-on-one trial phase was conducted for 6 students of class VIII MTs 1 and 2 NW Lenek East Lombok who were considered to have high, medium, low ability based on grades and information obtained from class teachers. The implementation will be on Wednesday 10 June 2019 from 09.30 West Indonesia Time to 11.30 West Indonesia Time, housed in class VIII of MTs NW 1 Lenek. At the end of learning the learners are asked to respond to the PBM model they have just followed. In this discussion only the results of 7 questions are displayed as a representation of the answers of PBM participants. The results obtained an average recapitulation of 4,307 markets with a very good category.

Small Group Trials.

The small group trial phase involved 12 students of class VIII consisting of 4 high-ability students, 4 medium students, 4 low people based on grades and information obtained from class teachers. The treatment is like the one-on-one trial discussion. After determining the average of all indicators, a response from learners is 4.57 which shows that the development of the PBM model is very good, as shown in Figure 3.

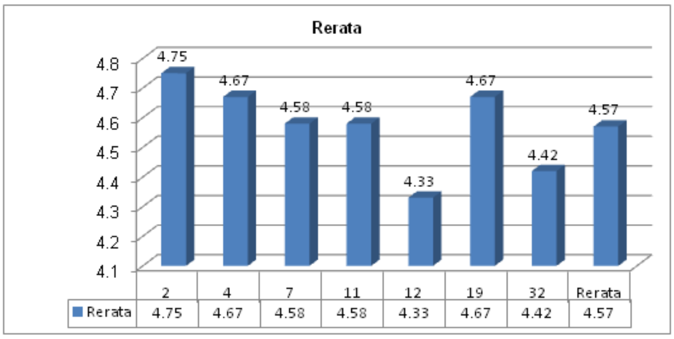

Figure 3.Diagram of students' responses in the small group trial phase.

Stage III and IV of Main Field & Operational Field Test Results.

The main field test was conducted involving research subjects of VIII grade students and Integrated Science teachers in MTs NW 1 and 2 Lenek East Lombok in Odd semester 2018/2019, followed by 35 students divided into 5 PBM groups. The operational field test involved 39 research subjects divided into 4 groups and Integrated Science teachers as tutors on Integrated Science subjects. The result is observational data and questionnaire results in the form of: Recapitulation of the attendance of each participant, recapitulation of formative evaluation scores, evaluation and observation of tutors, assessment results of tutors conducted by PBM participants, PBM participant questionnaire results, value of process competencies and products of each participant results teacher assessment, final grade. Summary of formative evaluation values can be seen in table 2.

MTS	PokokBahasan (P. B)	P.B I	Delta	P.B II	Delta	P.B III	Delta	P.B IV	Delta	P.B V
MAIN LAP/ MTs 1	Nilai rata-rata	70.77	7.09	77.86	5.68	83.64	3.26	86.8	6.0	92.4
	Cacahpositif		35		33		35		33	35
	Cacah delta negatif		0		1				0	
	Cacah delta nol		0	1					2	
LAP OPERASIONAL/ MTs 2	Nilai rata-rata	71.20	7.00	78.2	3.49	81.69	5.91	87.0	1.95	88.95
	Cacah delta positif		39		38		38		37	
	Cacah delta negatif		0		0		0		0	
	Cacah delta nol		0		1		1		2	

Table 2. Recapitulation of Formative Evaluation Delta Value

Based on the results of an analysis of the effectiveness of learning conducted for 5 learning objectives on five subjects as listed in table 2, it can be concluded that there is an increase in the development of student knowledge that follows PBM learning models for Integrated Science from the main field test, when compared with the results of the operational field test.Increased measurable knowledge on delta data for each subject.Delta is an intermediate line: PB I formative value with PB II formative value, PB II formative value PB PB, PB

III formative value PB IV and PB IV formative value PB PB If positive delta means there is an increase in knowledge of each subject, then it can be interpreted that the PBM model developed is effective in achieving learning objectives.

Students' Competency Achievement.

The main field test conducted on the NWs 1 and 2 Lenek Lombok East from the knowledge side of the student achievement was excellent, with the number of students achieving a score of 75 (study completion 75) of 91.4%. Once the learning model has been revised and tested again in the operational field test it is achieved that student achievement increases by 100% of students achieving 70 (above 70 learning). The above calculation is based on the calculation of the final value. The components of the final value are the document values of each subject, individual documents, discussion values, formative values of each subject, UTS values and UAS values (table 3)

Table 3. Competency Standard Achievements and Integrated Natural Science Basic Competencies

Competency Standards / TIU	Basic Competencies	Approach	Outcome Achievements	
			Main Report / MTs 1	Operational Report/ MTs 2
Students in the VIII MTs will be able to apply the Integrated IPA concepts to their lives	Identifying a variety of functions fitted with its correct benefits. Finding for the information about chemistry functions and effect in daily life. Describing naturaland artificial chemicals in packaging contained in food ingredients. Classifying the substances contained in objects or forms in daily activities. Explaining some changes in substances. Identifying the living creatures' characteristics. Classifying some creatures based on their characteristics. Describing the organization system diversity in life from the cellular to the organism level. Explaining about eco-system. Identifying eco-system components structures and maintaining the balance for the live sustainability.	Formative test for each PB, UTS, UAS. Competency process assessment. Product competency assessment. Peer group assessment.	32 (91.4%) of the students scored 75 above.	39 (100%) of the students scored 70 above.

Students' score with PBM model learning based was obtained within the process of learning in one semester since this integrated IPA learning model with PBM constituted with five themes or learning materials. Each of themruns for three meeting, so that after each of the subjectwas done, then formative test is conducted. Thus, there were five times formative tests withing one semester, and

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two tests namely UTS and UAS. Based on this view, the learners are highly expected to learn harder in order they will have a better knowledge particularly in the operational field test result.

To measure the skill achievement competencies' result in the integrated IPAin PBM learning model was done with the approaches such as looking at the process competency result scoring on the learning skill, peer group work, and problem-solving skill.The other assessment approach was conducted through peer group assessment. Thus, the result of the main field test was 62% of the students' competent at learning confidence, 85.72% of the students' competent at peer group work, and 85.72% at problem solving competency. Since the peer group assessment was no yet existed, then the number of the active students in learning activities and problem solving had not been counted.

The field operational test result showed that there were 82.04% of the students were competent at leaning independency, 89.74% of the students were competent at peer group work, 92.31% of the students were competent at problem solving and 100% of the students were competent based on their peers' assessment and categorized active in learning activity and problem solving.

DISCUSSION

The development of the PBM learning model with research procedure and development by Borg and Gallconsisted of ten steps, modified by MPI in the second and the third step. Those ten steps are; 1) research and information collection, 2) planning, 3) development of the former product, 4) field trial test, 5) former product revision, 6) the main field trial, 7) operational product revision, 8) operational product trial, 9) the last product revision, 10) dissemination and operational product, (Borg and Gall, 2007:625). The tenth step was not conducted since it requires a lot of time and energy involving 10 to 30 schools. This study uses Borg and Gall development model combined with the instructional development model because it is oriented to educational products. Furthermore, the training that follows each step in the MPI is directed towards the development of subjects (Li and Chun, 2011: 129).

The steps used in the evaluation stage, the researcher refers to the steps of Tessmer formative evaluation combined with Suparman's formative evaluation which consists of four stages, they are; review by the expert of the subject, one by one evaluations, small group evaluation and field trial. Formative steps are highly needed by the researcher to assist the appropriateness of the use of developed PBM model including effectivity learning model.

The Teachers' Involvement as The Collaborator.

The previous research and the integrated IPA teachers were cooperated for discussing some learning problems of Integrated IPA subject, ready for answering the researchers' questions which deal with model needs. The involvement of the teachers is not restricted to the current time, but to the development of PBM for the integrated IPA learning material (Jonassen and Hernandes, 2002: 65). This issue currently runs well where the researchers can collaborate with Integrated IPA teachers starting from the main field trial test, operational trials test as they eager and enthusiastic atapplying the PBM model. It is hoped that this study will not stop to this point, but they are expected to apply it further.

This PBM model in Integrated IPA subject was tested in two different characteristics of MTs. This difference characteristics included: subject highlighting, the availability of supported the facilities in PBM, determination of the learning mastery minimum criteria and KKM learning outcomes, response and support of all teachers, the head master till the students of PBM. This difference characteristic may ease the and smooth the implementation of PBM model because the real situation can develop and modify PBM learning model corresponding with the characteristics of each MTs (Wartono, and Diarno, 2018: 33).

MTs NW 1 and 2 Lenek Eat Lombok has highlighted characteristics in the field of

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environmental study. This school consists of class VIII which contain the special students ofclass VIII A where the number of its students has more than the other classes. The number of students in class VIII A is 35 students if they are looked at the model development and formative evaluation of MPI model by Suparmanwhere it is not taken into account because in the field test, the number of the students as the research object was about 15-30 students. So, the difference of the 5 students can be overcome by adding the number of group members.

This PBM model is never been applied earlier so that after applying it into this research, it gets well responds from the teachers, head masters, and students. The mastery score is fit with the minimum score criteria or KKM, it is 7.5 (75). If you see the final score of all PBMstudents getting an average score above 75 is 91.4% corresponds to KKM, it means that the complete learning of Integrated IPA subject with this model is 91.4%.

MTs NW 1Lenek has prominent characteristics in Integrated IPA subjects so that it is very supportive inconducting this research.

The number of students of MTs 1 NW Lenek is quite a lot especially in class VIII so that the frequency of using the class is very high.Theimplementation of PMB that the researchers propose does not use any facilities and infrastructure which are in accordance with the provisions of the PBM model because there is no special class for PBM.

The absence of specific discussion class for PBM implementation is becoming a concern but does not preclude the implementation of PBM because it can be arranged and placed in unused class such as meeting room, library, and other classes.

But most of PBM implementation are carried out in one class, such as class VIII, as MTs NW 2 Lenek did as well.The mastery learning score in MTs NW 1 Lenek is adjusted to KKM such as 70 for class VIII and 75 for class XI. If it is seen from the recapitulation of the PBM learning score, their score is 100% and 75 above, it means that the learning outcomes of PBM students are 100% complete.

The implementation of PBM model.

The implementation of PBM model: 1) Product: it has a teacher's guide in implementing PBM learning model, teaching materials arranged based on the PBM model steps integrated with MPI, so that it easier the students to learn both independently and in group learning (inside and outside the classroom),LKS-PBM (problem triggers learning, learning implementation guide which completed with meeting forms and assessment forms, 2). The learning process changes from an active teacher / teacher-centered learning while the learner is only passive, to be an active learner / learner-centered while the teacher only acts as a tutor who guides, facilitates, and evaluates.

3). Can train leadership through group discussion learning or tutorial discussion and plenary discussion. Independent learning by building learning skills. Learn to work together and respect the opinions of others (Sujanem and Jatmiko, 2018: 1). The learning process becomes more fun and not boring. Motivate learners to learn and learn continuously and encourage their critical thinking (Drahicescuat.all, 2014: 297)

RESEARCH LIMITATION

This study is limited onlyon the use of formative evaluation with material expert testing stages, design expert trial tests, media expert trial tests, one by one trial test, small group trial test, and actual field trial test.

To obtain good trial test results, it is necessary to have a large group trial test of the PBM model that has been developed.While the true field trial test, researchers only used two schools; namely MTs NW 1 and MTs NW 2 Lenekof East Lombok which have certain characteristics. Are the results obtained will be the same if the PBM model is applied to other schools? Or needs to do a further research in the form of research and innovative development in a bigger research subject as well as

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a wider range so that the components of the resulting learning model can be a platform for improving the quality of the learning process.

This PBM model development research is still limited to one subject, namely Integrated IPA, the model developed is also needed to be expanded again so that it involves a family consisting of several interrelated subjects.

CONCLUSION

After conducting the research, then the development of learning models is highly needed, especially in the development of PBM models that can be applied to students, particularly in class VIII of MTs NW 1 and MTs NW 2 Lenekof East Lombok.The revised results of the PBM model for Integrated IPA have been carried out several times, namely: based on the review of Integrated IPA experts, learning design experts, as the media experts say that the Integrated IPA PBM model has been appropriate to use. One by one trials test, small-group trial tests are very good. The final product is a problem-based learning model such as the teachers' guide to implementing the PBM model, teaching materials, LKS-PBM.

The evaluation toward PBM model products with the stages of reviewing material experts, design experts, media experts, one by one trials test, small groups and field trials test, after being analyzed overall, it is categorized as "very good", so that it becomes a final product that is fit tobe used as a PBM models which are interesting, fun and not boring.There is a significant increase between the results of the main field test and the operational field test after the learning model has been revised and refined. And there is a significant increase between the results of the main field test comparing with the PBM Model test developed for Integrated IPA learning subject toward 5 subjects. And it is also very effective for achieving learning objectives as long as infrastructure, the availability of tutors, the availability of learning resources andothersupporting factors are fulfilled.

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